BAKASH Sophie

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	16 from 20	1 from 1	6 from 10	5 from 5	3 from 3	1 from 1
A02 and 3	42 from 60	5 from 11	12 from 16	9 from 9	11 from 16	5 from 8
Total	58 from 80	6 from 12	18 from 26	14 from 14	14 from 19	6 from 9

Your Pinpoint Topics

Topic 1: Loci and Construction. Mathswatch Clip: 165

Topic 2: Distance Time Graphs. Mathswatch Clip: 143

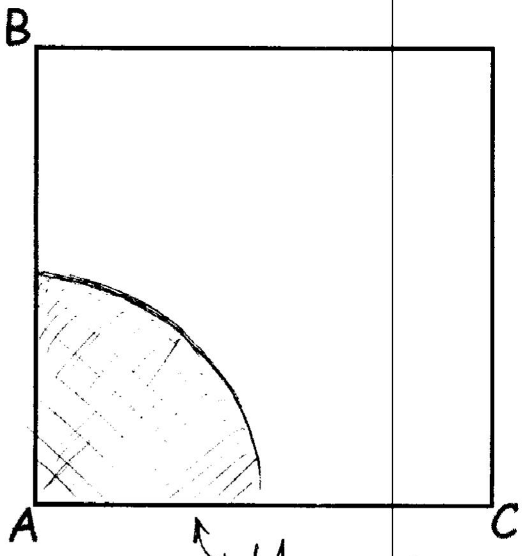
Topic 3: Proportionality. Mathswatch Clip: 199

Topic 4: Proof. Mathswatch Clip: 193

Topic 5: Completing the Square. Mathswatch Clip: 209

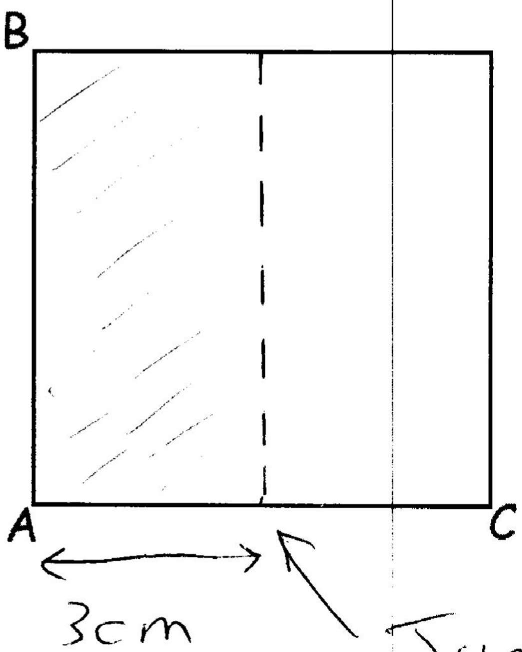
1) Loci and Construction: Easier

1) Shade the area closer than 3cm to point A within the square below:



Use compass at 3cm

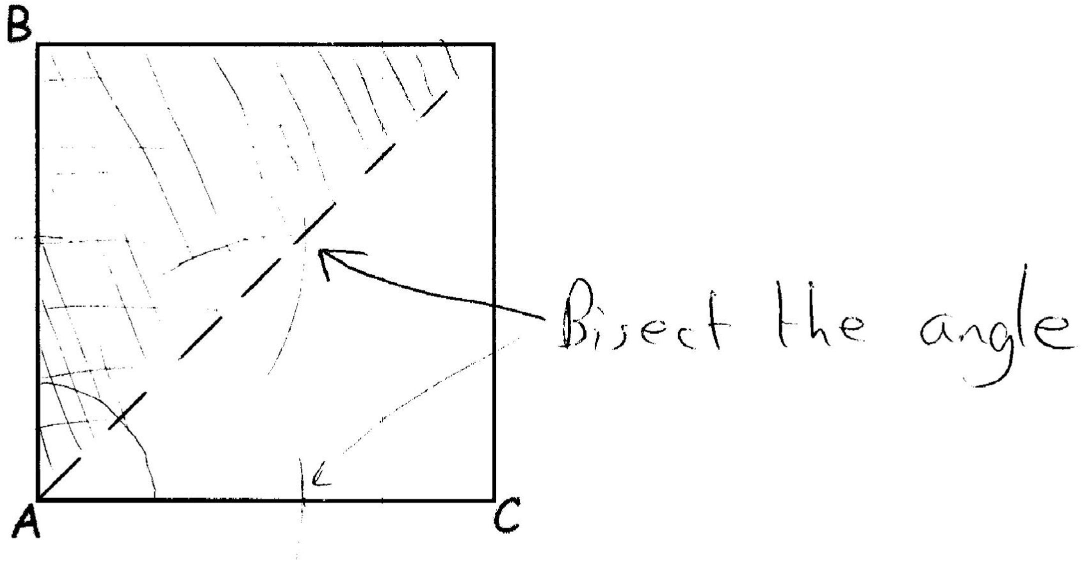
2) Shade the area closer than 3cm to the line AB within the square below:



Just measure 3cm with your ruler

1) Loci and Construction: Medium

3) Shade the area closer to the line AB than AC within the square below:

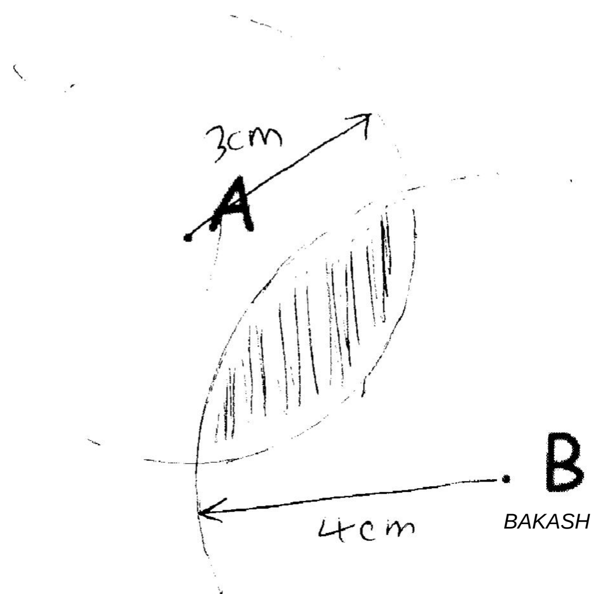


4) Two mobile phone stations transmit a signal.

Mobile phone station A transmits its signal ~~5~~ 3 miles.

Mobile phone station B transmits its signal 4 miles.

When you can receive both signals you experience interference on your phone.   Shade below the area of interference.



Scale: 1 cm represents 1 mile

1) Loci and Construction: Harder

5) Mariam wants to plant a flower:

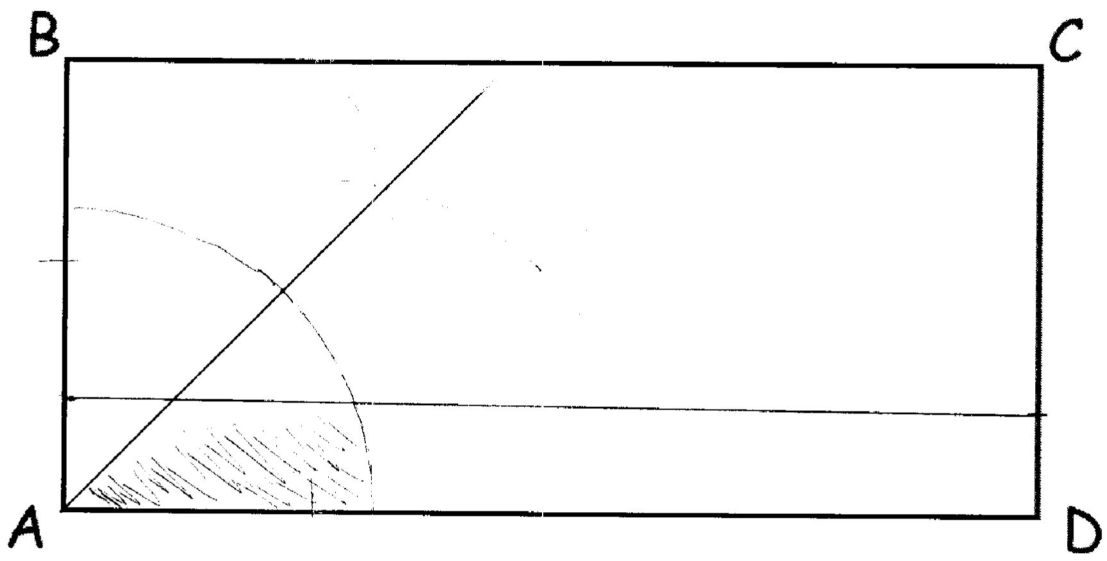
Within 4m of A

Closer to AD than AB

Less than 1.5m from AD.

Shade below the region where Mariam should plant her flower.

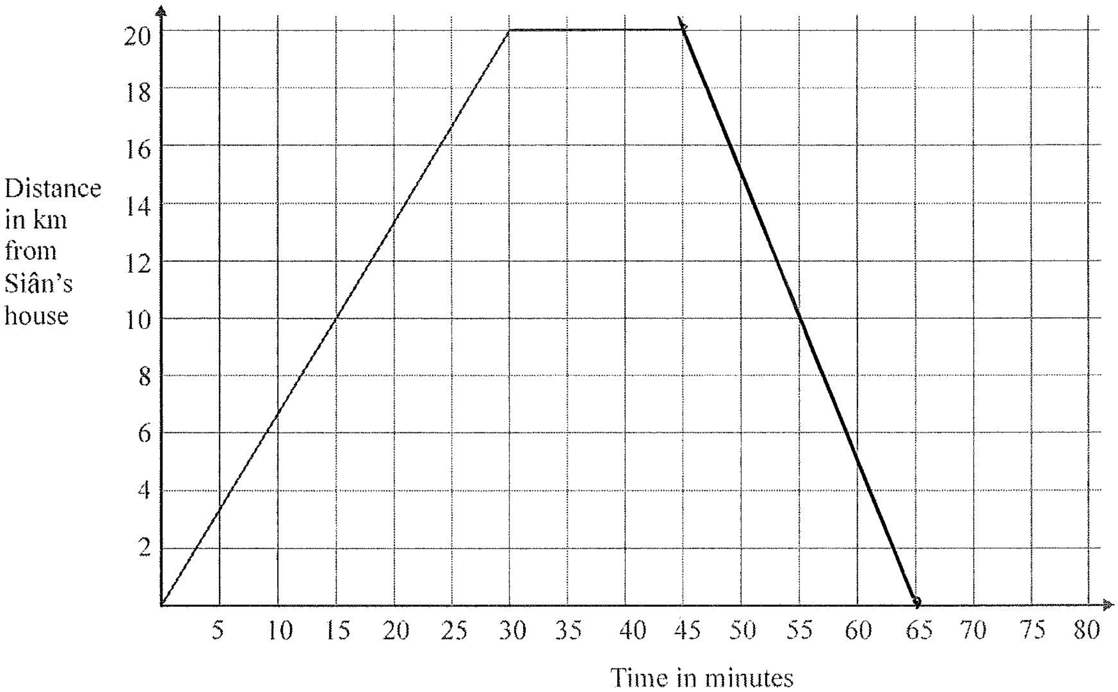
Show any construction lines your draw.



Scale: 1 cm represents 1 metre

2) Distance Time Graphs: Easier

1. Here is part of a travel graph of Siân's journey from her house to the shops and back.



(a) Work out Siân's speed for the first 30 minutes of her journey.
Give your answer in km/h.

distance ÷ time   30 minutes = 0.5 hours.

20 ÷ 0.5 = 40

40 .... km/h

(2)

Siân spends 15 minutes at the shops.
She then travels back to her house at 60 km/h.

(b) Complete the travel graph.

20km at 60 km/h

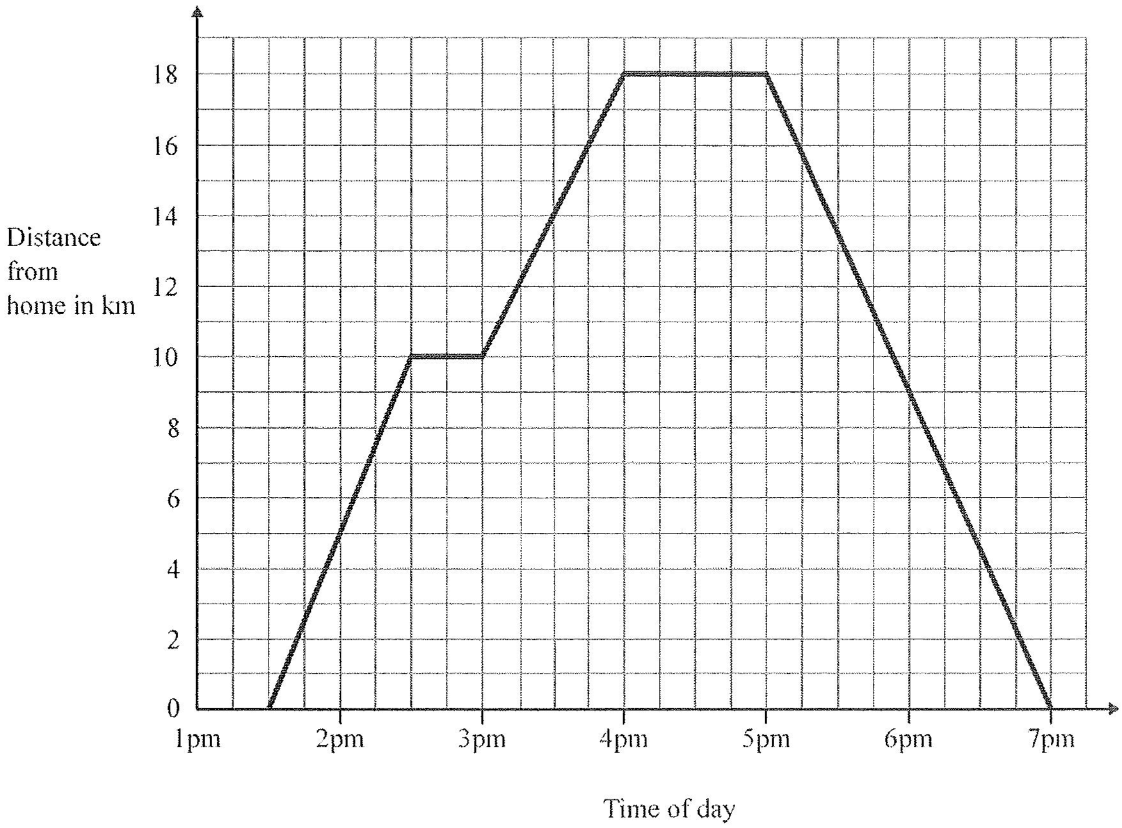
20 in 20minutes

(2)

(Total 4 marks)

2) Distance Time Graphs: Medium

10. Pete visited his friend and then returned home.
The travel graph shows some information about Pete's journey.



(a) Write down the time that Pete started his journey.

1.30pm

(1)

At 2.30 pm Pete stopped for a rest.

(b) (i) Find his distance from home when he stopped for this rest.

10 km

(ii) How many minutes was this rest?

30 minutes

(2)

Pete stayed with his friend for one hour.
He then returned home.

(c) Work out the total distance travelled by Pete on this journey.

$18 \times 2 = 36$

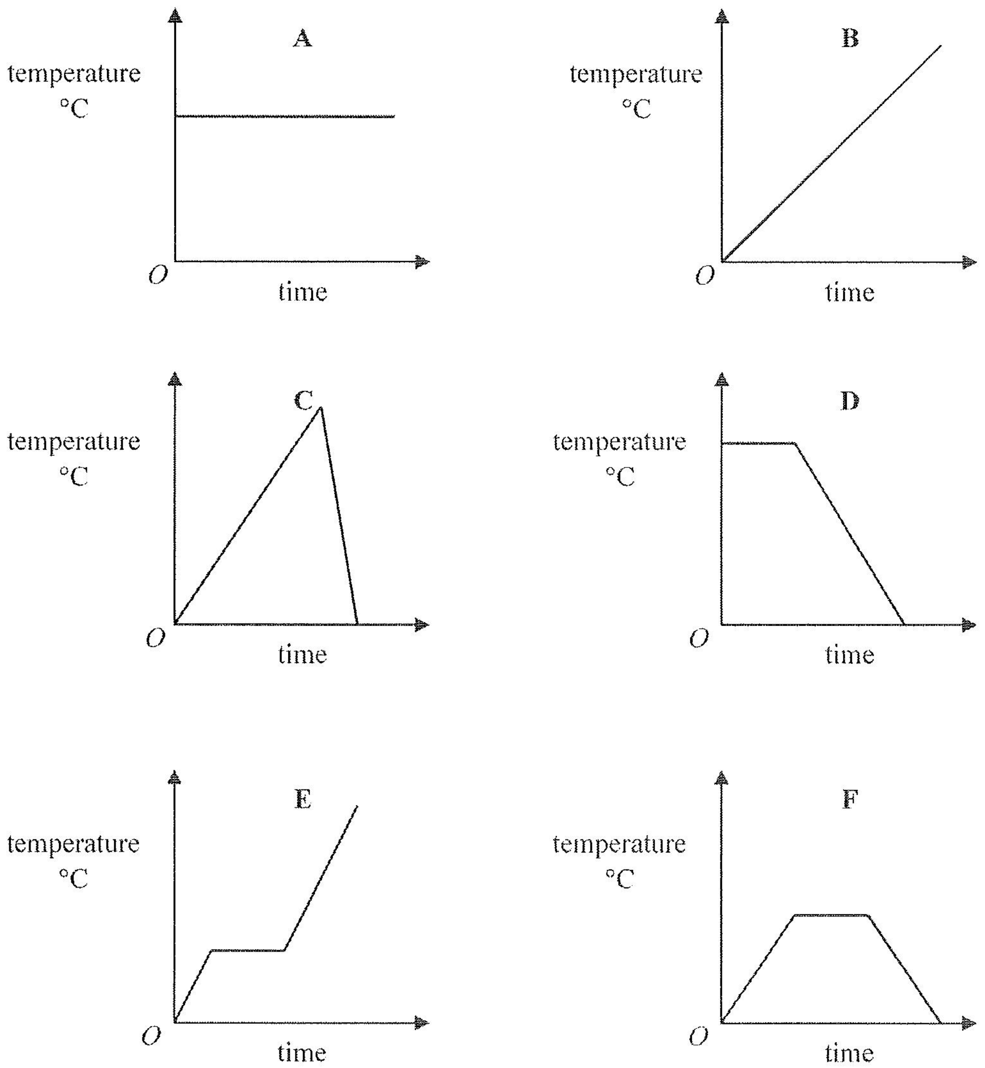
36 km

(2)

(Total 5 marks)

2) Distance Time Graphs: Harder

11. Here are six temperature/time graphs.



Each sentence in the table describes one of the graphs.
Write the letter of the correct graph next to each sentence.

The first one has been done for you.

The temperature starts at 0°C and keeps rising.	**B**
The temperature stays the same for a time and then falls.	D
The temperature rises and then falls quickly.	C
The temperature is always the same.	A
The temperature rises, stays the same for a time and then falls.	F
The temperature rises, stays the same for a time and then rises again.	E

(Total 3 marks)

3) Proportionality: Easier

1) Here is a formula, where V is the volume of a pipe in m^3 and d is the diameter of the pipe in m.

$$V = 8d^2$$

(a) A pipe has volume $2m^3$.
Find the diameter of the pipe.

$2 = 8 \times d^2$
$2 \div 8 = d^2$
$d^2 = 0.25$
$d = \sqrt{0.25} = 0.5$m

(b) Which of these statements is true for the pipe?
Tick one box

- ☐ It has a volume of $4m^3$ with **exactly double** the diameter in part (a)
- ■ It has a volume of $4m^3$ with **less than double** the diameter in part (a)
- ☐ It has a volume of $4m^3$ with **more than double** the diameter in part (a)

You **must** show working to support your answer

$4 = 8 \times d^2$
$d^2 = 0.5$
$d = \sqrt{0.5} = 0.7$m

(5 Marks)

---

2) Here is a formula, where E is the energy of a particle measured in Joules and v is the velocity of the particle measured in m/s.

$$E = 6v^2$$

(a) A moving particle has 54 Joules of energy.
Find the velocity of the particle.

$54 = 6 \times v^2$
$54 \div 6 = v^2$
$v^2 = 9$
$v = \sqrt{9} = 3$m/s

Which of these statements is true for the particle?

Tick one box

- ☐ It has 108J of energy when travelling at **exactly double** the velocity in (a)
- ■ It has 108J of energy when travelling at **less than double** the velocity in (a)
- ☐ It has 108J of energy when travelling at **more than double** the velocity in (a)

You **must** show working to support your answer

$108 = 6 \times v^2$
$108 \div 6 = v^2$
$v^2 = 18$
$v = \sqrt{18} = 4.2$m/s

(5 Marks)

3) Proportionality: Medium

3) The table shows pairs of values x and y.

x	6	7
y	480	560

(a) Tick the correct statement

Trial and error:

Is $y \propto x$?

$480 \div 6 = 80$

$560 \div 7 = 80$

$y \propto x$ …Yes…..

$y \propto x^2$ …………..

$y \propto x^3$ …………..

(b) Write a formula for y in terms of x.

$y = \mathrm{k}x$

$480 = 6\mathrm{k}$

$\mathrm{k} = 480 \div 6$

$\mathrm{k} = 80$ => $y = 80x$

(3 Marks)

4) The table shows pairs of values x and y.

x	4	5
y	48	75

(i) Tick the correct statement

Trial and error:

Is $y \propto x$?

$48 \div 4 = 12$

$75 \div 5 = 15$

No

Is $y \propto x^2$?

$48 \div 4^2 = 3$

$75 \div 5^2 = 3$

Yes

$y \propto x$ …………..

$y \propto x^2$ … Yes …..

$y \propto x^3$ …………..

(ii) Write a formula for y in terms of x.

$y = \mathrm{k}x^2$

$48 = 4^2\mathrm{k}$

$\mathrm{k} = 48 \div 16$

$\mathrm{k} = 3$ => $y = 3x$

(3 Marks)

3) Proportionality: Harder

5) The table shows pairs of values x and y.

x	3	4
y	8	6

(i) Tick the correct statement

As x increases y decreases (no further reasoning necessary)

$y \propto x$ …………..

$y \propto x^2$ …………..

$y \propto \frac{1}{x}$ …Yes…..

(ii) Write a formula for y in terms of x.

$$y = \frac{k}{x}$$

$$8 = \frac{k}{3}$$

k = 8 × 3

k = 24 => $y = \frac{24}{x}$

(3 Marks)

6) The table shows pairs of values x and y.

x	2	3
y	9	4

(i) Tick the correct statement

Trial and error:

Is $y \propto \frac{1}{x}$?
$9 \times 2 = 18$
$4 \times 3 = 12$
No

Is $y \propto \frac{1}{x^2}$?
$9 \times 2^2 = 36$
$4 \times 3^2 = 36$
Yes

$y \propto \frac{1}{x}$ …………..

$y \propto \frac{1}{x^2}$ …Yes…..

$y \propto \frac{1}{x^3}$ …………..

(ii) Write a formula for y in terms of x.

$$y = \frac{k}{x^2}$$

$k = 4 \times 3^2 = 36$ => $y = \frac{36}{x^2}$

(3 Marks)

4) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As $2n$ is even $2n+1$ will be odd and so $2n+2$ is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

4) Proof: Medium

8. Prove that

$$(n + 1)^2 - (n - 1)^2 + 1 \text{ is always odd for all positive integer values of } n.$$

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$

$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$

$= 4n + 1$

4n is a multiple of 4 so it must be even which means 4n+1 is odd.

(3 marks)

PINPOINT

4) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$n^2 + (n+1)^2$

$= n^2 + n^2 + 2n + 1$

$= 2n^2 + 2n + 1$

$= 2n(n+1) + 1$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

$2n(n+1)$ is $2 \times$ an even number which has to be a multiple of 4

So $2n(n+1) + 1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

5) Completing the Square: Easier

1) Express $x^2 + 6x + 10$ in the form $(x + p)^2 + q$

$$(x+3)^2 - 3^2 + 10$$

$$= (x+3)^2 - 9 + 10$$

$$= (x+3)^2 + 1$$

$p = 3$

$q = 1$

5) Completing the Square: Medium

2) Express $x^2 - 3x + 5$ in the form $(x + a)^2 + b$

$$(x-1.5)^2 - 1.5^2 + 5$$

$$= (x-1.5)^2 - 2.25 + 5$$

$$= (x-1.5)^2 + 2.75$$

$a = -1.5, b = 2.75$

5) Completing the Square: Harder

3) What is the minimum value of
$(x-2)^2 + 5$?

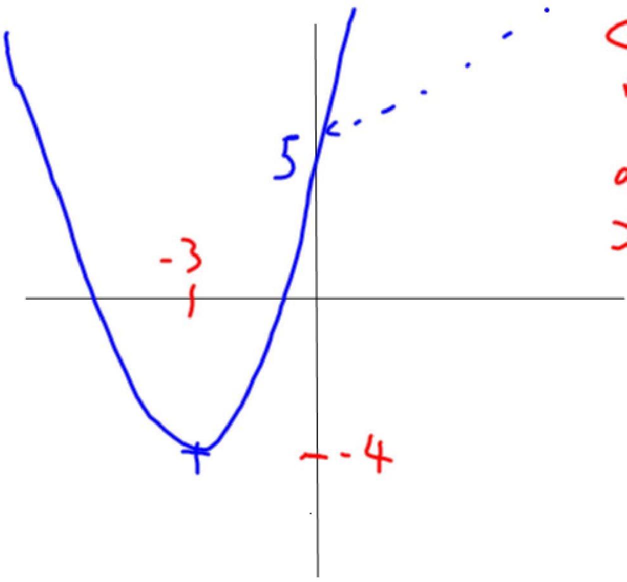
5, which occurs when
$x = 2$.
$(x-2)^2$ can never be
negative.

4) a) Express $x^2 + 6x + 5$ in the form of $(x + a)^2 + b$

$(x+3)^2 - 3^2 + 5$

$= (x+3)^2 - 4$

b) Now sketch the graph of $y = x^2 + 6x + 5$
stating the minimum point of the graph
and where it crosses the axis



min point
at
$x=-3, y=-4$

BROOKES Max

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Total	52 from 80	7 from 12	20 from 26	8 from 14	11 from 19	6 from 9

Your Pinpoint Topics

Topic 1: Expressions, identities and equations. MW: 7

Topic 2: Distance Time Graphs. Mathswatch Clip: 143

Topic 3: Simultaneous Equations. Mathswatch Clip: 162

Topic 4: Proportionality. Mathswatch Clip: 199

Topic 5: Box plots. Mathswatch Clip: 187

PINPOINT

1) Expressions, identities and equations: Easier

1) Fill in the gaps with an appropriate word from the list
EQUATION, IDENTITY, EXPRESSION, TERMS

$$3x + 4 \; is \; an \; expression \; with \; two \; terms$$

$$2(x + 4) \equiv 2x + 8 \; is \; an \; identity$$

$$2x + 3 = 11 \; is \; an \; equation$$

....

(2 Marks)

2) Circle the identity

A $5(x + 3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x + 3)$ D $x^2 + 2 = 27$

(1 Mark)

3) Circle the expression

A $5(x + 3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x + 3)$ D $x^2 + 2 = 27$

....

(1 Mark)

1) Expressions, identities and equations: Medium

4) Annemarie is asked to form an expression, given the following information.
There are a sweets in every packet. I have 3 packets of sweets. I put all the sweets in one container and eat 2 of them. Form an expression for the number of sweets I have left.

Annemarie writes

3a = -2

Write down one mistake Annemarie has made

She has written an equation, (with an equals) she wasn't told how many sweets there are left just that there are two less than 3 bags so she should have written 3a-2 which is an expression

(1 Mark)

---

5) Insert the correct symbol, = or ≡ in the boxes below

$$2x + 3 \quad \boxed{=} \quad 10$$

$$2a \times 3a^2 \quad \boxed{\equiv} \quad 6a^3$$

$$5(x - 2) \quad \boxed{\equiv} \quad 5x - 10$$

Remember an equation is true for some values of the variable and an identity is true for all values of the variable

....

(3 Marks)

1) Expressions, identities and equations: Harder

6) Jim says that

$$(x + 4)^2 = x^2 + 16$$

is an identity. Paul says it is an equation and not an identity. Who is correct? You must explain your reasoning.

Paul is right, it is an equation, for the value $x = 0$ the equation is true as

$(0 + 4)^2 = 0^2 + 4^2$ as they are both equal to 16

It is not true for all values of x for example for $x = 1$

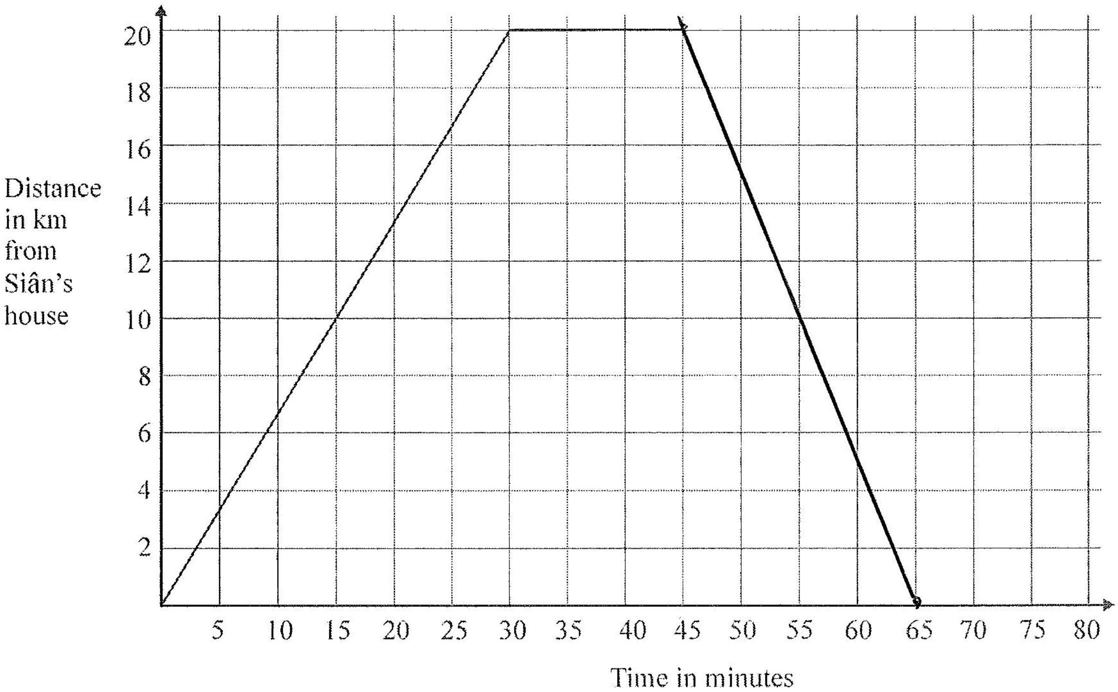
$(1 + 4)^2 = 25$ *and* $1^2 + 16 = 17$ so it does not hold for all values of x

$(x + 4)^2 = x^2 + 8x + 16$ is an identity

(1 Mark)

2) Distance Time Graphs: Easier

1. Here is part of a travel graph of Siân's journey from her house to the shops and back.



(a) Work out Siân's speed for the first 30 minutes of her journey.
Give your answer in km/h.

distance ÷ time   30 minutes = 0.5 hours.

20 ÷ 0.5 = 40

40 .... km/h

(2)

Siân spends 15 minutes at the shops.
She then travels back to her house at 60 km/h.

(b) Complete the travel graph.

20km at 60 km/h

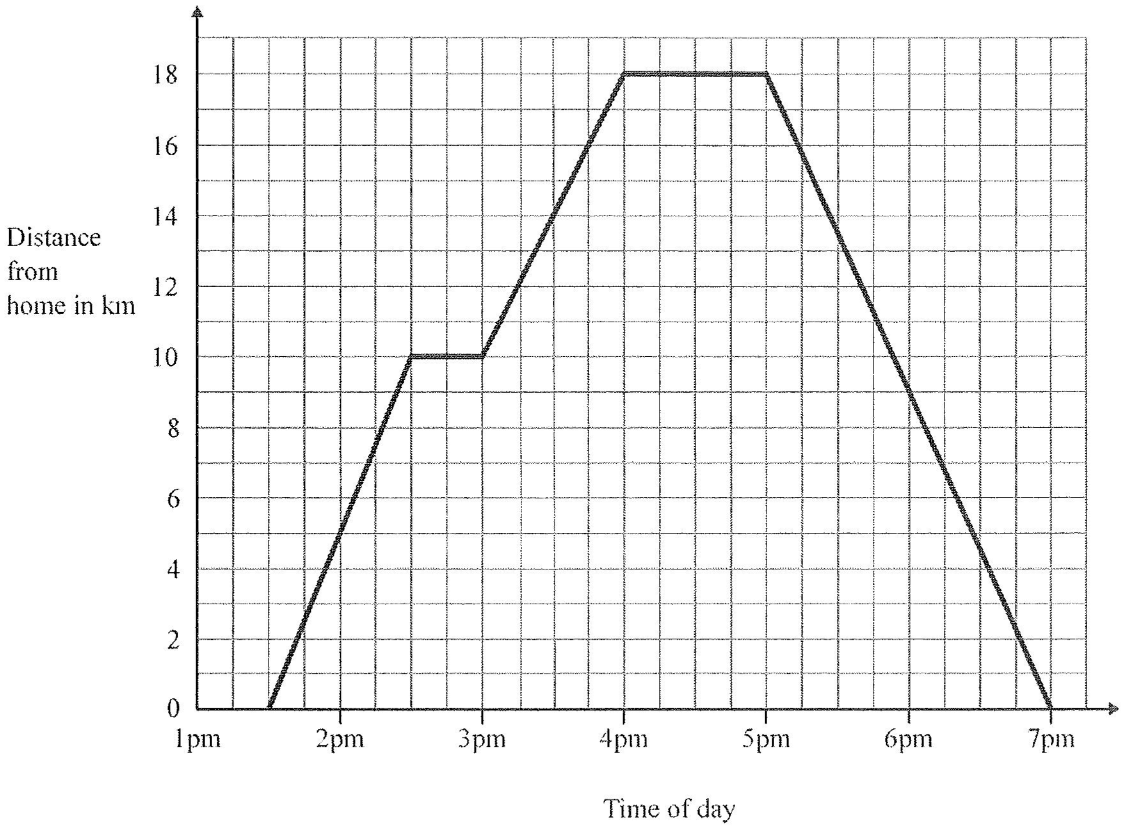
20 in 20minutes

(2)

(Total 4 marks)

2) Distance Time Graphs: Medium

10. Pete visited his friend and then returned home.
The travel graph shows some information about Pete's journey.



(a) Write down the time that Pete started his journey.

1.30pm

(1)

At 2.30 pm Pete stopped for a rest.

(b) (i) Find his distance from home when he stopped for this rest.

10 km

(ii) How many minutes was this rest?

30 minutes

(2)

Pete stayed with his friend for one hour.
He then returned home.

(c) Work out the total distance travelled by Pete on this journey.

$18 \times 2 = 36$

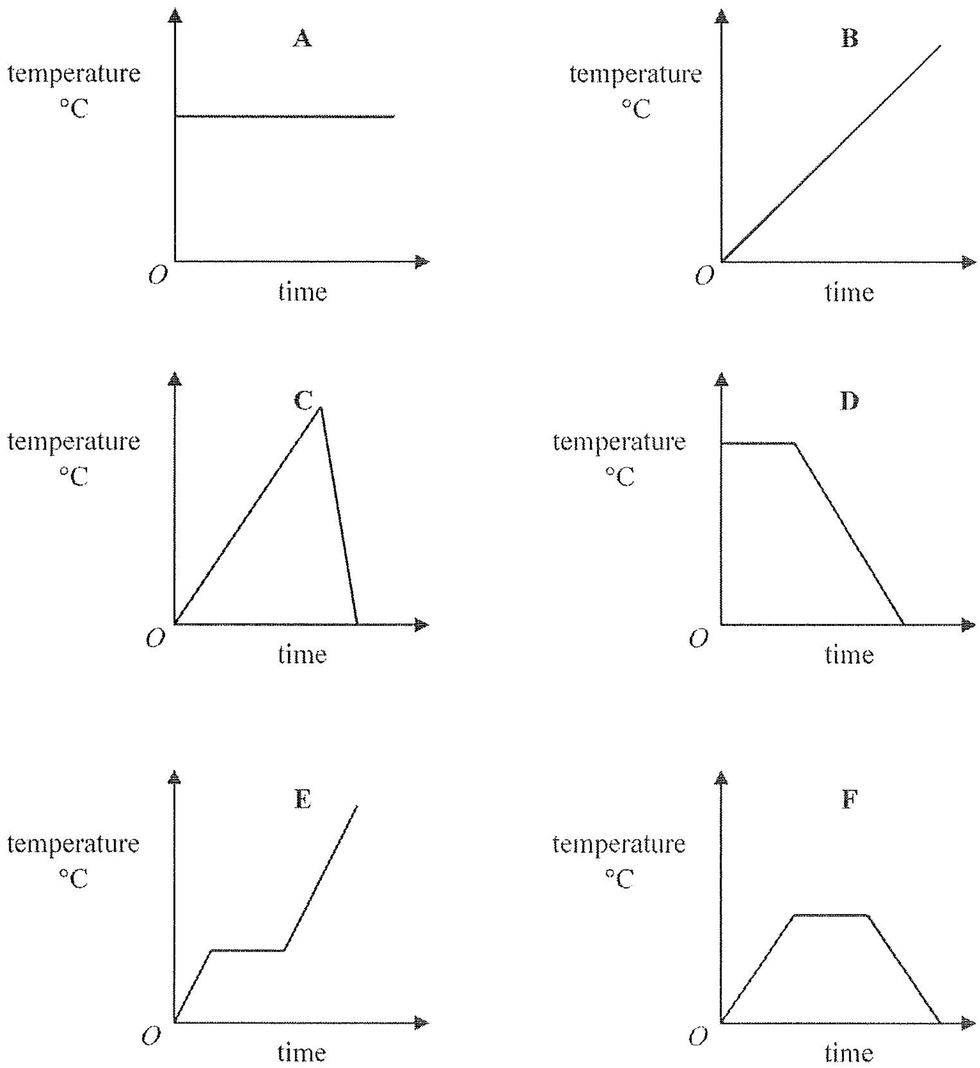
36 km

(2)

(Total 5 marks)

2) Distance Time Graphs: Harder

11. Here are six temperature/time graphs.



Each sentence in the table describes one of the graphs.
Write the letter of the correct graph next to each sentence.

The first one has been done for you.

The temperature starts at 0°C and keeps rising.	**B**
The temperature stays the same for a time and then falls.	D
The temperature rises and then falls quickly.	C
The temperature is always the same.	A
The temperature rises, stays the same for a time and then falls.	F
The temperature rises, stays the same for a time and then rises again.	E

(Total 3 marks)

3) Simultaneous Equations: Easier

1) Solve the simultaneous equations.

$$\text{①} \quad 2x + 3y = 9$$

$$\text{②} \quad 5x + 3y = 18$$

② − ①

$5x + 3y = 18$

$2x + 3y = 9$ −

$\dfrac{3x}{3} = \dfrac{9}{3}$

$x = 3$

Sub $x = 3$ into ①

$2x + 3y = 9$

$6 + 3y = 9$

$3y = 3$

$y = 1$

x = 3

y = 1

(3 Marks)

---

2) Solve the simultaneous equations.

$$\text{①} \quad 4x + 2y = 9 \quad \times 2$$

$$\text{②} \quad 8x + 8y = 20$$

③ $8x + 4y = 18$

② − ③

$8x + 8y = 20$

$8x + 4y = 18$ −

$\dfrac{4y}{4} = \dfrac{2}{4}$

$y = 0.5$

Sub $y = 0.5$ into ①

$4x + 1 = 9$

$-1 \quad -1$

$\dfrac{4x}{4} = \dfrac{8}{4}$

$x = 2$

x = 2

y = 0.5

(4 Marks)

3) Simultaneous Equations: Medium

7) Solve the simultaneous equations.

① $6x + 3y = 15$ $\times 3$

② $4x - 9y = -34$

③ $18x + 9y = 45$

② + ③

$$4x - 9y = -34$$
$$18x + 9y = 45 \quad +$$
$$\frac{22x}{22} = \frac{11}{22}$$
$$x = 0.5$$

Sub $x = 0.5$ into ①

$$3 + 3y = 15$$
$$-3 \qquad -3$$
$$\frac{3y}{3} = \frac{12}{3}$$
$$y = 4$$

x = 0.5

y = 4

(4 Marks)

8) Solve the simultaneous equations.

① $5x + 2y = 29$ $\times 3$

② $8x - 6y = 51$

③ $15x + 6y = 87$

② + ③

$$8x - 6y = 51$$
$$15x + 6y = 87 \quad +$$
$$\frac{23x}{23} = \frac{138}{23}$$
$$x = 6$$

Sub $x = 6$ into ①

$$30 + 2y = 29$$
$$-30 \qquad -30$$
$$\frac{2y}{2} = \frac{-1}{2}$$
$$y = -0.5$$

x = 6

y = −0.5

(4 Marks)

3) Simultaneous Equations: Harder

9) Bill goes into a chip shop and buys **3 fish** and **2 portions of chips,** it cost him £5.20

Jenny also goes into the same chip shop. She buys **5 fish** and **6 portions of chips,** it cost her £10.80

What is the cost of a portion of fish and chips?

① $3f + 2p = 5.20$ $\times 3$

② $5f + 6p = 10.80$

③ $9f + 6p = 15.60$

③ − ②

$9f + 6p = 15.60$

$5f + 6p = 10.80$

$4f = 4.8$

$\frac{4f}{4} = \frac{4.80}{4}$

$f = 1.20$

Sub into ①

$3.60 + 2p = 5.20$

$-3.60 \qquad -3.60$

$2p = 1.60$

$p = 0.80$

$p + f = £2$

(5 Marks)

10) There are some ducks and some sheep on a farm. Altogether they have 35 heads and 94 feet.

How many ducks and sheep are there?

① $d + s = 35$ (heads) $\times 2$

② $2d + 4s = 94$ (feet)

③ $2d + 2s = 70$

② − ③

$2d + 4s = 94$

$2d + 2s = 70$ −

$2s = 24$

Sub $s = 12$ into ①

$d + 12 = 35$

$-12 \qquad -12$

$d = 23$

Ducks = 23

Sheep = 12

(5 Marks)

4) Proportionality: Easier

1) Here is a formula, where V is the volume of a pipe in m^3 and d is the diameter of the pipe in m.

$$V = 8d^2$$

(a) A pipe has volume $2m^3$.
Find the diameter of the pipe.

$2 = 8 \times d^2$
$2 \div 8 = d^2$
$d^2 = 0.25$
$d = \sqrt{0.25} = 0.5$m

(b) Which of these statements is true for the pipe?
Tick one box

- [ ] It has a volume of $4m^3$ with **exactly double** the diameter in part (a)
- [x] It has a volume of $4m^3$ with **less than double** the diameter in part (a)
- [ ] It has a volume of $4m^3$ with **more than double** the diameter in part (a)

You **must** show working to support your answer

$4 = 8 \times d^2$
$d^2 = 0.5$
$d = \sqrt{0.5} = 0.7$m

(5 Marks)

---

2) Here is a formula, where E is the energy of a particle measured in Joules and v is the velocity of the particle measured in m/s.

$$E = 6v^2$$

(a) A moving particle has 54 Joules of energy.
Find the velocity of the particle.

$54 = 6 \times v^2$
$54 \div 6 = v^2$
$v^2 = 9$
$v = \sqrt{9} = 3$m/s

Which of these statements is true for the particle?

Tick one box

- [ ] It has 108J of energy when travelling at **exactly double** the velocity in (a)
- [x] It has 108J of energy when travelling at **less than double** the velocity in (a)
- [ ] It has 108J of energy when travelling at **more than double** the velocity in (a)

You **must** show working to support your answer

$108 = 6 \times v^2$
$108 \div 6 = v^2$
$v^2 = 18$
$v = \sqrt{18} = 4.2$m/s

(5 Marks)

---

4) Proportionality: Medium

3) The table shows pairs of values x and y.

x	6	7
y	480	560

(a) Tick the correct statement

Trial and error:

Is $y \propto x$?

$480 \div 6 = 80$

$560 \div 7 = 80$

$y \propto x$ …Yes…..

$y \propto x^2$ …………..

$y \propto x^3$ …………..

(b) Write a formula for y in terms of x.

$y = kx$

$480 = 6k$

$k = 480 \div 6$

$k = 80$ => $y = 80x$

(3 Marks)

4) The table shows pairs of values x and y.

x	4	5
y	48	75

(i) Tick the correct statement

Trial and error:

Is $y \propto x$?

$48 \div 4 = 12$

$75 \div 5 = 15$

No

Is $y \propto x^2$?

$48 \div 4^2 = 3$

$75 \div 5^2 = 3$

Yes

$y \propto x$ …………..

$y \propto x^2$ … Yes …..

$y \propto x^3$ …………..

(ii) Write a formula for y in terms of x.

$y = kx^2$

$48 = 4^2k$

$k = 48 \div 16$

$k = 3$ => $y = 3x$

(3 Marks)

PINPOINT

4) Proportionality: Harder

5) The table shows pairs of values x and y.

x	3	4
y	8	6

(i) Tick the correct statement

As x increases y decreases (no further reasoning necessary)

$y \propto x$ …………..

$y \propto x^2$ …………..

$y \propto \frac{1}{x}$ …Yes…..

(ii) Write a formula for y in terms of x.

$$y = \frac{k}{x}$$

$$8 = \frac{k}{3}$$

$k = 8 \times 3$

$k = 24$ => $y = \frac{24}{x}$

(3 Marks)

6) The table shows pairs of values x and y.

x	2	3
y	9	4

(i) Tick the correct statement

Trial and error:

Is $y \propto \frac{1}{x}$?
$9 \times 2 = 18$
$4 \times 3 = 12$
No

Is $y \propto \frac{1}{x^2}$?
$9 \times 2^2 = 36$
$4 \times 3^2 = 36$
Yes

$y \propto \frac{1}{x}$ …………..

$y \propto \frac{1}{x^2}$ …Yes…..

$y \propto \frac{1}{x^3}$ …………..

(ii) Write a formula for y in terms of x.

$$y = \frac{k}{x^2}$$

$k = 4 \times 3^2 = 36$ => $y = \frac{36}{x^2}$

(3 Marks)

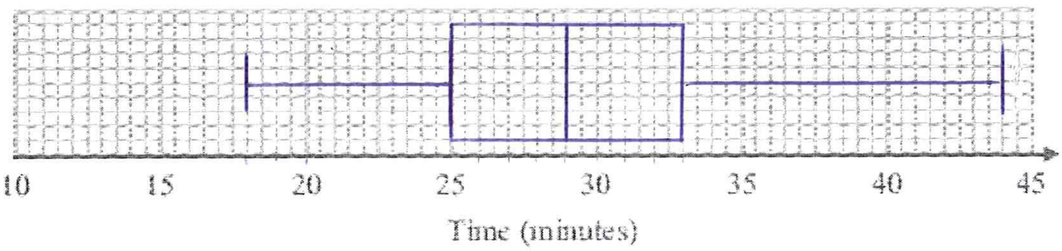
5) Box plots: Easier

2. Sameena recorded the times, in minutes, some girls took to do a jigsaw puzzle.

Sameena used her results to work out the information in this table.

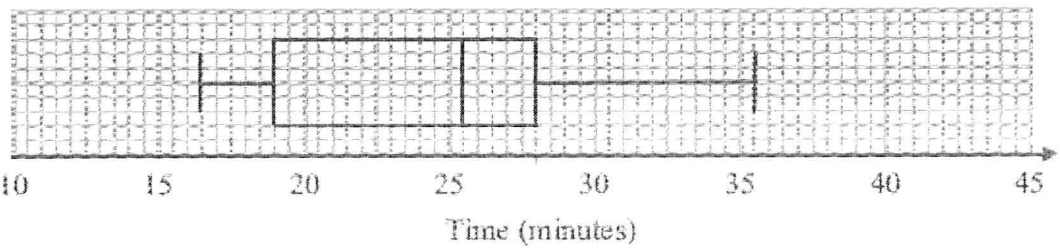
	Minutes
Shortest time	18
Lower quartile	25
Median	29
Upper quartile	33
Longest time	44

(a) On the grid, draw a box plot to show the information in the table.



(2)

The box plot below shows information about the times, in minutes, some boys took to do the same jigsaw puzzle.



(b) Compare the distributions of the girls' times and the boys' times.

The boys median time was less than that of the girls; Boys 25.5mins, Girls 29 mins.

The spread of data for the interquartile range is smaller for the girls (8 mins) then for the boys (9 mins).

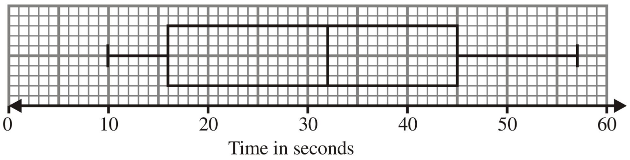
(2)

(4 marks)

5) Box plots: Medium

2. (a) 32 — 1

B1 for 32 (accept 31.5 to 33.5 inclusive)

(b) 

— 3

B1 for ends of whiskers at 9 and 57 (with a box)
B1 for ends of box at 16 and 45/46 (±0.5)
B1for median marked at "32" or complete box and whisker diagram drawn with a median inside the box

(c) Median(B)>Median(G); on average boys take longer
IQR(B)>IQR(G); times for boys have a greater spread — 2

B1 eg for comparison of medians (ft on diagrams)
B1 eg for comparison of (interquartile) ranges (ft on diagram)

[6]

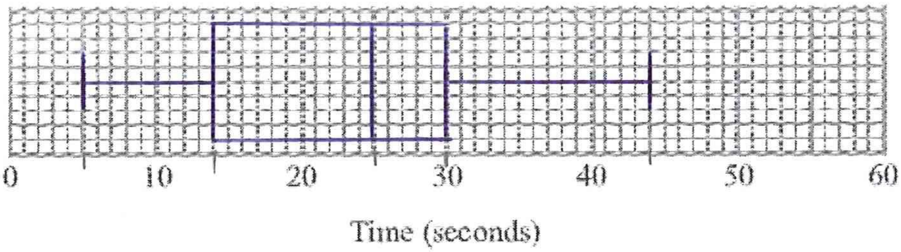
5) Box plots: Harder

7. Here are the times, in seconds, that 15 people waited to be served at Rose's garden centre.

5 9 11 $\boxed{14}$ 15 20 22 $\boxed{25}$ 27 27 28 $\boxed{30}$ 32 35 44

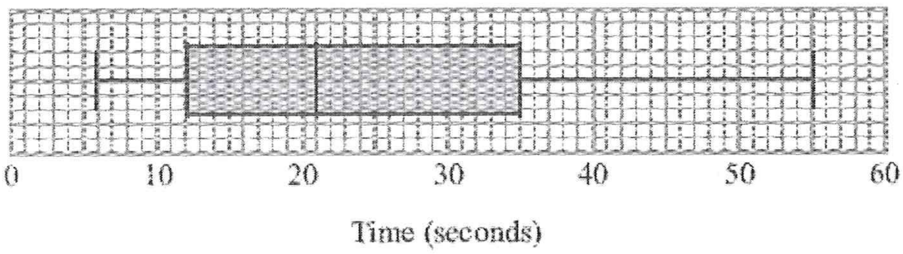
LQ Median UQ.

(a) On the grid, draw a box plot for this information.



(3)

The box plot below shows the distribution of the times that people waited to be served at Green's garden centre.



(b) Compare the distribution of the times that people waited at Rose's garden centre and the distribution of the times that people waited at Green's garden centre.

There was a greater spread of waiting times in the interquartile range for Green's Garden Centre than Rose's Garden centre

The median waiting time is shorter at ~~Roses~~ Greens than Roses Garden centre.

(2)

(5 marks)

BURNS Megan

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	15 from 20	1 from 1	5 from 10	5 from 5	3 from 3	1 from 1
A02 and 3	51 from 60	11 from 11	13 from 16	7 from 9	13 from 16	7 from 8
Total	66 from 80	12 from 12	18 from 26	12 from 14	16 from 19	8 from 9

Your Pinpoint Topics

Topic 1: Recognising cubic and quadratic graphs. MW: 99

Topic 2: Box plots. Mathswatch Clip: 187

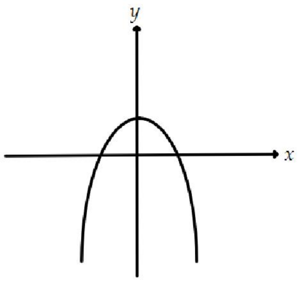
Topic 3: Counting Methods. Mathswatch Clip: NA

Topic 4: Proof. Mathswatch Clip: 193

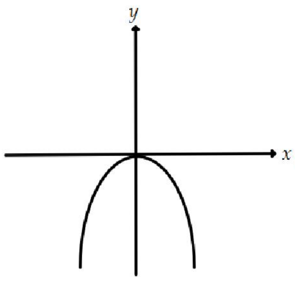
Topic 5: Iterative processes. Mathswatch Clip: 180

1) Recognising cubic and quadratic graphs: Easier

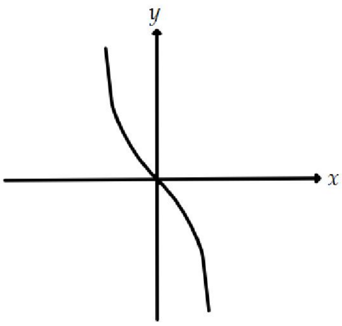
1) Karen has sketched quadratic and cubic graphs. Match each graph with its possible equation, the first one is done for you



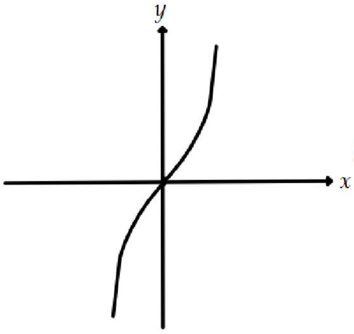
$y = x^3$



$y = 4 - x^2$



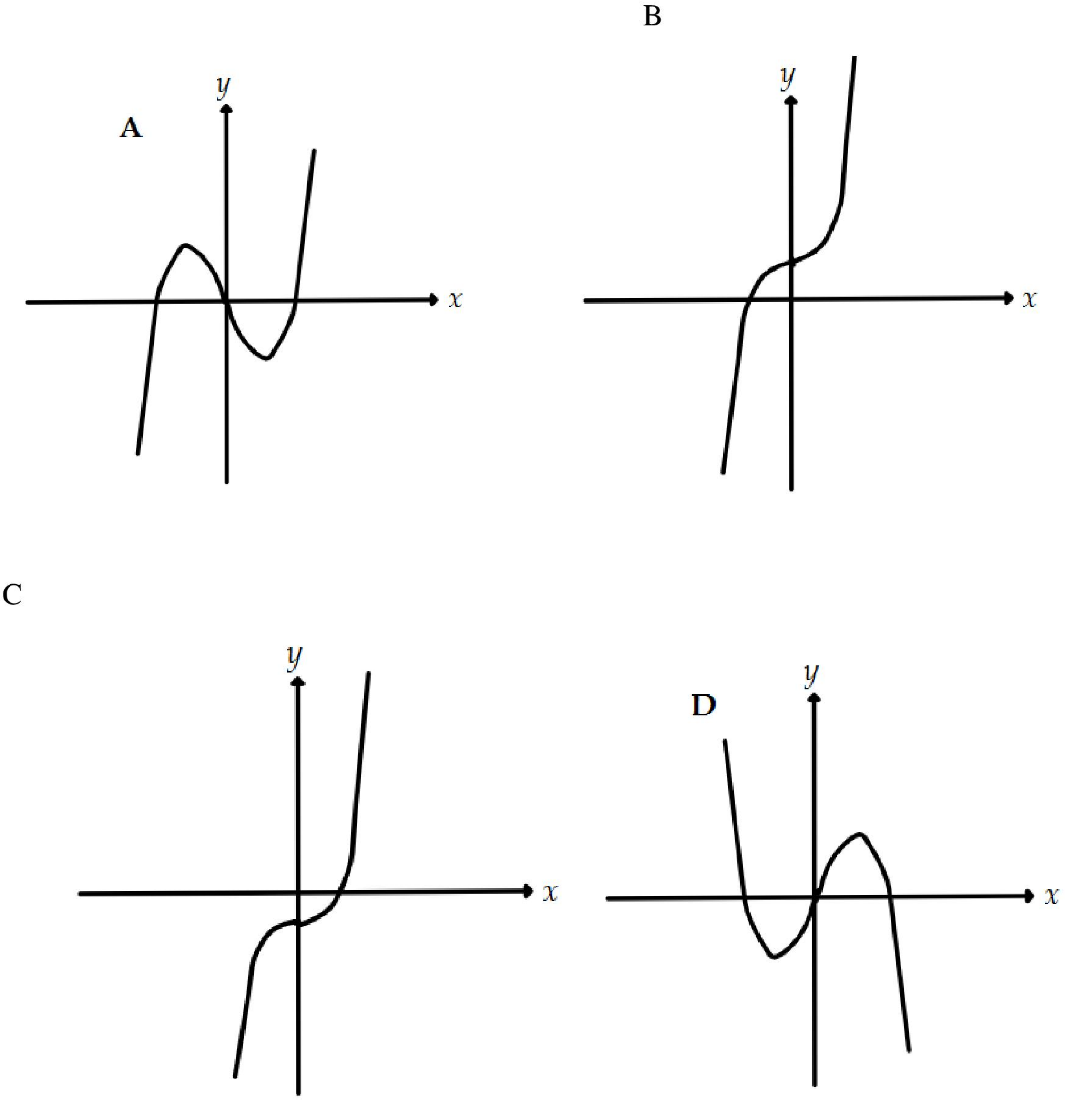
$y = -x^3$



$y = -x^2$

1) Recognising cubic and quadratic graphs: Medium

2) Harry has sketched some cubic graphs,



a) Write down the letter of the graph that could have the equation $y = x^3 - 3$

C

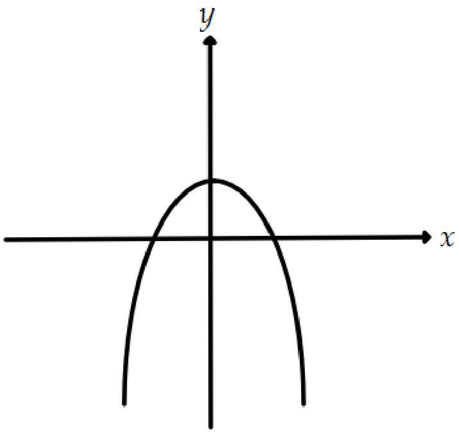
____

(1 Mark)

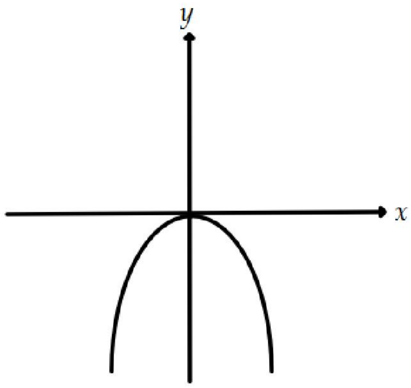
1) Recognising cubic and quadratic graphs: Harder

3) Harry has sketched some quadratic graphs,

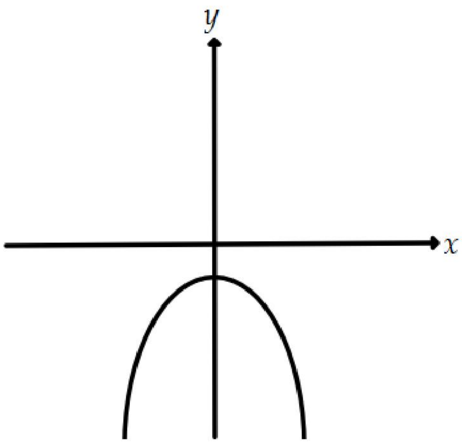
A



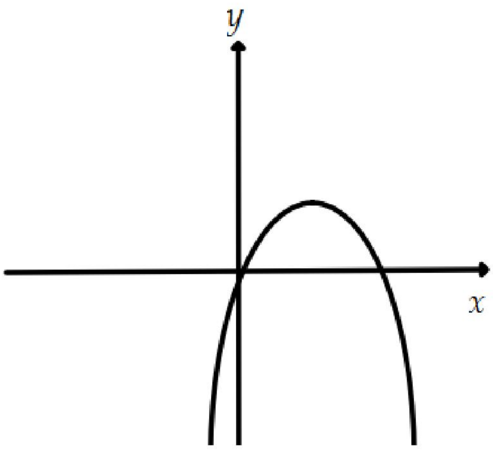
B



C



D



a) Write down the letter of the graph that could have the equation $y = x^2 - 4$

C

____

(1 Mark)

b) Write down the letter of the graph that could have the equation $y = x^2 - 4x$

D

____

(1 Mark)

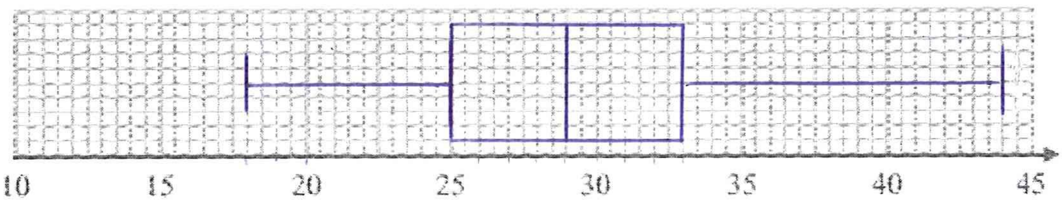
2) Box plots: Easier

2. Sameena recorded the times, in minutes, some girls took to do a jigsaw puzzle.

Sameena used her results to work out the information in this table.

	Minutes
Shortest time	18
Lower quartile	25
Median	29
Upper quartile	33
Longest time	44

(a) On the grid, draw a box plot to show the information in the table.



(2)

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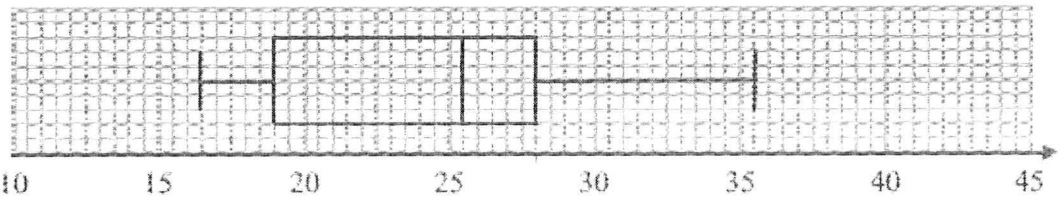

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The boys median time was less than that of the girls; Boys 25.5mins, Girls 29 mins.

The spread of data for the interquartile range is smaller for the girls (8 mins) Then for the boys (9 mins)

(2)

(4 marks)

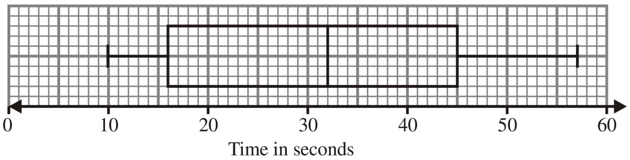
PINPOINT

2) Box plots: Medium

2. (a) 32 1

B1 for 32 (accept 31.5 to 33.5 inclusive)

(b) 3



B1 for ends of whiskers at 9 and 57 (with a box)
B1 for ends of box at 16 and 45/46 ($\pm$0.5)
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IQR(B)>IQR(G); times for boys have a greater spread 2

B1 eg for comparison of medians (ft on diagrams)
B1 eg for comparison of (interquartile) ranges (ft on diagram)

[6]

2) Box plots: Harder

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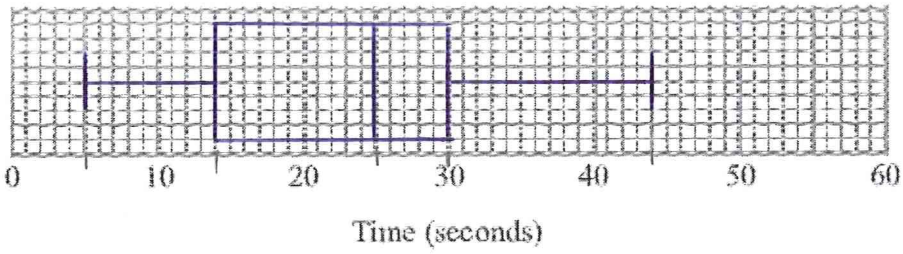
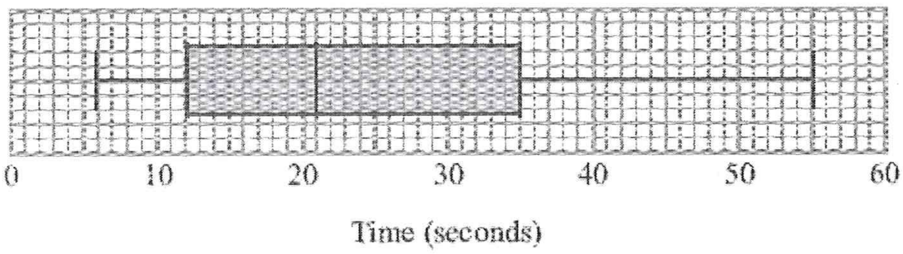
LQ Median UQ.

(a) On the grid, draw a box plot for this information.



(3)

The box plot below shows the distribution of the times that people waited to be served at Green's garden centre.



(b) Compare the distribution of the times that people waited at Rose's garden centre and the distribution of the times that people waited at Green's garden centre.

There was a greater spread of waiting times in the interquartile range for Green's Garden Centre than Rose's Garden centre

The Median waiting time is shorter at ~~Rose's~~ Greens than Roses Garden centre.

(2)

(5 marks)

3) Counting Methods: Easier

1) Ryan has four shorts of different colours, blue, red, green and yellow.
He has three different T-shirts of different colours, black, white and orange.

Blue shorts and a black T-Shirt would be one possible outfit.
How many different outfits of Shorts and T-Shirts can Ryan wear?

4 shorts × 3 T-shirts = 12 possible outfits

____

(2 Marks)

2) There are 13 boys and 10 girls in a class.
Work out the total number of ways that 1 boy and 1 girl can be chosen from the class.

13 × 10 = 130 ways

____

(2 Marks)

3) There are 7 boys and 10 girls in a class.
Work out the total number of ways that 1 boys and 2 girls can be chosen from the class.

7 × 10 × 9 = 630 ways

____

(2 Marks)

3) Counting Methods: Medium

4) Mason's bank secret pin code is a four digit number and each digit can be the numbers 0, 1, 2, 3, 4, 5, 6 , 7, 8, or 9. For example one possible pin number could be 9021.

a) Mason's bank card is stolen. What is the probability with one guess only that someone correctly guesses Mason's pin number? Leave your answer as a fraction.

$10 \times 10 \times 10 \times 10 = 10000$ possibilities.

Probability of guessing first time = $\frac{1}{10000}$

____

(2 Marks)

Ishmael's bank does not allow any digit to be repeated in his secret pin number. For example 7762 would not be allowed, nor would 5075.

b) Ishmael's bank card is stolen. What is the probability with one guess only that someone correctly guesses Ishmael's pin number? Leave your answer as a fraction.

$10 \times 9 \times 8 \times 7 = 5040$ possibilities.

Probability of guessing first time = $\frac{1}{5040}$

____

(3 Marks)

3) Counting Methods: Harder

5) A restaurant menu has 6 starters, 10 mains and 6 desserts.
A customer can choose from the following meals

- a starter and a main,
- a main and a dessert,
- a starter, a main and a dessert.

Show that there are 480 different ways of choosing a meal at this restaurant.

$$(6 \times 10) + (10 \times 6) + (6 \times 10 \times 6)$$

$$= 60 + 60 + 360$$

$$= 480 \text{ ways}$$

____

(3 Marks)

6) A simple computer password only allows you to use two letters a and b.
"abaab" would be an example of one password which consists of 5 letters.
How many letters must your password contain such that the probability of someone randomly guessing it first time is less than 1 in a 1000?

Use Trial and Improvement:

2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 1024 ways with 10 letters.

Therefore a password of <u>10 letters</u> is needed as $\frac{1}{1024} < \frac{1}{1000}$

____

(3 Marks)

4) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As $2n$ is even $2n+1$ will be odd and so $2n+2$ is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

4) Proof: Medium

8. Prove that

$(n+1)^2 - (n-1)^2 + 1$ is always odd for all positive integer values of n.

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$

$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$

$= 4n + 1$

4n is a multiple of 4 so it must be even which means 4n+1 is odd.

(3 marks)

4) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$$n^2 + (n+1)^2$$

$$= n^2 + n^2 + 2n + 1$$

$$= 2n^2 + 2n + 1$$

$$= 2n(n+1) + 1$$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

$2n(n+1)$ is 2 x an even number which has to be a multiple of 4

So $2n(n+1) + 1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

5) Iterative processes: Easier

Solution for Question 1:

$$U_1 = 2$$

$$U_2 = 2(2) + 3 = 4 + 3$$

$$U_2 = 7$$

$$U_3 = 2(7) + 3 = 14 + 3$$

$$U_3 = 17$$

$$U_4 = 2(17) + 3 = 34 + 3$$

$$U_4 = 37$$

Solution for Question 2:

$$x_0 = 2$$

$$x_1 = (3(2) - 1)^{\frac{1}{3}}$$

$$x_1 = 5^{\frac{1}{3}} = 1.70996 \ldots$$

$$x_2 = \left(3\left(5^{\frac{1}{3}}\right) - 1\right)^{\frac{1}{3}}$$

$$x_2 = 1.60441 \ldots$$

$$x_3 = (3(1.60441 \ldots) - 1)^{\frac{1}{3}}$$

$$x_3 = 1.5623 \ldots$$

Solution for Question 3:

a) $5x - x^3 = 2$

Add x^3 to both sides: $5x = 2 + x^3$

Dividing both sides by 5 will give: $x = \frac{2}{5} + \frac{x^3}{5}$

b) $x_0 = 0.3$

$$x_1 = \frac{2}{5} + \frac{(0.3)^3}{5}$$

$$x_1 = 0.4054$$

$$x_2 = \frac{2}{5} + \frac{(0.4054)^3}{5}$$

$$x_2 = 0.413325 \ldots$$

$$x_3 = \frac{2}{5} + \frac{(0.413325 \ldots)^3}{5}$$

5) Iterative processes: Medium

$$x_3 = 0.414122 \ldots$$

$$x_4 = \frac{2}{5} + \frac{(0.414122 \ldots)^3}{5}$$

$$x_4 = 0.41420 \ldots$$

c) Root of $5x - x^3 = 2$ to two decimal places: $x = 0.41$

Solution for Question 4:

a) $x^3 + 3x^2 - 2 = 0$

Sub in $x = -2$: $(-2)^3 + 3(-2)^2 - 2 = 2$

Sub in $x = -3$: $(-3)^3 + 3(-3)^2 - 2 = -2$

Since there is a change in sign from where $x = -2$ to $x = -3$, there is a root between -2 and -3

b) $x^3 + 3x^2 - 2 = 0$

Add 2 to both sides: $x^3 + 3x^2 = 2$

Take away $3x^2$ from both sides: $x^3 = 2 - 3x^2$

Dividing both sides by x^2 gives: $x = \frac{2}{x^2} - 3$

c) $x_0 = 0.5$

$$x_1 = \frac{2}{0.5^2} - 3,\ x_1 = 5$$

$$x_2 = \frac{2}{5^2} - 3,\ x_2 = -2.92$$

$$x_3 = \frac{2}{(-2.92)^2} - 3,\ x_3 = -2.765 \ldots$$

$$x_4 = \frac{2}{(-2.765 \ldots)^2} - 3,\ x_4 = -2.738 \ldots$$

$$x_5 = \frac{2}{(-2.738 \ldots)^2} - 3,\ x_5 = -2.733 \ldots$$

$$x_6 = \frac{2}{(-2.733 \ldots)^2} - 3,\ x_6 = -2.732 \ldots$$

$$x_7 = \frac{2}{(-2.732)^2} - 3,\ x_7 = -2.732 \ldots$$

Therefore, to three decimal places, the root of $x^3 + 3x^2 - 2 = 0$: $x = -2.732$

5) Iterative processes: Harder

Solution for Question 5:

Number of Tadpoles in 2016: $P_0 = 50$
Number of Tadpoles in 2017: $P_1 = 1.02(50 + 6),\ P_1 = 57.12$
Number of Tadpoles in 2018: $P_2 = 1.02(57.12 + 6),\ P_2 = 64.38\ldots$
Number of Tadpoles in 2019: $P_3 = 1.02(64.38\ldots + 6),\ P_3 = 71.79\ldots$
Number of Tadpoles in 2020: $P_4 = 1.02(71.79\ldots + 6),\ P_4 = 79.35\ldots$

Predicted number of Tadpoles at the start of 2020: 79

FARTHING Rachel

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	18 from 20	1 from 1	8 from 10	5 from 5	3 from 3	1 from 1
A02 and 3	42 from 60	6 from 11	12 from 16	5 from 9	11 from 16	8 from 8
Total	60 from 80	7 from 12	20 from 26	10 from 14	14 from 19	9 from 9

Your Pinpoint Topics

Topic 1: Loci and Construction. Mathswatch Clip: 165

Topic 2: Box plots. Mathswatch Clip: 187

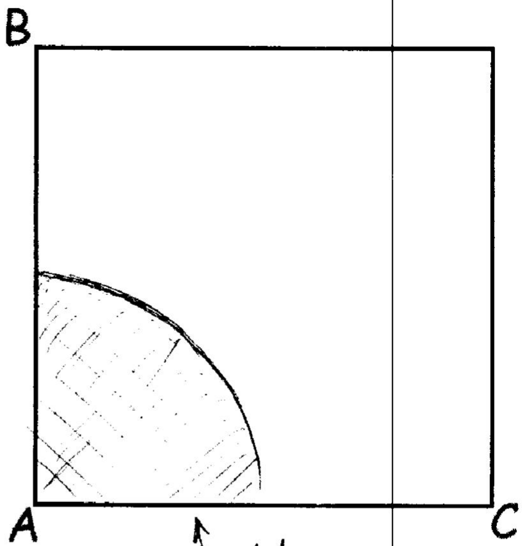
Topic 3: Proof. Mathswatch Clip: 193

Topic 4: Completing the Square. Mathswatch Clip: 209

Topic 5: Upper and Lower Bounds. Mathswatch Clip: 206

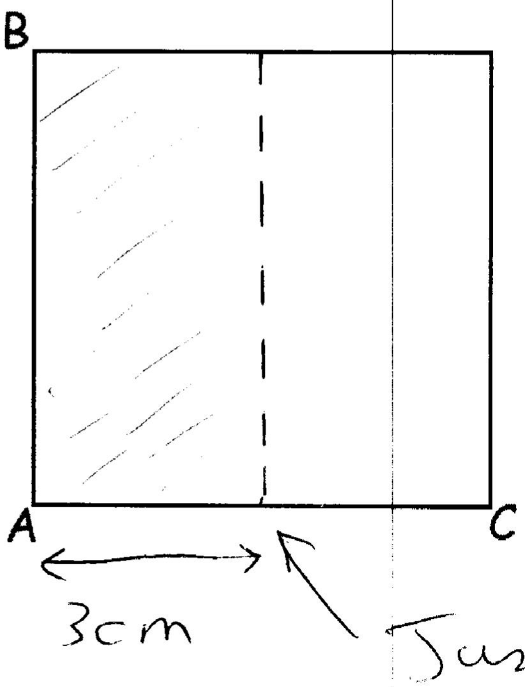
1) Loci and Construction: Easier

1) Shade the area closer than 3cm to point A within the square below:



Use compass at 3cm

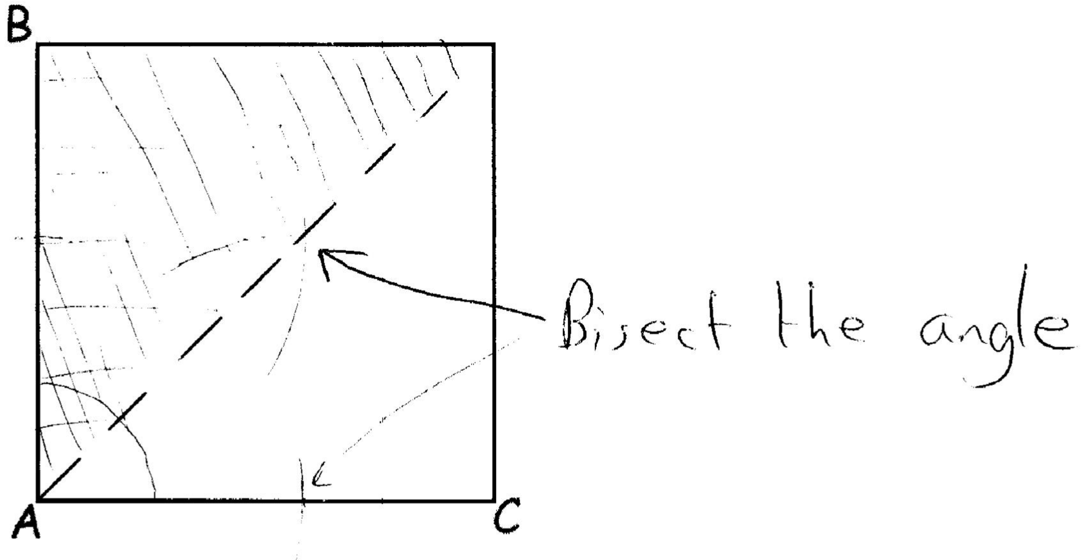
2) Shade the area closer than 3cm to the line AB within the square below:



Just measure 3cm with your ruler

1) Loci and Construction: Medium

3) Shade the area closer to the line AB than AC within the square below:

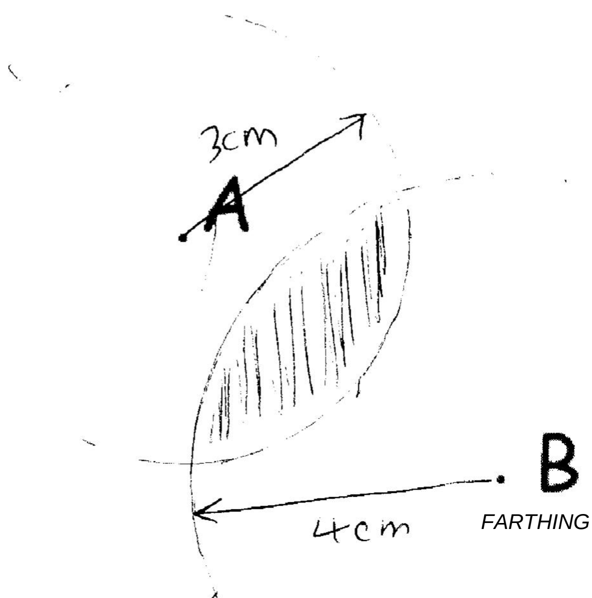


4) Two mobile phone stations transmit a signal.

Mobile phone station A transmits its signal ~~5~~ 3 miles.

Mobile phone station B transmits its signal 4 miles.

When you can receive both signals you experience interference on your phone. Shade below the area of interference.



Scale: 1 cm represents 1 mile

1) Loci and Construction: Harder

5) Mariam wants to plant a flower:

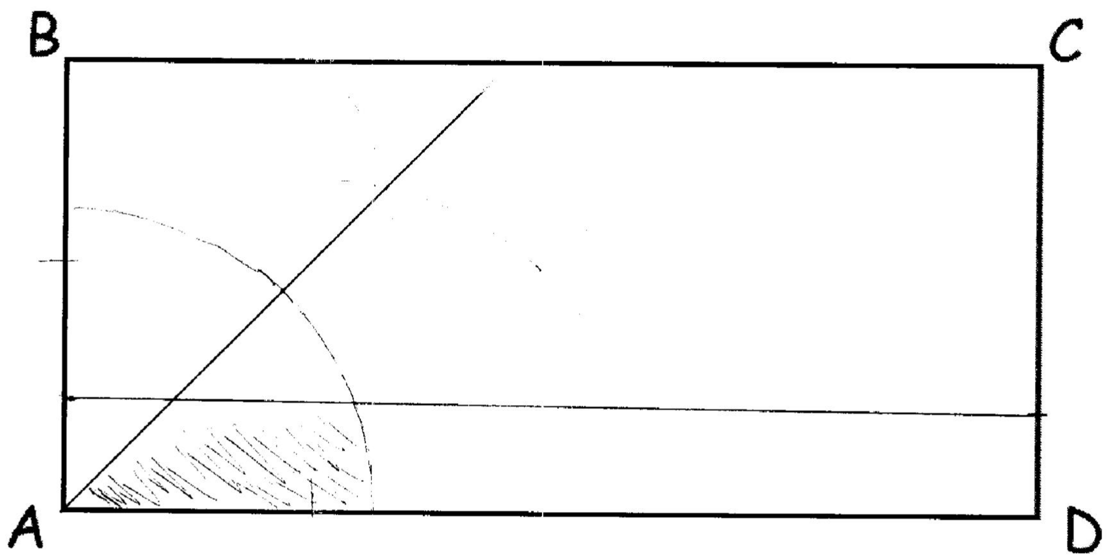
Within 4m of A

Closer to AD than AB

Less than 1.5m from AD.

Shade below the region where Mariam should plant her flower.

Show any construction lines your draw.



Scale: 1 cm represents 1 metre

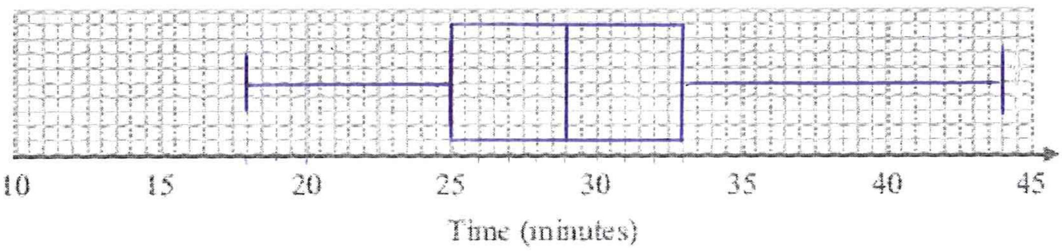
2) Box plots: Easier

2. Sameena recorded the times, in minutes, some girls took to do a jigsaw puzzle.

Sameena used her results to work out the information in this table.

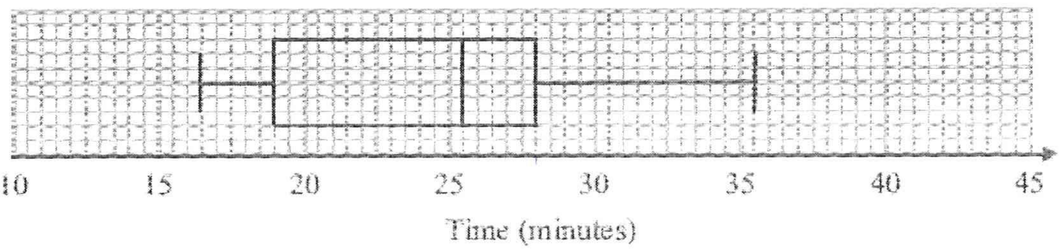
	Minutes
Shortest time	18
Lower quartile	25
Median	29
Upper quartile	33
Longest time	44

(a) On the grid, draw a box plot to show the information in the table.



(2)

The box plot below shows information about the times, in minutes, some boys took to do the same jigsaw puzzle.



(b) Compare the distributions of the girls' times and the boys' times.

The boys median time was less than that of the girls: Boys 25.5mins, Girls 29 mins.

The spread of data for the interquartile range is smaller for the girls (8 mins) than for the boys (9 mins).

(2)

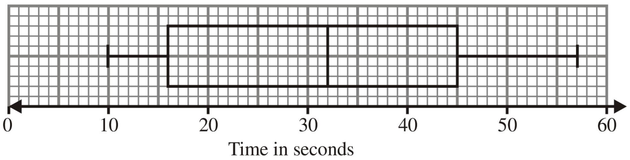
(4 marks)

2) Box plots: Medium

2. (a) 32 1

B1 for 32 (accept 31.5 to 33.5 inclusive)

(b) 3



B1 for ends of whiskers at 9 and 57 (with a box)
B1 for ends of box at 16 and 45/46 (± 0.5)
B1for median marked at "32" or complete box and whisker diagram drawn with a median inside the box

(c) Median(B)>Median(G); on average boys take longer
IQR(B)>IQR(G); times for boys have a greater spread 2

B1 eg for comparison of medians (ft on diagrams)
B1 eg for comparison of (interquartile) ranges (ft on diagram)

[6]

PINPOINT

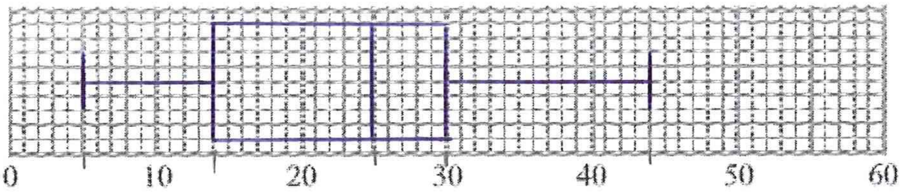
2) Box plots: Harder

7. Here are the times, in seconds, that 15 people waited to be served at Rose's garden centre.

5 9 11 $\boxed{14}$ 15 20 22 $\boxed{25}$ 27 27 28 $\boxed{30}$ 32 35 44

LQ Median UQ.

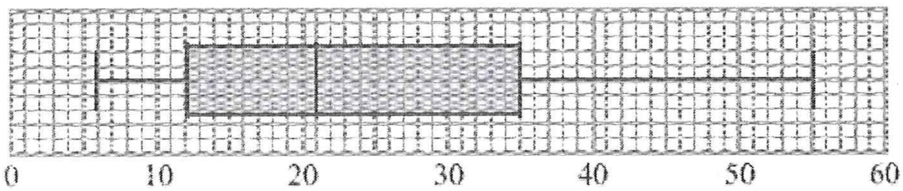
(a) On the grid, draw a box plot for this information.



Time (seconds)

(3)

The box plot below shows the distribution of the times that people waited to be served at Green's garden centre.



Time (seconds)

(b) Compare the distribution of the times that people waited at Rose's garden centre and the distribution of the times that people waited at Green's garden centre.

There was a greater spread of waiting times in the interquartile range for Green's Garden Centre than Rose's Garden centre

The median waiting time is shorter at ~~Roses~~ Greens than Roses Garden centre.

(2)

(5 marks)

PINPOINT

3) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As $2n$ is even $2n+1$ will be odd and so $2n+2$ is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

3) Proof: Medium

8. Prove that

$(n + 1)^2 - (n - 1)^2 + 1$ is always odd for all positive integer values of n.

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$$
$$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$$
$$= 4n + 1$$

4n is a multiple of 4 so it must be even which means 4n+1 is odd.

(3 marks)

3) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$$n^2 + (n+1)^2$$

$$= n^2 + n^2 + 2n + 1$$

$$= 2n^2 + 2n + 1$$

$$= 2n(n+1) + 1$$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

$2n(n+1)$ is $2 \times$ an even number which has to be a multiple of 4

So $2n(n+1) + 1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

4) Completing the Square: Easier

1) Express $x^2 + 6x + 10$ in the form $(x + p)^2 + q$

$(x+3)^2 - 3^2 + 10$

$= (x+3)^2 - 9 + 10$

$= (x+3)^2 + 1$

$p = 3$

$q = 1$

4) Completing the Square: Medium

2) Express $x^2 - 3x + 5$ in the form $(x + a)^2 + b$

$$(x-1.5)^2 - 1.5^2 + 5$$

$$= (x-1.5)^2 - 2.25 + 5$$

$$= (x-1.5)^2 + 2.75$$

$a = -1.5$, $b = 2.75$

4) Completing the Square: Harder

3) What is the minimum value of

$(x-2)^2 + 5$?

5, which occurs when $x = 2$.

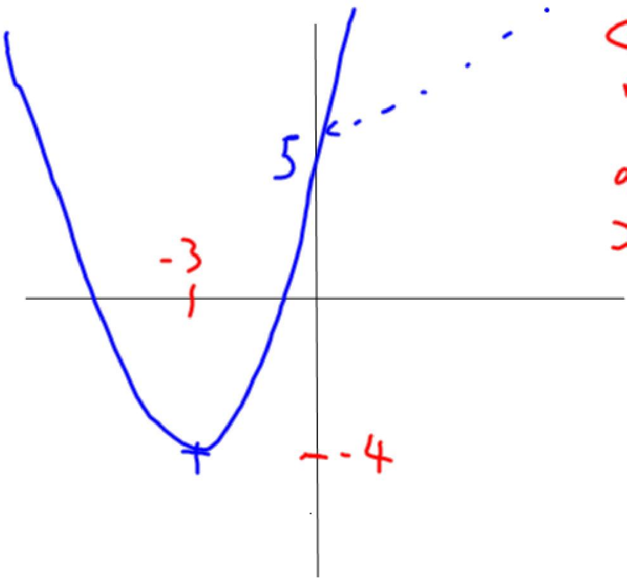
$(x-2)^2$ can never be negative.

4) a) Express $x^2 + 6x + 5$ in the form of $(x + a)^2 + b$

$(x+3)^2 - 3^2 + 5$

$= (x+3)^2 - 4$

b) Now sketch the graph of $y = x^2 + 6x + 5$ stating the minimum point of the graph and where it crosses the axis



min point at $x = -3, y = -4$

5) Upper and Lower Bounds: Easier

1. The weight of a plasma TV is 12kg to the nearest kg.

a) What is the smallest possible weight of the TV?

11.5Kg

……………… **(1)**

b) What is the largest possible weight of the TV?

12.5Kg

……………… **(1)**

2. The height of a wardrobe is given as 253 cm to the nearest cm. What is the maximum height the wardrobe could be?

253.5cm

……………… **(1)**

3. The number of people that attended a football fixture is given as 3200 to two significant figures. What is the minimum number of people that could have attended?

3250

……………… **(1)**

5) Upper and Lower Bounds: Medium

6. On sports day a girl runs 100m, to the nearest metre. She wins and finishes in 11.3 seconds, correct to the nearest tenth of a second.

What is the fastest possible speed she could have run?

$$Speed = \frac{distance}{time}$$

$$UB(Speed) = \frac{UB(distance)}{LB(time)}$$

$$UB(Speed) = \frac{100.5}{11.25}$$

=8.99m/s

…..……………. **(4)**

7. The maximum load for a crane is 5400kg, measured to the nearest 100 kg. Each crate weighs 20kg, measured to the nearest 10kg.

What is the maximum number of crates the crane can safely take?

$$Max\ number\ of\ cranes = \frac{LB(Max\ load)}{UB(weight\ of\ crate)}$$

$$= \frac{5350}{25}$$

=214 Crates

…..……………. **(4)**

5) Upper and Lower Bounds: Harder

8. The formula for density is

$$D = \frac{M}{V}$$

V is the volume of the object, M is the mass and D the density.

The Volume of a liquid is given as 500ml to the nearest 10ml and the Mass of the liquid is 600g to nearest gram

By considering bounds, give the Density of the drink to a suitable degree of accuracy. You must show all of your working and give a reason for your answer

$$UB(D) = \frac{UB(M)}{LB(V)}$$

$$UB(D) = \frac{505}{599.5} = 0.842369$$

$$LB(D) = \frac{LB(M)}{UB(V)}$$

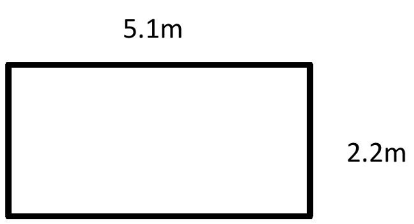
$$LB(D) = \frac{495}{600.5} = 0.824313$$

The lower bound and the upper bound are the same to one significant figure so 0.8

0.8g/ml

……...............g/ml **(4)**

*9. Sabrina is decorating and is painting a feature wall. The measurements of the wall are shown below to the nearest 0.1m. A pot of paint covers 12m^2 of wall to the nearest 1m^2. By considering bounds, does Sabrina definitely have enough paint to cover the wall with one pot?



UB (area of wall)= 5.15 x 2.25=11.5875m^2

LB(area paint covers) = 11.5m^2

No she does not definitely have enough as she could only have enough for 11.5m^2 but she could need enough for 11.5875m^2

PINPOINT

GREAVES Will

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	18 from 20	1 from 1	8 from 10	5 from 5	3 from 3	1 from 1
A02 and 3	39 from 60	9 from 11	11 from 16	7 from 9	5 from 16	7 from 8
Total	57 from 80	10 from 12	19 from 26	12 from 14	8 from 19	8 from 9

Your Pinpoint Topics

Topic 1: Expressions, identities and equations. MW: 7

Topic 2: Loci and Construction. Mathswatch Clip: 165

Topic 3: Box plots. Mathswatch Clip: 187

Topic 4: Proof. Mathswatch Clip: 193

Topic 5: Completing the Square. Mathswatch Clip: 209

1) Expressions, identities and equations: Easier

1) Fill in the gaps with an appropriate word from the list
EQUATION, IDENTITY, EXPRESSION, TERMS

$$3x + 4 \; is \; an \; expression \; with \; two \; terms$$

$$2(x + 4) \equiv 2x + 8 \; is \; an \; identity$$

$$2x + 3 = 11 \; is \; an \; equation$$

....

(2 Marks)

---

2) Circle the identity

A $5(x + 3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x + 3)$ D $x^2 + 2 = 27$

(1 Mark)

---

3) Circle the expression

A $5(x + 3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x + 3)$ D $x^2 + 2 = 27$

....

(1 Mark)

1) Expressions, identities and equations: Medium

4) Annemarie is asked to form an expression, given the following information.
There are a sweets in every packet. I have 3 packets of sweets. I put all the sweets in one container and eat 2 of them. Form an expression for the number of sweets I have left.

Annemarie writes

3a = -2

Write down one mistake Annemarie has made

She has written an equation, (with an equals) she wasn't told how many sweets there are left just that there are two less than 3 bags so she should have written 3a-2 which is an expression

(1 Mark)

---

5) Insert the correct symbol, = or ≡ in the boxes below

$$2x + 3 \quad \boxed{=} \quad 10$$

$$2a \times 3a^2 \quad \boxed{\equiv} \quad 6a^3$$

$$5(x - 2) \quad \boxed{\equiv} \quad 5x - 10$$

Remember an equation is true for some values of the variable and an identity is true for all values of the variable

....

(3 Marks)

1) Expressions, identities and equations: Harder

6) Jim says that

$$(x+4)^2 = x^2 + 16$$

is an identity. Paul says it is an equation and not an identity. Who is correct? You must explain your reasoning.

Paul is right, it is an equation, for the value $x = 0$ the equation is true as

$(0+4)^2 = 0^2 + 4^2$ as they are both equal to 16

It is not true for all values of x for example for $x = 1$

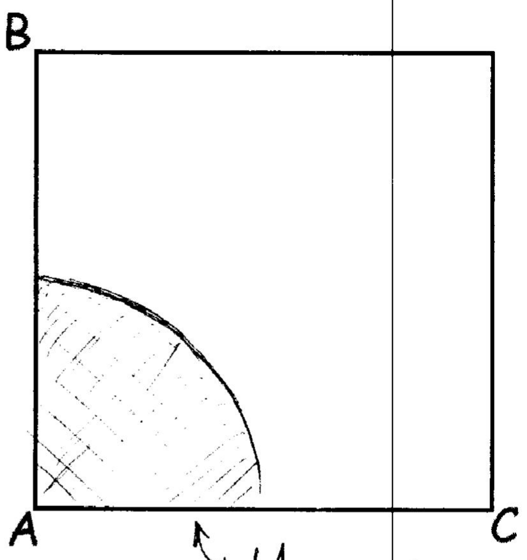
$(1+4)^2 = 25$ *and* $1^2 + 16 = 17$ so it does not hold for all values of x

$(x+4)^2 = x^2 + 8x + 16$ is an identity

(1 Mark)

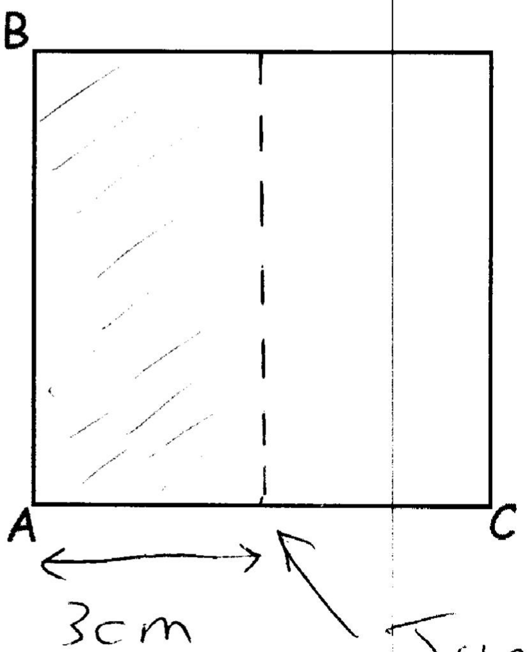
2) Loci and Construction: Easier

1) Shade the area closer than 3cm to point A within the square below:



Use compass at 3cm

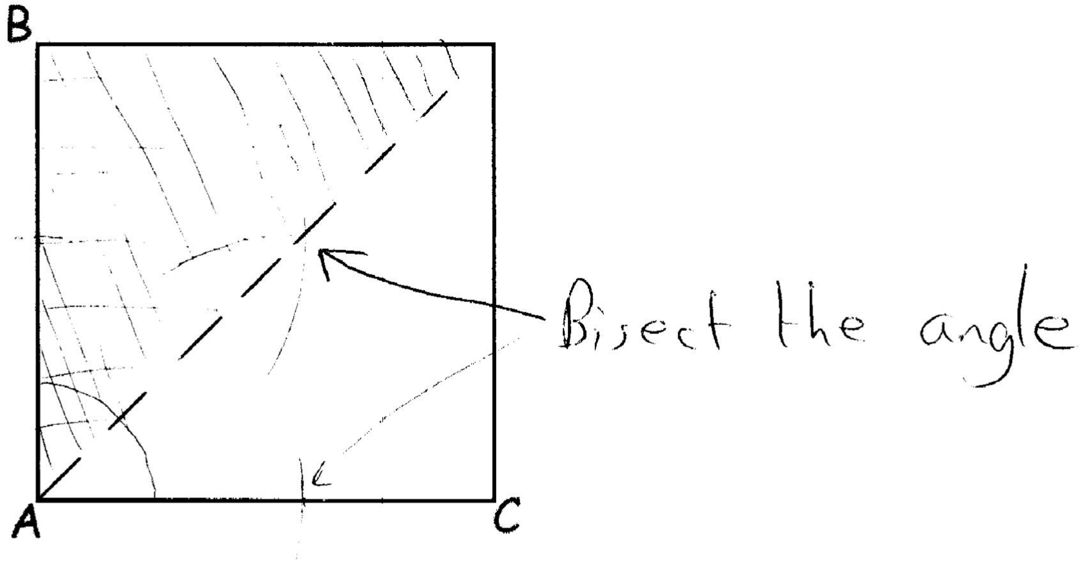
2) Shade the area closer than 3cm to the line AB within the square below:



Just measure 3cm with your ruler

2) Loci and Construction: Medium

3) Shade the area closer to the line AB than AC within the square below:

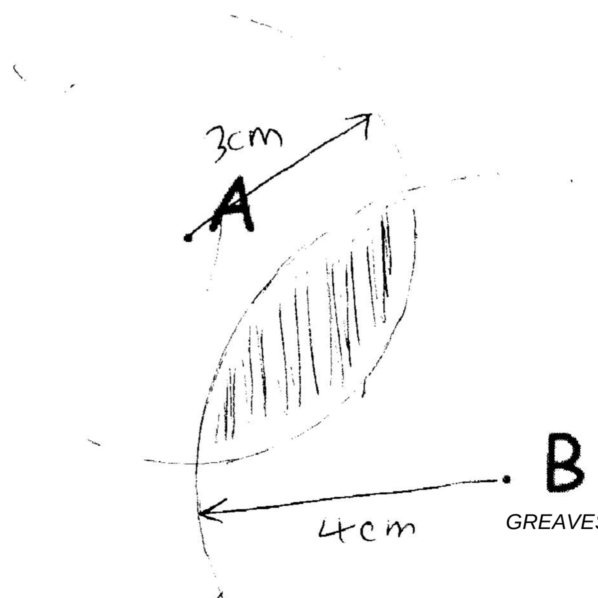


4) Two mobile phone stations transmit a signal.

Mobile phone station A transmits its signal ~~5~~3 miles.

Mobile phone station B transmits its signal 4 miles.

When you can receive both signals you experience interference on your phone. Shade below the area of interference.



Scale: 1 cm represents 1 mile

2) Loci and Construction: Harder

5) Mariam wants to plant a flower:

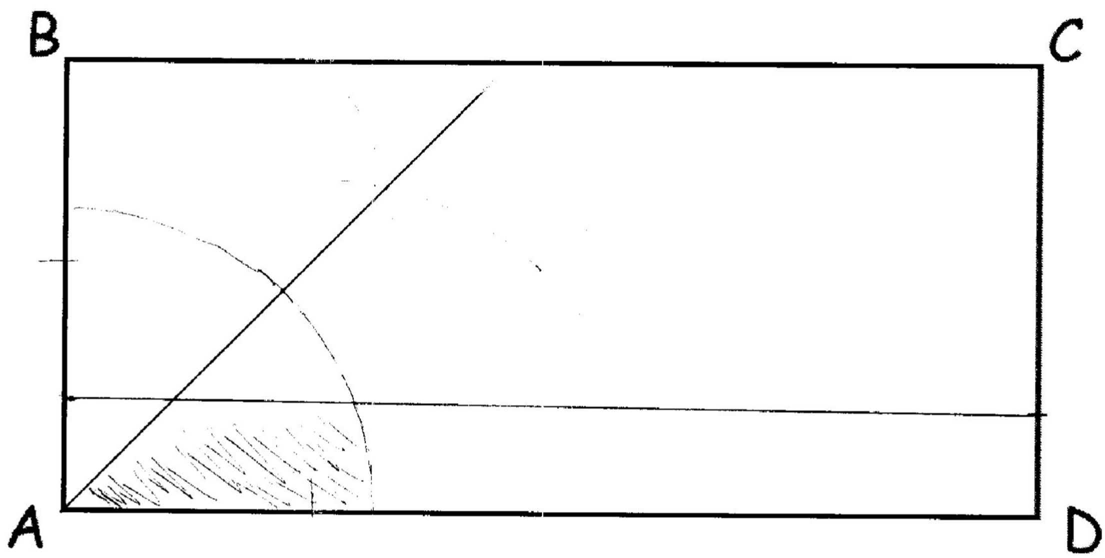
Within 4m of A

Closer to AD than AB

Less than 1.5m from AD.

Shade below the region where Mariam should plant her flower.

Show any construction lines your draw.



Scale: 1 cm represents 1 metre

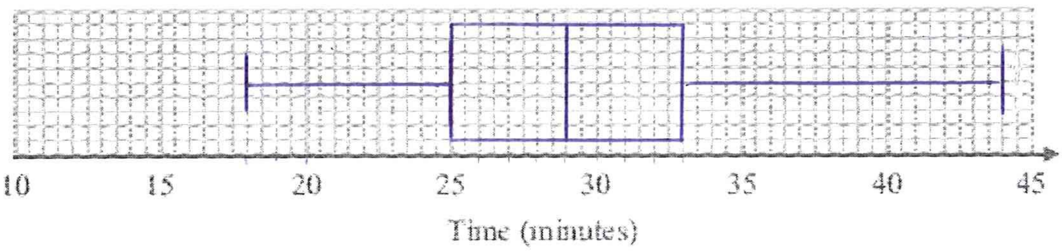
3) Box plots: Easier

2. Sameena recorded the times, in minutes, some girls took to do a jigsaw puzzle.

Sameena used her results to work out the information in this table.

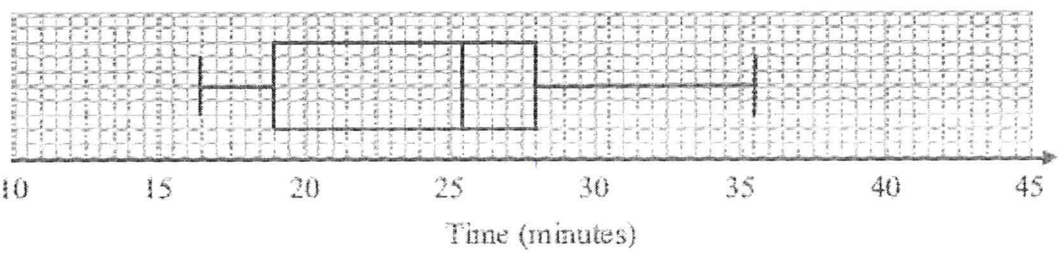
	Minutes
Shortest time	18
Lower quartile	25
Median	29
Upper quartile	33
Longest time	44

(a) On the grid, draw a box plot to show the information in the table.



(2)

The box plot below shows information about the times, in minutes, some boys took to do the same jigsaw puzzle.



(b) Compare the distributions of the girls' times and the boys' times.

The boys median time was less than that of the girls; Boys 25.5mins, Girls 29 mins.

The spread of data for the interquartile range is smaller for the girls (8 mins) Then for the boys (9 mins)

(2)

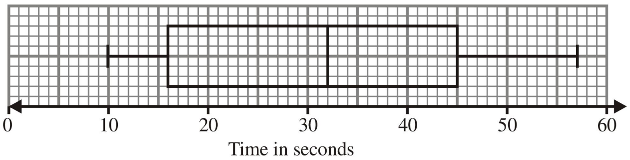
(4 marks)

3) Box plots: Medium

2. (a) 32 1

B1 for 32 (accept 31.5 to 33.5 inclusive)

(b) 3



B1 for ends of whiskers at 9 and 57 (with a box)
B1 for ends of box at 16 and 45/46 (±0.5)
B1for median marked at "32"or complete box and whisker diagram drawn with a median inside the box

(c) Median(B)>Median(G); on average boys take longer
IQR(B)>IQR(G); times for boys have a greater spread 2

B1 eg for comparison of medians (ft on diagrams)
B1 eg for comparison of (interquartile) ranges (ft on diagram)

[6]

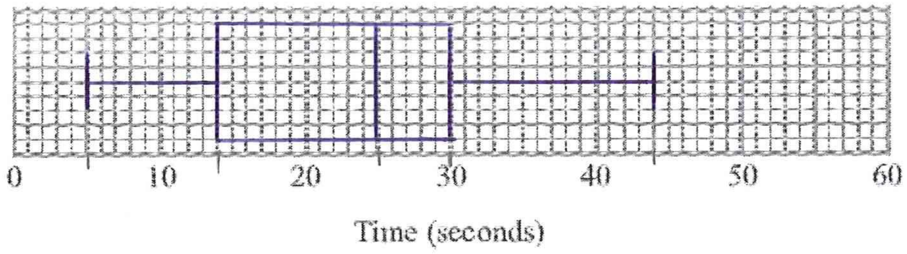
3) Box plots: Harder

7. Here are the times, in seconds, that 15 people waited to be served at Rose's garden centre.

5 9 11 $\boxed{14}$ 15 20 22 $\boxed{25}$ 27 27 28 $\boxed{30}$ 32 35 44

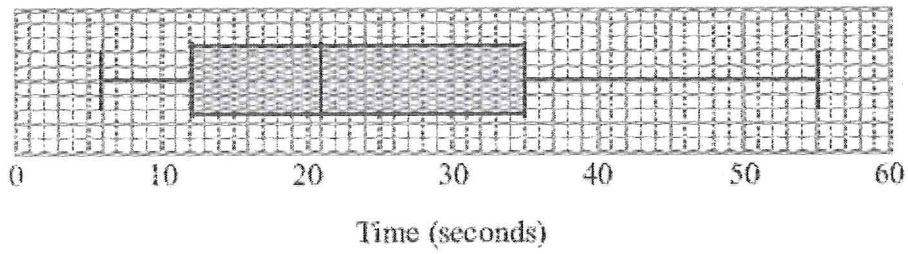
LQ Median UQ.

(a) On the grid, draw a box plot for this information.



(3)

The box plot below shows the distribution of the times that people waited to be served at Green's garden centre.



(b) Compare the distribution of the times that people waited at Rose's garden centre and the distribution of the times that people waited at Green's garden centre.

There was a greater spread of waiting times in the interquartile range for Green's Garden Centre than Rose's Garden centre

The Median waiting time is shorter at ~~Roses~~ Greens than Roses Garden centre.

(2)

(5 marks)

4) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As $2n$ is even

$2n+1$ will be odd and so $2n+2$ is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

4) Proof: Medium

8. Prove that

$(n+1)^2 - (n-1)^2 + 1$ is always odd for all positive integer values of n.

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$$(n+1)^2 - (n-1)^2 + 1 = (n^2+2n+1) - (n^2-2n+1) + 1$$
$$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$$
$$= 4n + 1$$

4n is a multiple of 4 so it must be even which means 4n+1 is odd.

(3 marks)

4) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and n+1

$$n^2 + (n+1)^2$$

$$= n^2 + n^2 + 2n + 1$$

$$= 2n^2 + 2n + 1$$

$$= 2n(n+1) + 1$$

n(n+1) is the product of 2 consecutive numbers. As one of them is even the product must be even.

2n(n+1) is 2 x an even number which has to be a multiple of 4

So 2n(n+1) + 1 is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

5) Completing the Square: Easier

1) Express $x^2 + 6x + 10$ in the form $(x + p)^2 + q$

$$(x+3)^2 - 3^2 + 10$$

$$= (x+3)^2 - 9 + 10$$

$$= (x+3)^2 + 1$$

$p = 3$

$q = 1$

5) Completing the Square: Medium

2) Express $x^2 - 3x + 5$ in the form $(x + a)^2 + b$

$$(x-1.5)^2 - 1.5^2 + 5$$

$$= (x-1.5)^2 - 2.25 + 5$$

$$= (x-1.5)^2 + 2.75$$

$a = -1.5,\ b = 2.75$

5) Completing the Square: Harder

3) What is the minimum value of
$(x-2)^2 + 5$?

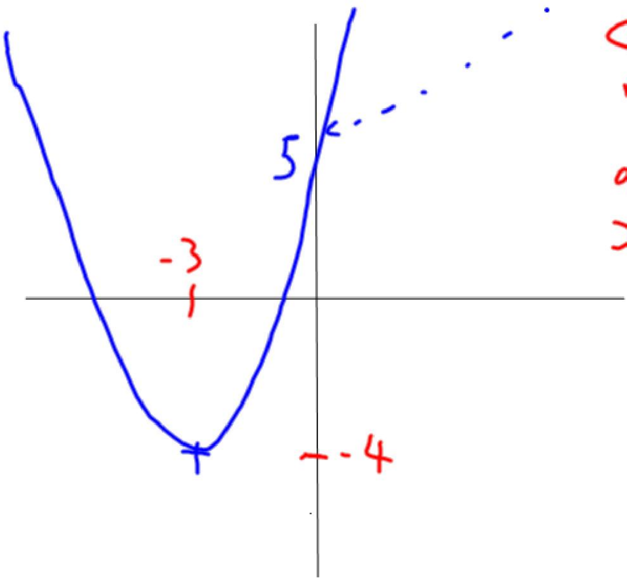
5, which occurs when
$x = 2$.
$(x-2)^2$ can never be
negative.

4) a) Express $x^2 + 6x + 5$ in the form of $(x + a)^2 + b$

$(x+3)^2 - 3^2 + 5$

$= (x+3)^2 - 4$

b) Now sketch the graph of $y = x^2 + 6x + 5$
stating the minimum point of the graph
and where it crosses the axis



min point
at
$x = -3, y = -4$

GREGG Samuel

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

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A02 and 3	52 from 60	9 from 11	14 from 16	7 from 9	14 from 16	8 from 8
Total	70 from 80	10 from 12	22 from 26	12 from 14	17 from 19	9 from 9

Your Pinpoint Topics

Topic 1: Counting Methods. Mathswatch Clip: NA

Topic 2: Proof. Mathswatch Clip: 193

Topic 3: Upper and Lower Bounds. Mathswatch Clip: 206

Topic 4: Extention1. Mathswatch Clip:

Topic 5: Extention2. Mathswatch Clip:

1) Counting Methods: Easier

1) Ryan has four shorts of different colours, blue, red, green and yellow.
He has three different T-shirts of different colours, black, white and orange.

Blue shorts and a black T-Shirt would be one possible outfit.
How many different outfits of Shorts and T-Shirts can Ryan wear?

4 shorts × 3 T-shirts = 12 possible outfits

____

(2 Marks)

2) There are 13 boys and 10 girls in a class.
Work out the total number of ways that 1 boy and 1 girl can be chosen from the class.

$13 \times 10 = 130$ ways

____

(2 Marks)

3) There are 7 boys and 10 girls in a class.
Work out the total number of ways that 1 boys and 2 girls can be chosen from the class.

$7 \times 10 \times 9 = 630$ ways

____

(2 Marks)

1) Counting Methods: Medium

4) Mason's bank secret pin code is a four digit number and each digit can be the numbers 0, 1, 2, 3, 4, 5, 6 , 7, 8, or 9. For example one possible pin number could be 9021.

a) Mason's bank card is stolen. What is the probability with one guess only that someone correctly guesses Mason's pin number? Leave your answer as a fraction.

$10 \times 10 \times 10 \times 10 = 10000$ possibilities.

Probability of guessing first time = $\frac{1}{10000}$

____

(2 Marks)

Ishmael's bank does not allow any digit to be repeated in his secret pin number. For example 7762 would not be allowed, nor would 5075.

b) Ishmael's bank card is stolen. What is the probability with one guess only that someone correctly guesses Ishmael's pin number? Leave your answer as a fraction.

$10 \times 9 \times 8 \times 7 = 5040$ possibilities.

Probability of guessing first time = $\frac{1}{5040}$

____

(3 Marks)

1) Counting Methods: Harder

5) A restaurant menu has 6 starters, 10 mains and 6 desserts.
A customer can choose from the following meals

- a starter and a main,
- a main and a dessert,
- a starter, a main and a dessert.

Show that there are 480 different ways of choosing a meal at this restaurant.

$$(6 \times 10) + (10 \times 6) + (6 \times 10 \times 6)$$

$$= 60 + 60 + 360$$

$$= 480 \text{ ways}$$

____

(3 Marks)

6) A simple computer password only allows you to use two letters a and b.
"abaab" would be an example of one password which consists of 5 letters.
How many letters must your password contain such that the probability of someone randomly guessing it first time is less than 1 in a 1000?

Use Trial and Improvement:

2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 1024 ways with 10 letters.

Therefore a password of <u>10 letters</u> is needed as $\frac{1}{1024} < \frac{1}{1000}$

____

(3 Marks)

2) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As $2n$ is even $2n+1$ will be odd and so $2n+2$ is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

2) Proof: Medium

8. Prove that

$(n+1)^2 - (n-1)^2 + 1$ is always odd for all positive integer values of n.

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$$
$$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$$
$$= 4n + 1$$

$4n$ is a multiple of 4 so it must be even which means $4n+1$ is odd.

(3 marks)

2) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$$n^2 + (n+1)^2$$

$$= n^2 + n^2 + 2n + 1$$

$$= 2n^2 + 2n + 1$$

$$= 2n(n+1) + 1$$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

$2n(n+1)$ is $2 \times$ an even number which has to be a multiple of 4

So $2n(n+1)+1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

3) Upper and Lower Bounds: Easier

1. The weight of a plasma TV is 12kg to the nearest kg.

a) What is the smallest possible weight of the TV?

11.5Kg

……………… **(1)**

b) What is the largest possible weight of the TV?

12.5Kg

……………… **(1)**

2. The height of a wardrobe is given as 253 cm to the nearest cm. What is the maximum height the wardrobe could be?

253.5cm

……………… **(1)**

3. The number of people that attended a football fixture is given as 3200 to two significant figures. What is the minimum number of people that could have attended?

3250

……………… **(1)**

3) Upper and Lower Bounds: Medium

6. On sports day a girl runs 100m, to the nearest metre. She wins and finishes in 11.3 seconds, correct to the nearest tenth of a second.

What is the fastest possible speed she could have run?

$$Speed = \frac{distance}{time}$$

$$UB(Speed) = \frac{UB(distance)}{LB(time)}$$

$$UB(Speed) = \frac{100.5}{11.25}$$

=8.99m/s

…..…………… **(4)**

7. The maximum load for a crane is 5400kg, measured to the nearest 100 kg. Each crate weighs 20kg, measured to the nearest 10kg.

What is the maximum number of crates the crane can safely take?

$$Max\ number\ of\ cranes = \frac{LB(Max\ load)}{UB(weight\ of\ crate)}$$

$$= \frac{5350}{25}$$

=214 Crates

…..…………… **(4)**

3) Upper and Lower Bounds: Harder

8. The formula for density is

$$D = \frac{M}{V}$$

V is the volume of the object, M is the mass and D the density.

The Volume of a liquid is given as 500ml to the nearest 10ml and the Mass of the liquid is 600g to nearest gram

By considering bounds, give the Density of the drink to a suitable degree of accuracy. You must show all of your working and give a reason for your answer

$$UB(D) = \frac{UB(M)}{LB(V)}$$

$$UB(D) = \frac{505}{599.5} = 0.842369$$

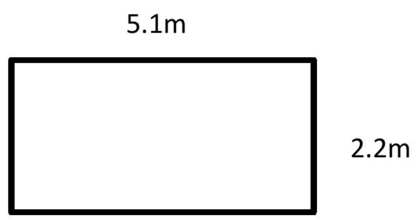
$$LB(D) = \frac{LB(M)}{UB(V)}$$

$$LB(D) = \frac{495}{600.5} = 0.824313$$

The lower bound and the upper bound are the same to one significant figure so 0.8

0.8g/ml
……..………..g/ml **(4)**

*9. Sabrina is decorating and is painting a feature wall. The measurements of the wall are shown below to the nearest 0.1m. A pot of paint covers 12m^2 of wall to the nearest 1m^2. By considering bounds, does Sabrina definitely have enough paint to cover the wall with one pot?

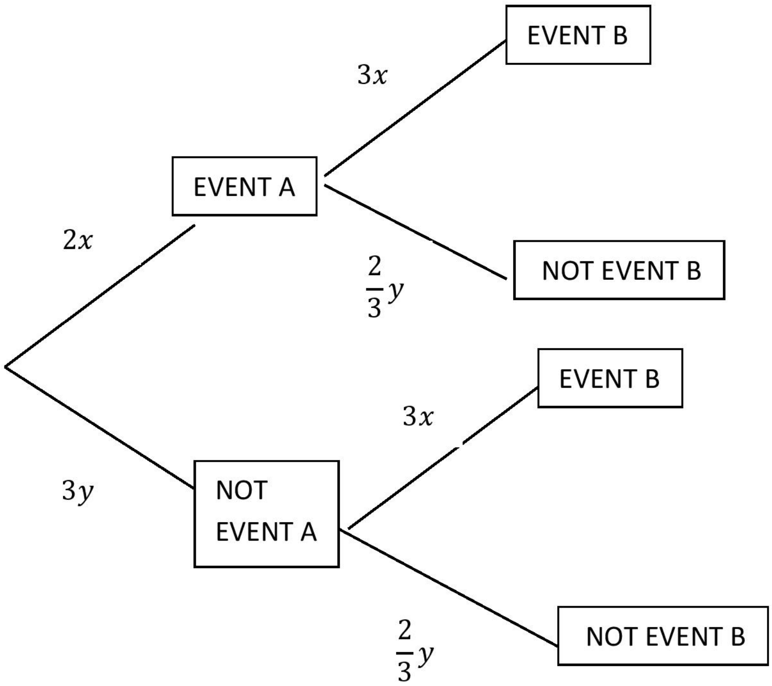


UB (area of wall)= 5.15 x 2.25=11.5875m^2

LB(area paint covers) = 11.5m^2
No she does not definitely have enough as she could only have enough for 11.5m^2 but she could need enough for 11.5875m^2

4) Extention1: Easier

1. The figure below shows a probability tree diagram for two events. What is the value of x and y?



From tree diagram (branches sum to one)

$$2x + 3y = 1$$

$$3x + \frac{2}{3}y = 1$$

Multiplying equations to eliminate x

$$6x + 9y = 3$$

$$6x + \frac{4}{3}y = 2$$

$$\frac{23}{3}y = 1$$

$$y = \frac{3}{23}$$

$$2x + \frac{9}{23} = 1$$

$$x = \frac{7}{23}$$

(4 marks)

4) Extention1: Medium

2. Given that $x^a = \frac{1}{x^b}$, What is the value of $2a + 2b$?

$$x^a = x^{-b}$$

$$a = -b$$

$$a + b = 0$$

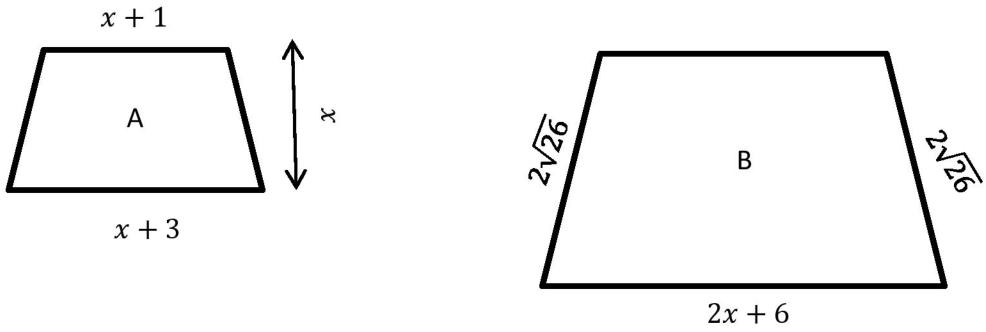
$$2(a + b) = 0$$

$$2a + 2b = 0$$

(3 marks)

4) Extention1: Harder

3. The two trapezia below are similar. The area of trapezium A is 35cm^2. Find the perimeter of trapezium B.



The area of trapezium A is given by $\frac{1}{2}(x+1+x+3)\times x$

$$\frac{1}{2}(2x+4)\times x = 35cm^2$$

$$x^2+2x = 35cm^2$$

$$x^2+2x-35=0$$

$$(x-5)(x+7)=0$$

$$x=5cm, \qquad (as\ x>0)$$

The perimeter of Trapezium A is

$$2x+6+2x+2+4\sqrt{26}$$

When $x=5$ $\quad 4(5)+8+4\sqrt{26}$

$$=18+\ 4\sqrt{26}$$

(4 marks)

5) Extention2: Easier

4. Given that $9^a = 2$, What are the possible values of 27^a?

$$9^a = 2$$

$$(3^2)^a = 2$$

$$3^{2a} = 2$$

$$(3^a)^2 = 2$$

$$(3^a) = \pm\sqrt{2}$$

$$27^a = (3^3)^a$$

$$= (3^a)^3$$

$$= \left(\pm\sqrt{2}\right)^3$$

$$= \pm 2\sqrt{2}$$

(4 marks)

5) Extention2: Medium

5) Extention2: Harder

PINPOINT

GRIFFIN Joshua

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	17 from 20	1 from 1	7 from 10	5 from 5	3 from 3	1 from 1
A02 and 3	54 from 60	10 from 11	14 from 16	9 from 9	13 from 16	8 from 8
Total	71 from 80	11 from 12	21 from 26	14 from 14	16 from 19	9 from 9

Your Pinpoint Topics

Topic 1: Loci and Construction. Mathswatch Clip: 165

Topic 2: Distance Time Graphs. Mathswatch Clip: 143

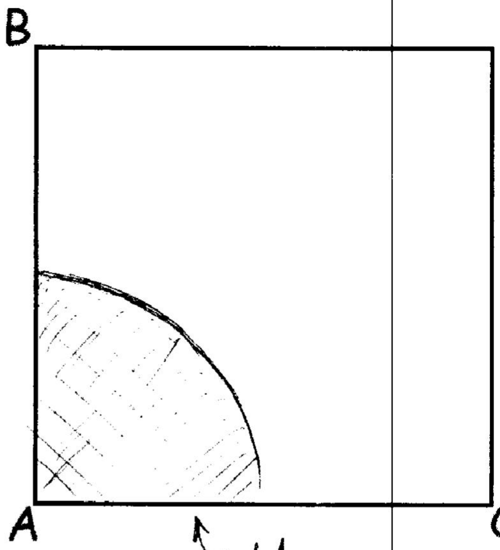
Topic 3: Proof. Mathswatch Clip: 193

Topic 4: Completing the Square. Mathswatch Clip: 209

Topic 5: Iterative processes. Mathswatch Clip: 180

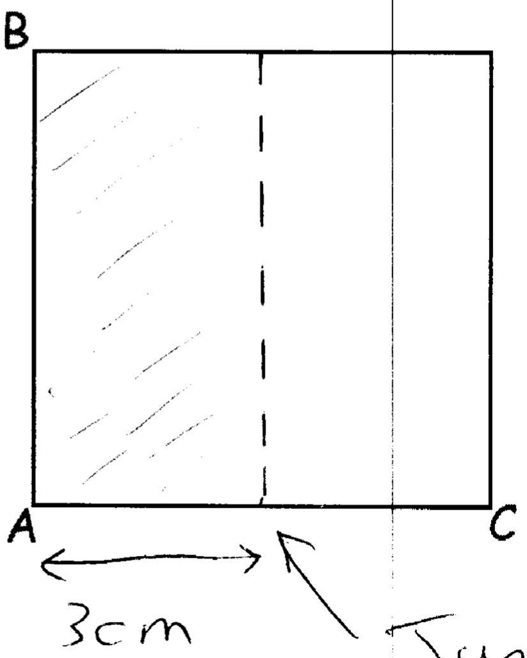
1) Loci and Construction: Easier

1) Shade the area closer than 3cm to point A within the square below:



Use compass at 3cm

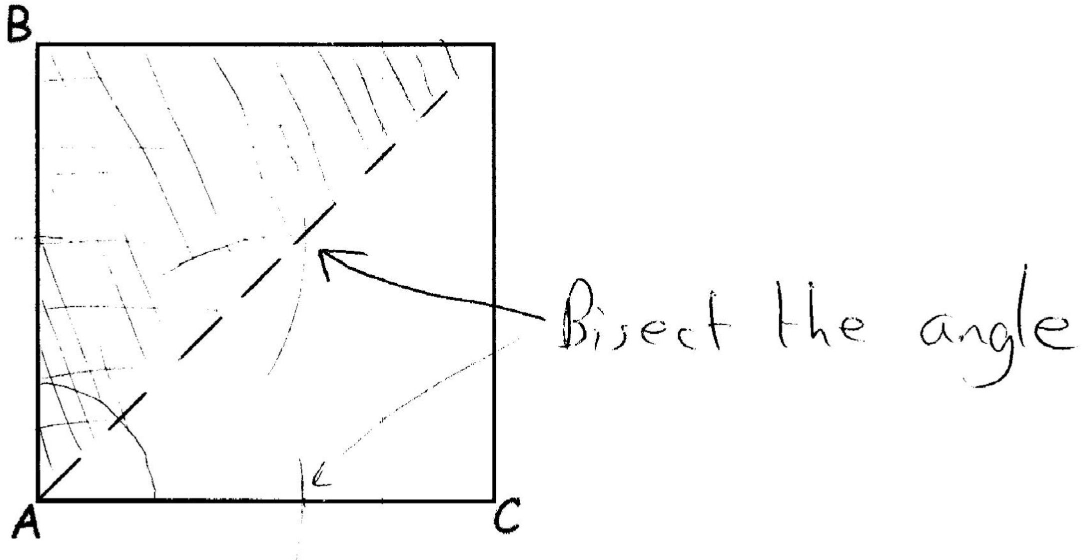
2) Shade the area closer than 3cm to the line AB within the square below:



Just measure 3cm with your ruler

1) Loci and Construction: Medium

3) Shade the area closer to the line AB than AC within the square below:

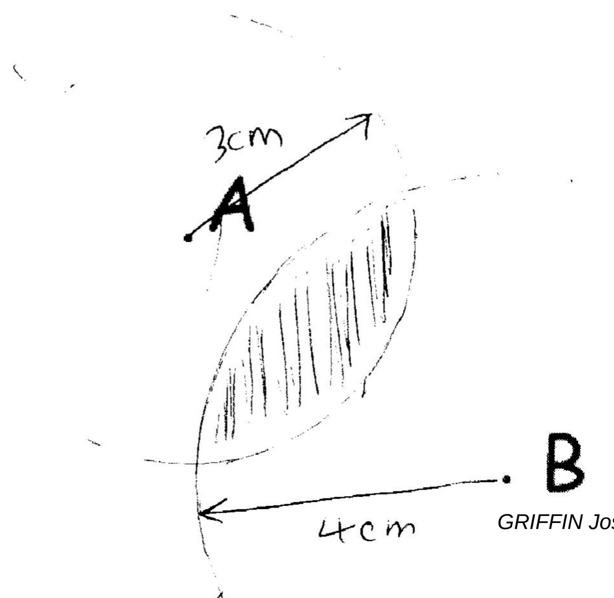


4) Two mobile phone stations transmit a signal.

Mobile phone station A transmits its signal ~~5~~ 3 miles.

Mobile phone station B transmits its signal 4 miles.

When you can receive both signals you experience interference on your phone. Shade below the area of interference.



Scale: 1 cm represents 1 mile

1) Loci and Construction: Harder

5) Mariam wants to plant a flower:

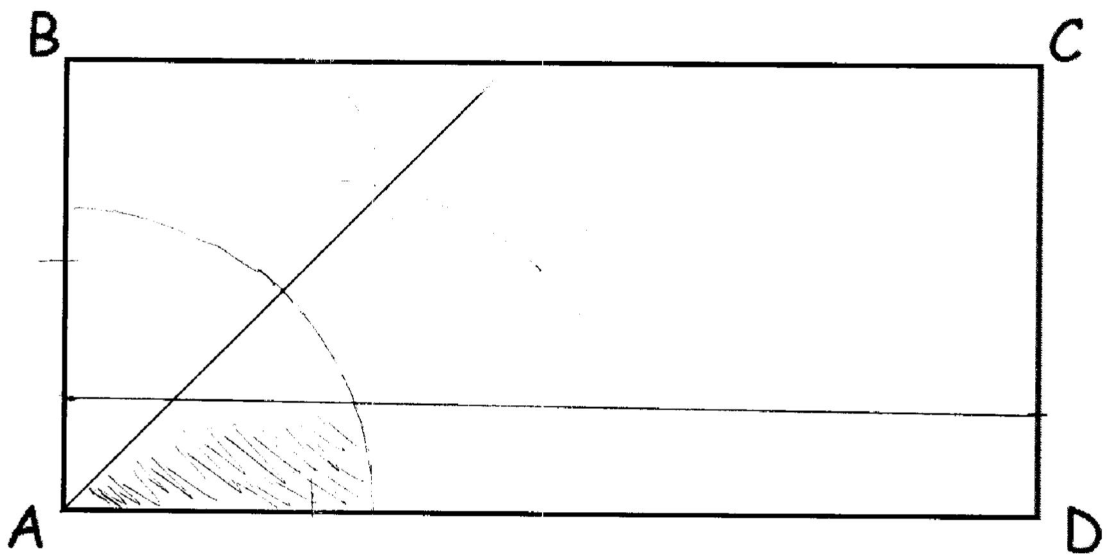
Within 4m of A

Closer to AD than AB

Less than 1.5m from AD.

Shade below the region where Mariam should plant her flower.

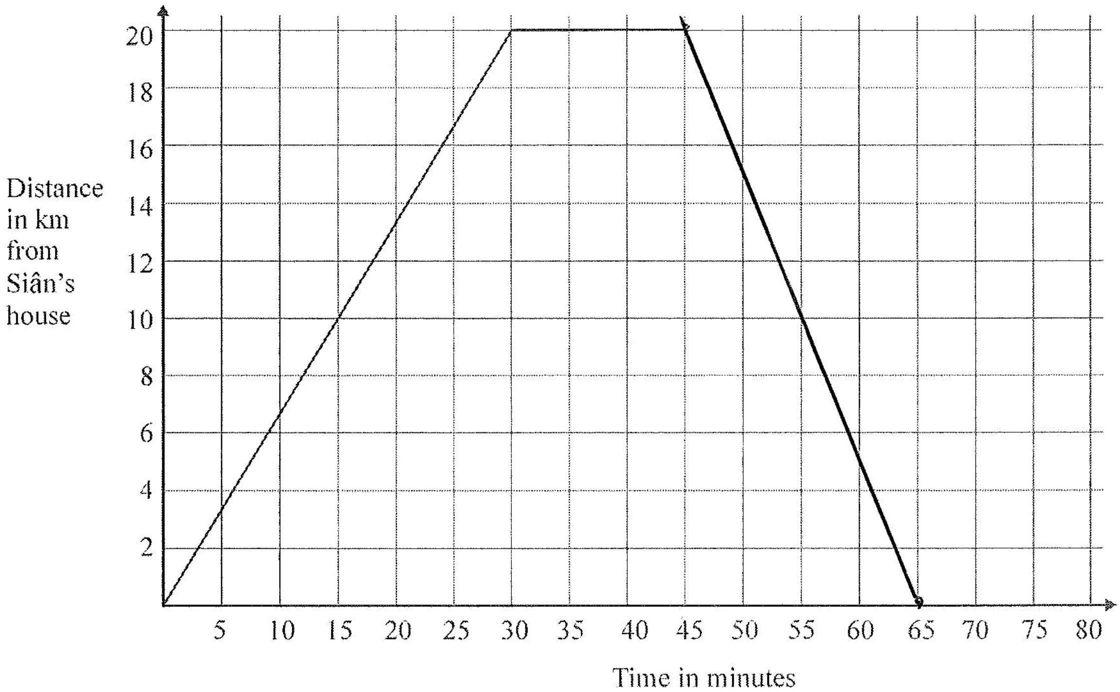
Show any construction lines your draw.



Scale: 1 cm represents 1 metre

2) Distance Time Graphs: Easier

1. Here is part of a travel graph of Siân's journey from her house to the shops and back.



(a) Work out Siân's speed for the first 30 minutes of her journey.
Give your answer in km/h.

distance ÷ time   30 minutes = 0.5 hours.

20 ÷ 0.5 = 40

40 .... km/h

(2)

Siân spends 15 minutes at the shops.
She then travels back to her house at 60 km/h.

(b) Complete the travel graph.

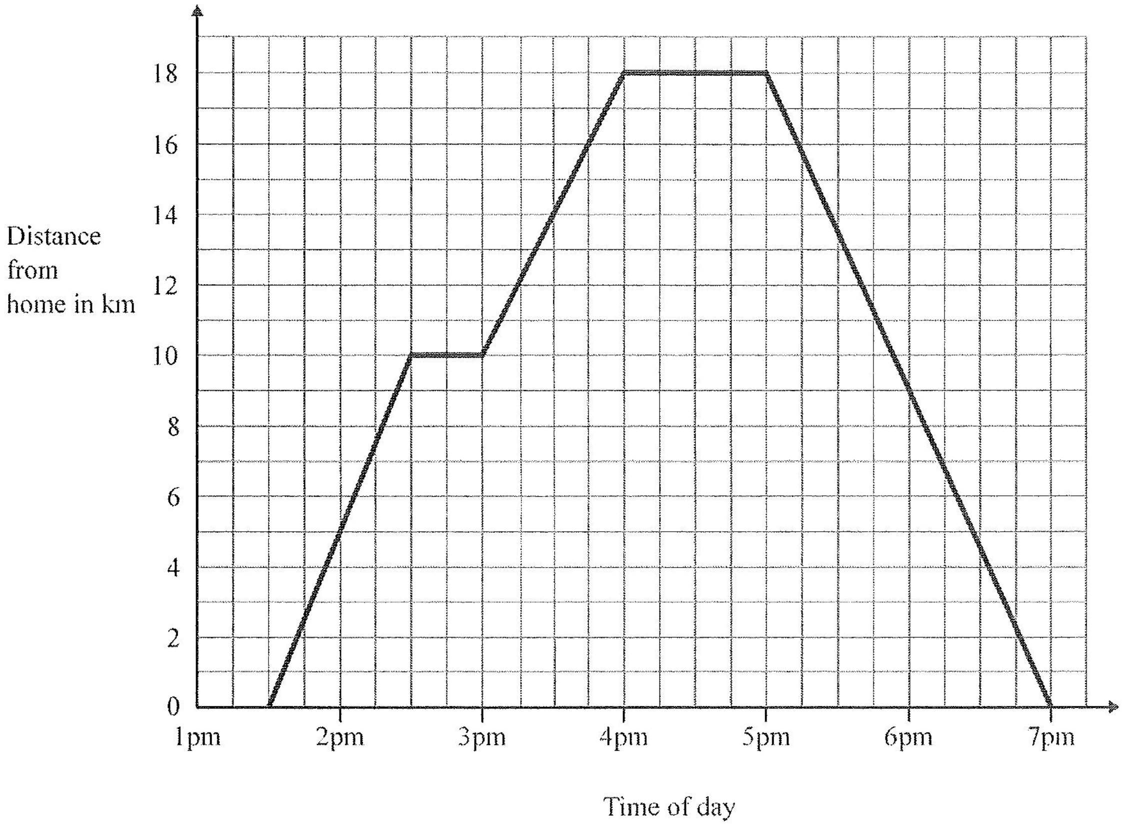
20km at 60 km/h

20 in 20minutes

(2)
(Total 4 marks)

2) Distance Time Graphs: Medium

10. Pete visited his friend and then returned home.
The travel graph shows some information about Pete's journey.



(a) Write down the time that Pete started his journey.

1.30pm

(1)

At 2.30 pm Pete stopped for a rest.

(b) (i) Find his distance from home when he stopped for this rest.

10 km

(ii) How many minutes was this rest?

30 minutes

(2)

Pete stayed with his friend for one hour.
He then returned home.

(c) Work out the total distance travelled by Pete on this journey.

18 x 2 = 36

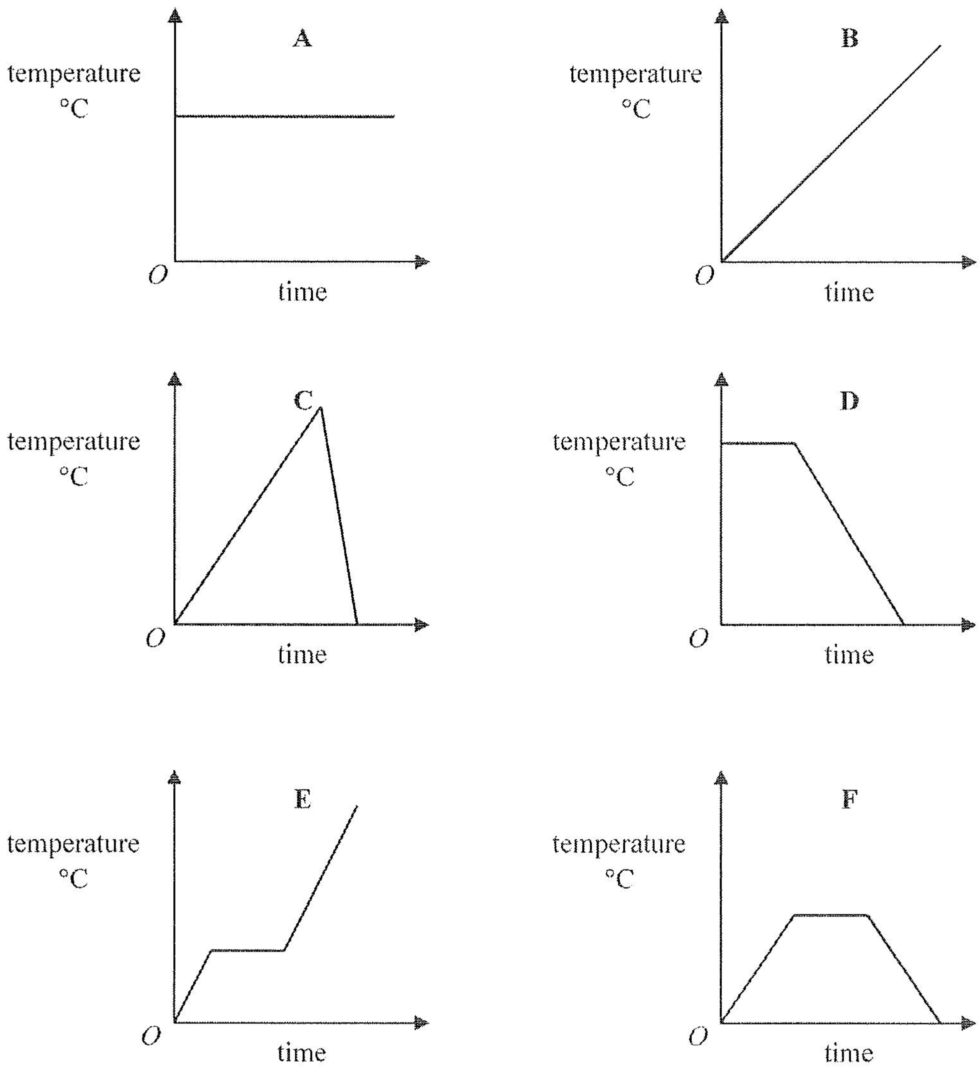
36 km

(2)

(Total 5 marks)

2) Distance Time Graphs: Harder

11. Here are six temperature/time graphs.



Each sentence in the table describes one of the graphs.
Write the letter of the correct graph next to each sentence.

The first one has been done for you.

The temperature starts at 0°C and keeps rising.	**B**
The temperature stays the same for a time and then falls.	D
The temperature rises and then falls quickly.	C
The temperature is always the same.	A
The temperature rises, stays the same for a time and then falls.	F
The temperature rises, stays the same for a time and then rises again.	E

(Total 3 marks)

3) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As 2n is even 2n+1 will be odd and so 2n+2 is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

3) Proof: Medium

8. Prove that

$(n + 1)^2 - (n - 1)^2 + 1$ is always odd for all positive integer values of n.

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$$
$$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$$
$$= 4n + 1$$

4n is a multiple of 4 so it must be even which means 4n+1 is odd.

(3 marks)

3) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$$n^2 + (n+1)^2$$

$$= n^2 + n^2 + 2n + 1$$

$$= 2n^2 + 2n + 1$$

$$= 2n(n+1) + 1$$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

$2n(n+1)$ is $2 \times$ an even number which has to be a multiple of 4

So $2n(n+1) + 1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

4) Completing the Square: Easier

1) Express $x^2 + 6x + 10$ in the form $(x + p)^2 + q$

$$(x+3)^2 - 3^2 + 10$$

$$= (x+3)^2 - 9 + 10$$

$$= (x+3)^2 + 1$$

$$\boxed{\begin{array}{l} p=3 \\ q=1 \end{array}}$$

4) Completing the Square: Medium

2) Express $x^2 - 3x + 5$ in the form $(x + a)^2 + b$

$$(x-1.5)^2 - 1.5^2 + 5$$

$$= (x-1.5)^2 - 2.25 + 5$$

$$= (x-1.5)^2 + 2.75$$

$a = -1.5,\ b = 2.75$

4) Completing the Square: Harder

3) What is the minimum value of
$(x-2)^2 + 5$?

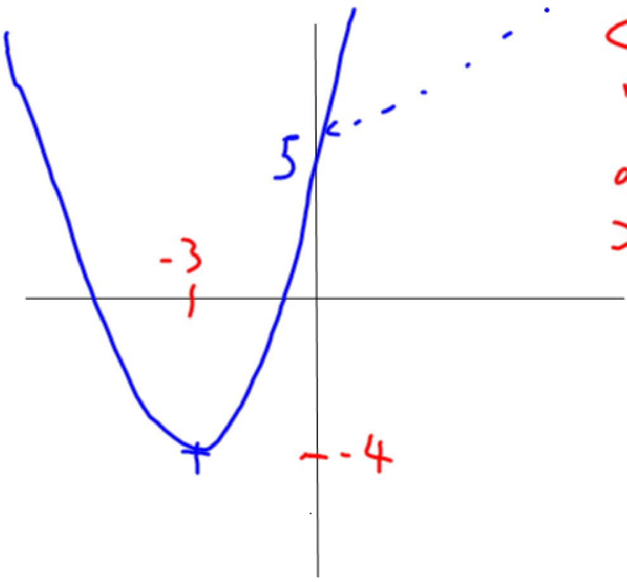
5, which occurs when
$x = 2$.
$(x-2)^2$ can never be negative.

4) a) Express $x^2 + 6x + 5$ in the form of $(x + a)^2 + b$

$(x+3)^2 - 3^2 + 5$

$= (x+3)^2 - 4$

b) Now sketch the graph of $y = x^2 + 6x + 5$
stating the minimum point of the graph
and where it crosses the axis



min point at
$x = -3, y = -4$

5) Iterative processes: Easier

Solution for Question 1:

$$U_1 = 2$$

$$U_2 = 2(2) + 3 = 4 + 3$$

$$U_2 = 7$$

$$U_3 = 2(7) + 3 = 14 + 3$$

$$U_3 = 17$$

$$U_4 = 2(17) + 3 = 34 + 3$$

$$U_4 = 37$$

Solution for Question 2:

$$x_0 = 2$$

$$x_1 = (3(2) - 1)^{\frac{1}{3}}$$

$$x_1 = 5^{\frac{1}{3}} = 1.70996 \ldots$$

$$x_2 = \left(3\left(5^{\frac{1}{3}}\right) - 1\right)^{\frac{1}{3}}$$

$$x_2 = 1.60441 \ldots$$

$$x_3 = (3(1.60441 \ldots) - 1)^{\frac{1}{3}}$$

$$x_3 = 1.5623 \ldots$$

Solution for Question 3:

a) $5x - x^3 = 2$

Add x^3 to both sides: $5x = 2 + x^3$

Dividing both sides by 5 will give: $x = \frac{2}{5} + \frac{x^3}{5}$

b) $x_0 = 0.3$

$$x_1 = \frac{2}{5} + \frac{(0.3)^3}{5}$$

$$x_1 = 0.4054$$

$$x_2 = \frac{2}{5} + \frac{(0.4054)^3}{5}$$

$$x_2 = 0.413325 \ldots$$

$$x_3 = \frac{2}{5} + \frac{(0.413325 \ldots)^3}{5}$$

5) Iterative processes: Medium

$$x_3 = 0.414122 \ldots$$

$$x_4 = \frac{2}{5} + \frac{(0.414122\ldots)^3}{5}$$

$$x_4 = 0.41420 \ldots$$

c) Root of $5x - x^3 = 2$ to two decimal places: $x = 0.41$

Solution for Question 4:

a) $x^3 + 3x^2 - 2 = 0$

Sub in $x = -2$: $(-2)^3 + 3(-2)^2 - 2 = 2$

Sub in $x = -3$: $(-3)^3 + 3(-3)^2 - 2 = -2$

Since there is a change in sign from where $x = -2$ to $x = -3$, there is a root between -2 and -3

b) $x^3 + 3x^2 - 2 = 0$

Add 2 to both sides: $x^3 + 3x^2 = 2$

Take away $3x^2$ from both sides: $x^3 = 2 - 3x^2$

Dividing both sides by x^2 gives: $x = \frac{2}{x^2} - 3$

c) $x_0 = 0.5$

$$x_1 = \frac{2}{0.5^2} - 3,\ x_1 = 5$$

$$x_2 = \frac{2}{5^2} - 3,\ x_2 = -2.92$$

$$x_3 = \frac{2}{(-2.92)^2} - 3,\ x_3 = -2.765 \ldots$$

$$x_4 = \frac{2}{(-2.765\ldots)^2} - 3,\ x_4 = -2.738 \ldots$$

$$x_5 = \frac{2}{(-2.738\ldots)^2} - 3,\ x_5 = -2.733 \ldots$$

$$x_6 = \frac{2}{(-2.733\ldots)^2} - 3,\ x_6 = -2.732 \ldots$$

$$x_7 = \frac{2}{(-2.732)^2} - 3,\ x_7 = -2.732 \ldots$$

Therefore, to three decimal places, the root of $x^3 + 3x^2 - 2 = 0$: $x = -2.732$

5) Iterative processes: Harder

Solution for Question 5:

Number of Tadpoles in 2016: $P_0 = 50$
Number of Tadpoles in 2017: $P_1 = 1.02(50 + 6),\ P_1 = 57.12$
Number of Tadpoles in 2018: $P_2 = 1.02(57.12 + 6),\ P_2 = 64.38\ldots$
Number of Tadpoles in 2019: $P_3 = 1.02(64.38\ldots + 6),\ P_3 = 71.79\ldots$
Number of Tadpoles in 2020: $P_4 = 1.02(71.79\ldots + 6),\ P_4 = 79.35\ldots$

Predicted number of Tadpoles at the start of 2020: 79

GROCH Anna

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	16 from 20	1 from 1	6 from 10	5 from 5	3 from 3	1 from 1
A02 and 3	45 from 60	8 from 11	11 from 16	5 from 9	14 from 16	7 from 8
Total	61 from 80	9 from 12	17 from 26	10 from 14	17 from 19	8 from 9

Your Pinpoint Topics

Topic 1: Distance Time Graphs. Mathswatch Clip: 143

Topic 2: Box plots. Mathswatch Clip: 187

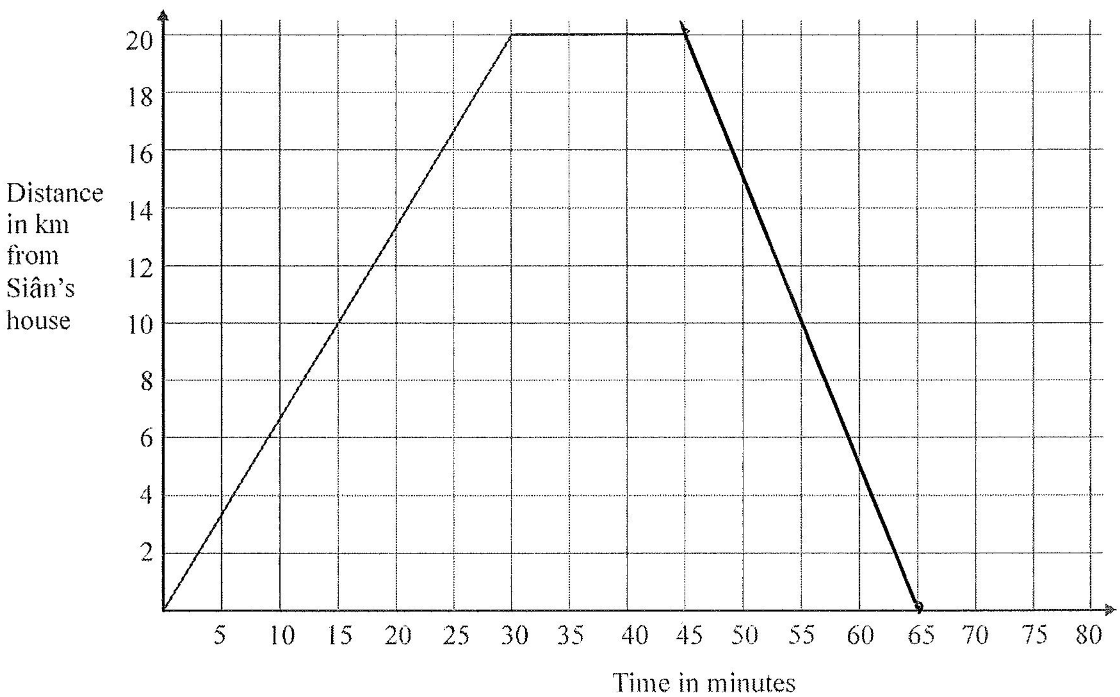
Topic 3: Counting Methods. Mathswatch Clip: NA

Topic 4: Proof. Mathswatch Clip: 193

Topic 5: Completing the Square. Mathswatch Clip: 209

1) Distance Time Graphs: Easier

1. Here is part of a travel graph of Siân's journey from her house to the shops and back.



(a) Work out Siân's speed for the first 30 minutes of her journey.
Give your answer in km/h.

distance ÷ time   30 minutes = 0.5 hours.

20 ÷ 0.5 = 40

40 .... km/h

(2)

Siân spends 15 minutes at the shops.
She then travels back to her house at 60 km/h.

(b) Complete the travel graph.

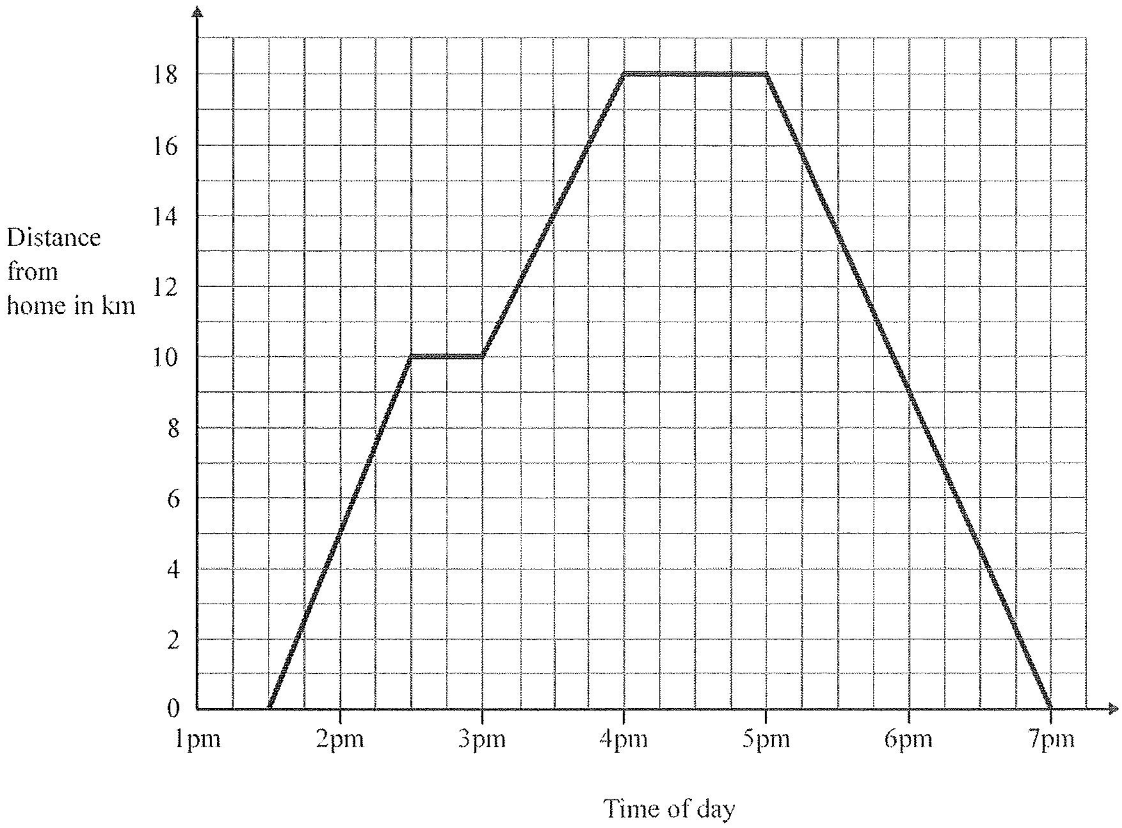
20km at 60 km/h

20 in 20minutes

(2)
(Total 4 marks)

1) Distance Time Graphs: Medium

10. Pete visited his friend and then returned home.
The travel graph shows some information about Pete's journey.



(a) Write down the time that Pete started his journey.

1.30pm

(1)

At 2.30 pm Pete stopped for a rest.

(b) (i) Find his distance from home when he stopped for this rest.

10 km

(ii) How many minutes was this rest?

30 minutes

(2)

Pete stayed with his friend for one hour.
He then returned home.

(c) Work out the total distance travelled by Pete on this journey.

18 × 2 = 36

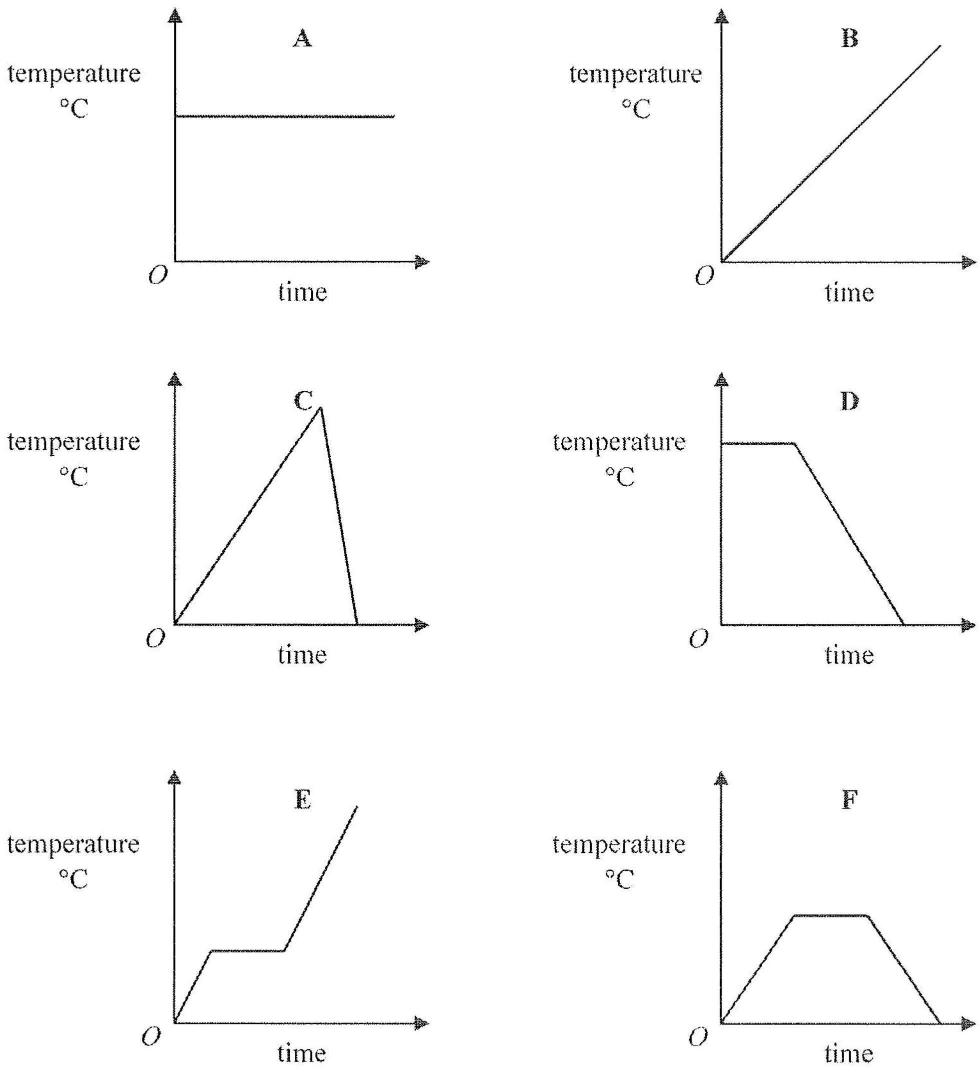
36 km

(2)

(Total 5 marks)

1) Distance Time Graphs: Harder

11. Here are six temperature/time graphs.



Each sentence in the table describes one of the graphs.
Write the letter of the correct graph next to each sentence.

The first one has been done for you.

The temperature starts at 0°C and keeps rising.	**B**
The temperature stays the same for a time and then falls.	D
The temperature rises and then falls quickly.	C
The temperature is always the same.	A
The temperature rises, stays the same for a time and then falls.	F
The temperature rises, stays the same for a time and then rises again.	E

(Total 3 marks)

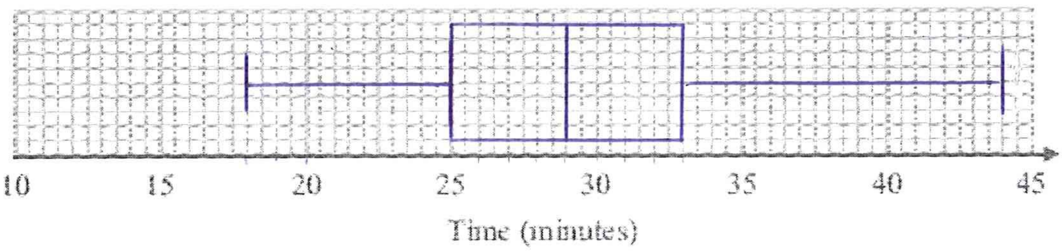
2) Box plots: Easier

2. Sameena recorded the times, in minutes, some girls took to do a jigsaw puzzle.

Sameena used her results to work out the information in this table.

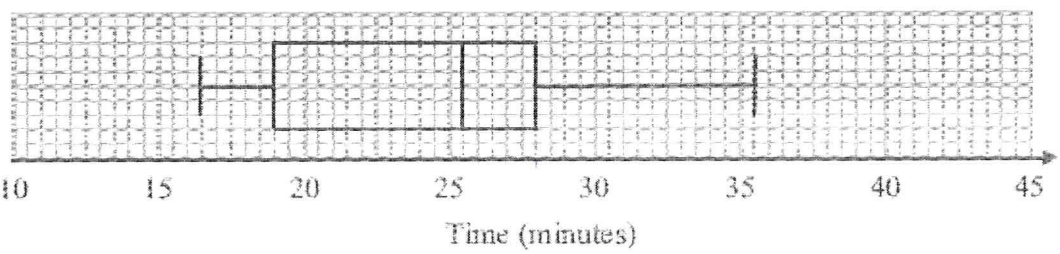
	Minutes
Shortest time	18
Lower quartile	25
Median	29
Upper quartile	33
Longest time	44

(a) On the grid, draw a box plot to show the information in the table.



(2)

The box plot below shows information about the times, in minutes, some boys took to do the same jigsaw puzzle.



(b) Compare the distributions of the girls' times and the boys' times.

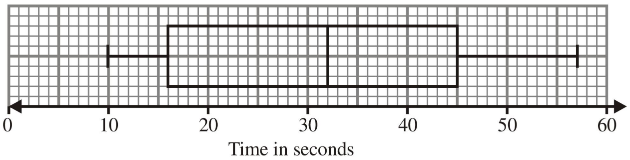
The boys median time was less than that of the girls; Boys 25.5mins, Girls 29 mins.

The spread of data for the interquartile range is smaller for the girls (8 mins) than for the boys (9 mins)

(2)

(4 marks)

2) Box plots: Medium

2.	(a)	32 *B1 for 32 (accept 31.5 to 33.5 inclusive)*	1
	(b)	 *B1 for ends of whiskers at 9 and 57 (with a box)* *B1 for ends of box at 16 and 45/46 (±0.5)* *B1for median marked at "32"or complete box and whisker diagram drawn with a median inside the box*	3
	(c)	Median(B)>Median(G); on average boys take longer IQR(B)>IQR(G); times for boys have a greater spread *B1 eg for comparison of medians (ft on diagrams)* *B1 eg for comparison of (interquartile) ranges (ft on diagram)*	2

[6]

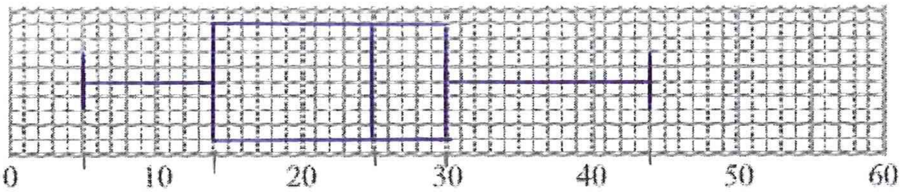
2) Box plots: Harder

7. Here are the times, in seconds, that 15 people waited to be served at Rose's garden centre.

5 9 11 $\boxed{14}$ 15 20 22 $\boxed{25}$ 27 27 28 $\boxed{30}$ 32 35 44

LQ Median UQ.

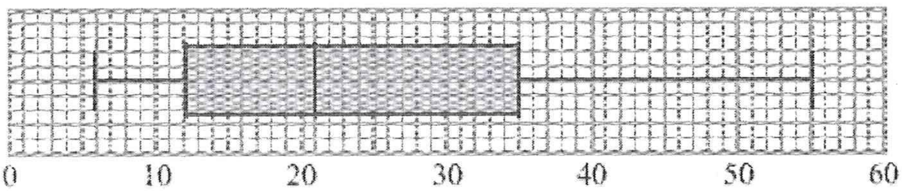
(a) On the grid, draw a box plot for this information.



Time (seconds)

(3)

The box plot below shows the distribution of the times that people waited to be served at Green's garden centre.



Time (seconds)

(b) Compare the distribution of the times that people waited at Rose's garden centre and the distribution of the times that people waited at Green's garden centre.

There was a greater spread of waiting times in the interquartile range for Green's Garden Centre than Rose's Garden centre

The median waiting time is shorter at ~~Rose's~~ Greens than Roses Garden centre.

(2)

(5 marks)

3) Counting Methods: Easier

1) Ryan has four shorts of different colours, blue, red, green and yellow.
He has three different T-shirts of different colours, black, white and orange.

Blue shorts and a black T-Shirt would be one possible outfit.
How many different outfits of Shorts and T-Shirts can Ryan wear?

4 shorts × 3 T-shirts = 12 possible outfits

____

(2 Marks)

2) There are 13 boys and 10 girls in a class.
Work out the total number of ways that 1 boy and 1 girl can be chosen from the class.

13 × 10 = 130 ways

____

(2 Marks)

3) There are 7 boys and 10 girls in a class.
Work out the total number of ways that 1 boys and 2 girls can be chosen from the class.

7 × 10 × 9 = 630 ways

____

(2 Marks)

3) Counting Methods: Medium

4) Mason's bank secret pin code is a four digit number and each digit can be the numbers 0, 1, 2, 3, 4, 5, 6 , 7, 8, or 9. For example one possible pin number could be 9021.

a) Mason's bank card is stolen. What is the probability with one guess only that someone correctly guesses Mason's pin number? Leave your answer as a fraction.

$10 \times 10 \times 10 \times 10 = 10000$ possibilities.

Probability of guessing first time = $\frac{1}{10000}$

____

(2 Marks)

Ishmael's bank does not allow any digit to be repeated in his secret pin number. For example 7762 would not be allowed, nor would 5075.

b) Ishmael's bank card is stolen. What is the probability with one guess only that someone correctly guesses Ishmael's pin number? Leave your answer as a fraction.

$10 \times 9 \times 8 \times 7 = 5040$ possibilities.

Probability of guessing first time = $\frac{1}{5040}$

____

(3 Marks)

3) Counting Methods: Harder

5) A restaurant menu has 6 starters, 10 mains and 6 desserts.
A customer can choose from the following meals

- a starter and a main,
- a main and a dessert,
- a starter, a main and a dessert.

Show that there are 480 different ways of choosing a meal at this restaurant.

$$(6 \times 10) + (10 \times 6) + (6 \times 10 \times 6)$$

$$= 60 + 60 + 360$$

= 480 ways

____

(3 Marks)

6) A simple computer password only allows you to use two letters a and b.
"abaab" would be an example of one password which consists of 5 letters.
How many letters must your password contain such that the probability of someone randomly guessing it first time is less than 1 in a 1000?

Use Trial and Improvement:

2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 1024 ways with 10 letters.

Therefore a password of <u>10 letters</u> is needed as $\frac{1}{1024} < \frac{1}{1000}$

____

(3 Marks)

4) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As $2n$ is even $2n+1$ will be odd and so $2n+2$ is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n+2+2 = 2n+4$

$2n+4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n+6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

4) Proof: Medium

8. Prove that

$(n + 1)^2 - (n - 1)^2 + 1$ is always odd for all positive integer values of n.

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$

$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$

$= 4n + 1$

$4n$ is a multiple of 4 so it must be even which means $4n+1$ is odd.

(3 marks)

4) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$$n^2 + (n+1)^2$$

$$= n^2 + n^2 + 2n + 1$$

$$= 2n^2 + 2n + 1$$

$$= 2n(n+1) + 1$$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

$2n(n+1)$ is $2 \times$ an even number which has to be a multiple of 4

So $2n(n+1) + 1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

5) Completing the Square: Easier

1) Express $x^2 + 6x + 10$ in the form $(x + p)^2 + q$

$$(x+3)^2 - 3^2 + 10$$

$$= (x+3)^2 - 9 + 10$$

$$= (x+3)^2 + 1$$

$p = 3$

$q = 1$

5) Completing the Square: Medium

2) Express $x^2 - 3x + 5$ in the form $(x + a)^2 + b$

$$(x - 1.5)^2 - 1.5^2 + 5$$

$$= (x - 1.5)^2 - 2.25 + 5$$

$$= (x - 1.5)^2 + 2.75$$

$a = -1.5$, $b = 2.75$

5) Completing the Square: Harder

3) What is the minimum value of

$(x-2)^2 + 5$?

5, which occurs when

$x = 2$.

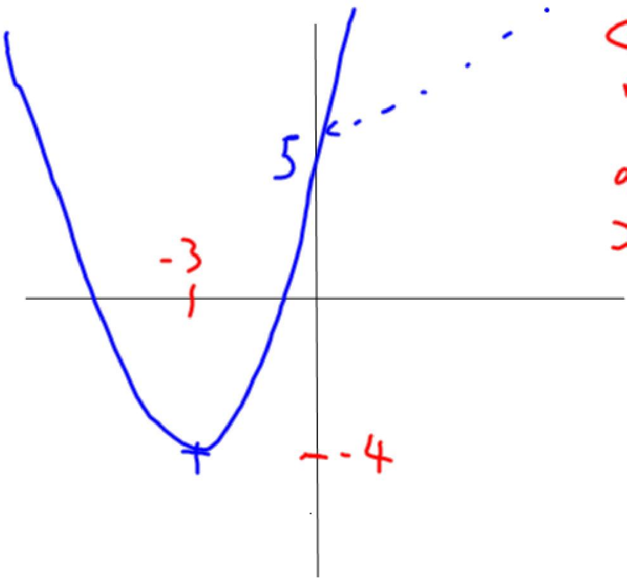
$(x-2)^2$ can never be negative.

4) a) Express $x^2 + 6x + 5$ in the form of $(x + a)^2 + b$

$(x+3)^2 - 3^2 + 5$

$= (x+3)^2 - 4$

b) Now sketch the graph of $y = x^2 + 6x + 5$ stating the minimum point of the graph and where it crosses the axis



min point at $x = -3, y = -4$

HATCHELL Charlie

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	13 from 20	1 from 1	3 from 10	5 from 5	3 from 3	1 from 1
A02 and 3	32 from 60	7 from 11	7 from 16	7 from 9	6 from 16	5 from 8
Total	45 from 80	8 from 12	10 from 26	12 from 14	9 from 19	6 from 9

Your Pinpoint Topics

Topic 1: Changing the Subject of a Formula. MW: 136

Topic 2: Expressions, identities and equations. MW: 7

Topic 3: Loci and Construction. Mathswatch Clip: 165

Topic 4: Simultaneous Equations. Mathswatch Clip: 162

Topic 5: Proof. Mathswatch Clip: 193

1) Changing the Subject of a Formula: Easier

1. Make p the subject of the formula $m = 3n + 2p$

$m = 3n + 2p$

$-3n \quad m - 3n = 2p \quad -3n$

$\div 2 \quad \frac{m-3n}{2} = p \quad \div 2$

$p = \frac{m-3n}{2}$

(Total 2 marks)

2. Make c the subject of the formula $a = 3c - 4$

$a = 3c - 4$

$+4 \quad a + 4 = 3c \quad +4$

$\div 3 \quad \frac{a+4}{3} = c \quad \div 3$

$c = \frac{a+4}{3}$

(Total 2 marks)

3. Make b the subject of the formula $P = 2a + 2b$

$P = 2a + 2b$

$-2a \quad P - 2a = 2b \quad -2a$

$\div 2 \quad \frac{P-2a}{2} = b \quad \div 2$

or

$P = 2a + 2b$

$P = 2(a+b)$

$\div 2 \quad \frac{P}{2} = a + b \quad \div 2$

$-a \quad \frac{P}{2} - a = b \quad -a$

$b = \frac{P-2a}{2}$ or $b = \frac{P}{2} - a$

(Total 2 marks)

1) Changing the Subject of a Formula: Medium

4. Make c the subject of the formula $f = 3c - 4$

$$f = 3c - 4$$
$$+4 \quad f + 4 = 3c \quad +4$$
$$\div 3 \quad \frac{f+4}{3} = c \quad \div 3$$

c = $\frac{f+4}{3}$

(Total 2 marks)

5. Make t the subject of the formula

$$u = 7t + 30$$

$$u = 7t + 30$$
$$-30 \quad u - 30 = 7t \quad -30$$
$$\div 7 \quad \frac{u-30}{7} = t \quad \div 7$$

t = $\frac{u-30}{7}$

(Total 2 marks)

1) Changing the Subject of a Formula: Harder

14. Make q the subject of the formula $P = 2q + 10$

$$P = 2q + 10$$

-10 | $P - 10 = 2q$ | -10

$\div 2$ | $\dfrac{P-10}{2} = q$ | $\div 2$

$q = \dfrac{P-10}{2}$

(Total 2 marks)

15. When you are h feet above sea level, you can see d miles to the horizon, where

$$d = \sqrt{\frac{3h}{2}}$$

Make h the subject of the formula $d = \sqrt{\frac{3h}{2}}$

$$d = \sqrt{\frac{3h}{2}}$$

square | $d^2 = \dfrac{3h}{2}$ | square

$\times 2$ | $2d^2 = 3h$ | $\times 2$

$\div 3$ | $\dfrac{2d^2}{3} = h$ | $\div 3$

$h = \dfrac{2d^2}{3}$

(Total 2 marks)

2) Expressions, identities and equations: Easier

1) Fill in the gaps with an appropriate word from the list
EQUATION, IDENTITY, EXPRESSION, TERMS

$$3x + 4 \textit{ is an expression with two terms}$$

$$2(x + 4) \equiv 2x + 8 \textit{ is an identity}$$

$$2x + 3 = 11 \textit{ is an equation}$$

....

(2 Marks)

---

2) Circle the identity

A $5(x + 3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x + 3)$ D $x^2 + 2 = 27$

(1 Mark)

---

3) Circle the expression

A $5(x + 3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x + 3)$ D $x^2 + 2 = 27$

....

(1 Mark)

2) Expressions, identities and equations: Medium

4) Annemarie is asked to form an expression, given the following information.
There are a sweets in every packet. I have 3 packets of sweets. I put all the sweets in one container and eat 2 of them. Form an expression for the number of sweets I have left.

Annemarie writes

3a = -2

Write down one mistake Annemarie has made

She has written an equation, (with an equals) she wasn't told how many sweets there are left just that there are two less than 3 bags so she should have written 3a-2 which is an expression

(1 Mark)

5) Insert the correct symbol, = or ≡ in the boxes below

$$2x + 3 \quad \boxed{=} \quad 10$$

$$2a \times 3a^2 \quad \boxed{\equiv} \quad 6a^3$$

$$5(x - 2) \quad \boxed{\equiv} \quad 5x - 10$$

Remember an equation is true for some values of the variable and an identity is true for all values of the variable

…………………………

(3 Marks)

2) Expressions, identities and equations: Harder

6) Jim says that

$$(x+4)^2 = x^2 + 16$$

is an identity. Paul says it is an equation and not an identity. Who is correct? You must explain your reasoning.

Paul is right, it is an equation, for the value $x = 0$ the equation is true as

$(0+4)^2 = 0^2 + 4^2$ as they are both equal to 16

It is not true for all values of x for example for $x = 1$

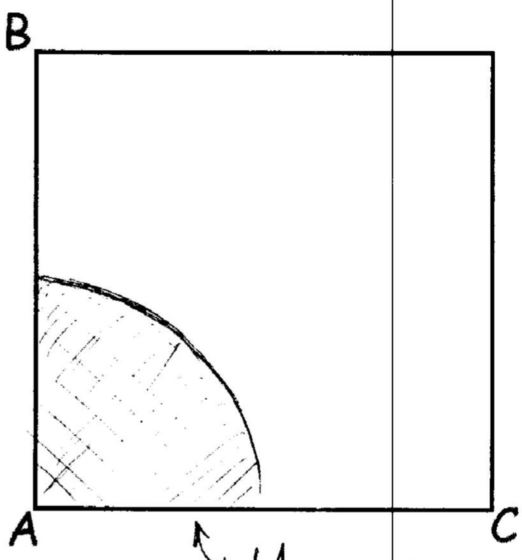
$(1+4)^2 = 25$ *and* $1^2 + 16 = 17$ so it does not hold for all values of x

$(x+4)^2 = x^2 + 8x + 16$ is an identity

(1 Mark)

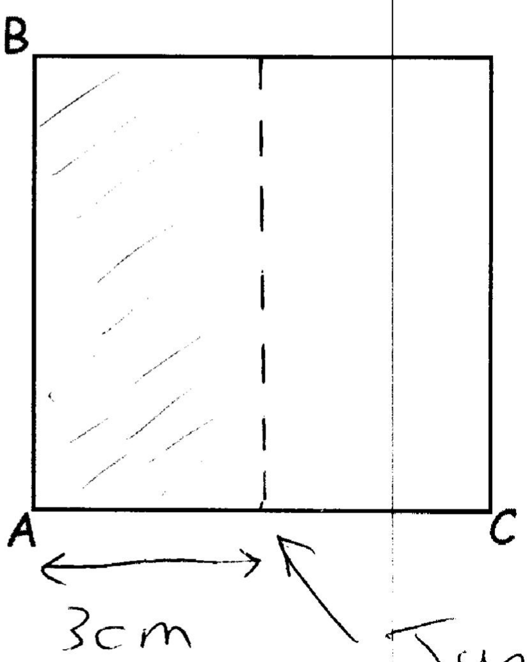
3) Loci and Construction: Easier

1) Shade the area closer than 3cm to point A within the square below:



Use compass at 3cm

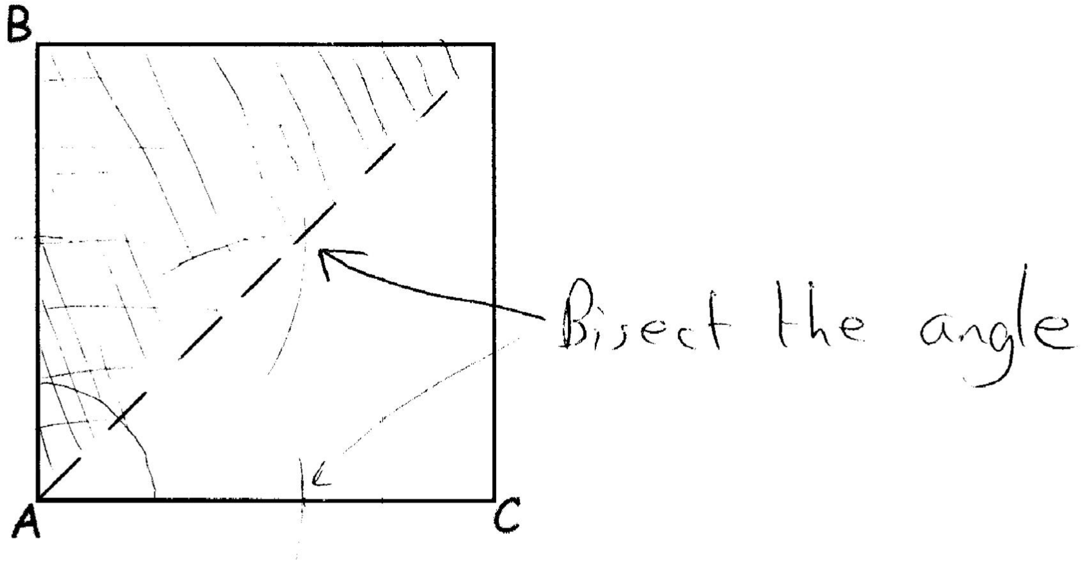
2) Shade the area closer than 3cm to the line AB within the square below:



Just measure 3cm with your ruler

3) Loci and Construction: Medium

3) Shade the area closer to the line AB than AC within the square below:

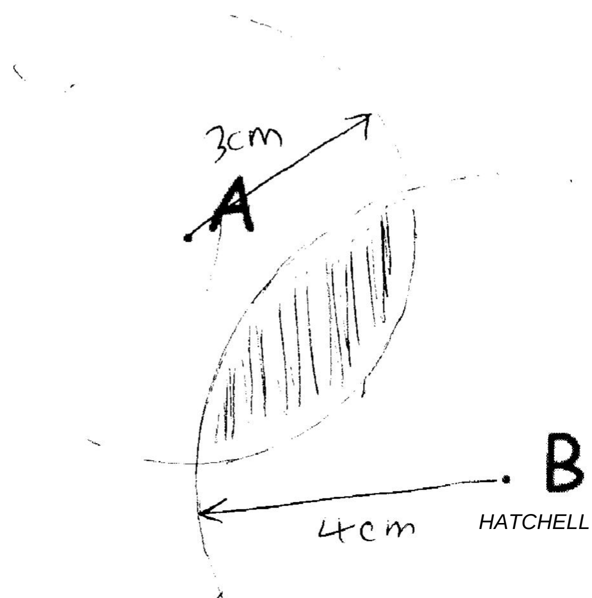


4) Two mobile phone stations transmit a signal.

Mobile phone station A transmits its signal ~~5~~ 3 miles.

Mobile phone station B transmits its signal 4 miles.

When you can receive both signals you experience interference on your phone. Shade below the area of interference.



Scale: 1 cm represents 1 mile

3) Loci and Construction: Harder

5) Mariam wants to plant a flower:

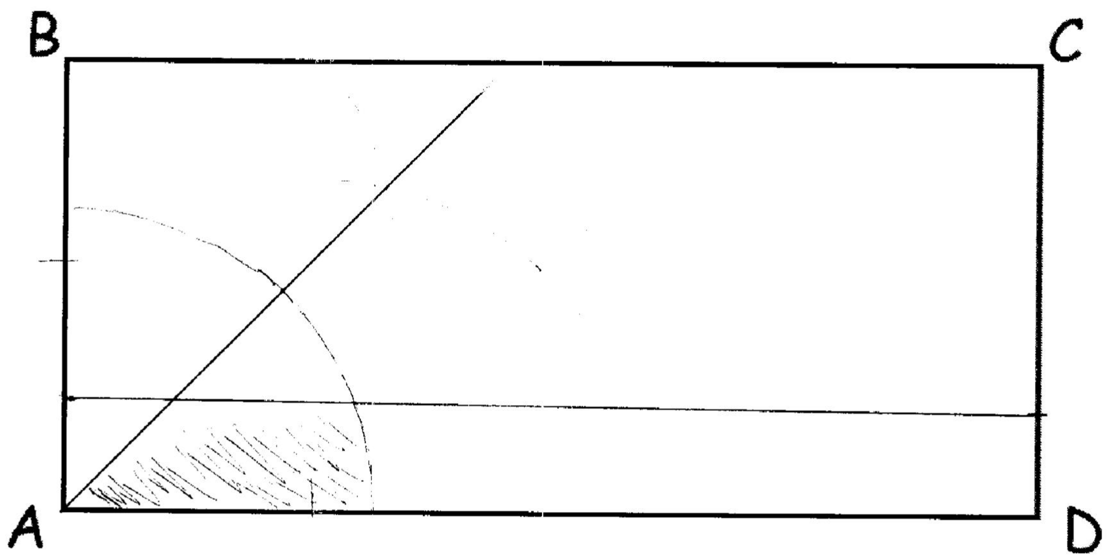
Within 4m of A

Closer to AD than AB

Less than 1.5m from AD.

Shade below the region where Mariam should plant her flower.

Show any construction lines your draw.



Scale: 1 cm represents 1 metre

4) Simultaneous Equations: Easier

1) Solve the simultaneous equations.

① $2x + 3y = 9$

② $5x + 3y = 18$

② − ①

$5x + 3y = 18$

$2x + 3y = 9$ −

$\frac{3x}{3} = \frac{9}{3}$

$x = 3$

Sub $x = 3$ into ①

$2x + 3y = 9$

$6 + 3y = 9$

$3y = 3$

$y = 1$

x = 3

y = 1

(3 Marks)

---

2) Solve the simultaneous equations.

① $4x + 2y = 9$ ×2

② $8x + 8y = 20$

③ $8x + 4y = 18$

② − ③

$8x + 8y = 20$

$8x + 4y = 18$ −

$\frac{4y}{4} = \frac{2}{4}$

$y = 0.5$

Sub $y = 0.5$ into ①

$4x + 1 = 9$

$-1 \quad -1$

$\frac{4x}{4} = \frac{8}{4}$

$x = 2$

x = 2

y = 0.5

(4 Marks)

4) Simultaneous Equations: Medium

7) Solve the simultaneous equations.

① $6x + 3y = 15$ $\times 3$

② $4x - 9y = -34$

③ $18x + 9y = 45$

② + ③

$4x - 9y = -34$

$18x + 9y = 45$ +

$\frac{22x}{22} = \frac{11}{22}$

$x = 0.5$

Sub $x = 0.5$ into ①

$3 + 3y = 15$

$-3 \quad -3$

$\frac{3y}{3} = \frac{12}{3}$

$y = 4$

x = 0.5

y = 4

(4 Marks)

8) Solve the simultaneous equations.

① $5x + 2y = 29$ $\times 3$

② $8x - 6y = 51$

③ $15x + 6y = 87$

② + ③

$8x - 6y = 51$

$15x + 6y = 87$ +

$\frac{23x}{23} = \frac{138}{23}$

$x = 6$

Sub $x = 6$ into ①

$30 + 2y = 29$

$-30 \quad -30$

$\frac{2y}{2} = \frac{-1}{2}$

$y = -0.5$

x = 6

y = -0.5

(4 Marks)

4) Simultaneous Equations: Harder

9) Bill goes into a chip shop and buys **3 fish** and **2 portions of chips,** it cost him £5.20

Jenny also goes into the same chip shop. She buys **5 fish** and **6 portions of chips,** it cost her £10.80

What is the cost of a portion of fish and chips?

① $3f + 2p = 5.20 \quad \times 3$

② $5f + 6p = 10.80$

③ $9f + 6p = 15.60$

③ − ②

$9f + 6p = 15.60$

$5f + 6p = 10.80$

$4f = 4.8$

$\frac{4f}{4} = \frac{4.80}{4}$

$f = 1.20$

Sub into ①

$3.60 + 2p = 5.20$

$-3.60 \qquad -3.60$

$2p = 1.60$

$p = 0.80$

$p + f = £2$

(5 Marks)

10) There are some ducks and some sheep on a farm. Altogether they have 35 heads and 94 feet.
How many ducks and sheep are there?

① $d + s = 35$ (heads) $\times 2$

② $2d + 4s = 94$ (feet)

③ $2d + 2s = 70$

② − ③

$2d + 4s = 94$

$2d + 2s = 70 \quad -$

$2s = 24$

Sub $s = 12$ into ①

$d + 12 = 35$

$-12 \qquad -12$

$d = 23$

Ducks = 23

Sheep = 12

(5 Marks)

5) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As $2n$ is even $2n+1$ will be odd and so $2n+2$ is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n+2+2 = 2n+4$

$2n+4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

5) Proof: Medium

2. Prove that $(3n + 1)^2 – (3n – 1)^2$ is a multiple of 4, for all positive integer values of n.

$$(3n+1)^2 - (3n-1)^2$$

$$(3n+1)^2 = (3n+1)(3n+1)$$
$$= 9n^2 + 6n + 1$$

$$(3n-1)^2 = (3n-1)(3n-1)$$
$$= 9n^2 - 6n + 1$$

$$(3n+1)^2 - (3n+1)^2 = (9n^2+6n+1) - (9n^2-6n+1)$$
$$= 9n^2 + 6n + 1 - 9n^2 + 6n - 1$$
$$= 12n$$
$$= 4(3n)$$

$\uparrow$

which is a multiple of 4

(3 marks)

5) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$n^2 + (n+1)^2$

$= n^2 + n^2 + 2n + 1$

$= 2n^2 + 2n + 1$

$= 2n(n+1) + 1$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

$2n(n+1)$ is $2 \times$ an even number which has to be a multiple of 4

So $2n(n+1) + 1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

HAYES Benjamin

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
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A02 and 3	54 from 60	9 from 11	13 from 16	9 from 9	16 from 16	7 from 8
Total	73 from 80	10 from 12	22 from 26	14 from 14	19 from 19	8 from 9

Your Pinpoint Topics

Topic 1: Proof. Mathswatch Clip: 193

Topic 2: Upper and Lower Bounds. Mathswatch Clip: 206

Topic 3: Extention1. Mathswatch Clip:

Topic 4: Extention2. Mathswatch Clip:

Topic 5: Extention3. Mathswatch Clip:

1) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As 2n is even
2n+1 will be odd and so 2n+2 is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

1) Proof: Medium

8. Prove that

$(n+1)^2 - (n-1)^2 + 1$ is always odd for all positive integer values of n.

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$$
$$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$$
$$= 4n + 1$$

4n is a multiple of 4 so it must be even which means 4n+1 is odd.

(3 marks)

1) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$n^2 + (n+1)^2$

$= n^2 + n^2 + 2n + 1$

$= 2n^2 + 2n + 1$

$= 2n(n+1) + 1$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

$2n(n+1)$ is $2 \times$ an even number which has to be a multiple of 4

So $2n(n+1) + 1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

2) Upper and Lower Bounds: Easier

1. The weight of a plasma TV is 12kg to the nearest kg.

a) What is the smallest possible weight of the TV?

11.5Kg

……………… **(1)**

b) What is the largest possible weight of the TV?

12.5Kg

……………… **(1)**

2. The height of a wardrobe is given as 253 cm to the nearest cm. What is the maximum height the wardrobe could be?

253.5cm

……………… **(1)**

3. The number of people that attended a football fixture is given as 3200 to two significant figures. What is the minimum number of people that could have attended?

3250

……………… **(1)**

2) Upper and Lower Bounds: Medium

6. On sports day a girl runs 100m, to the nearest metre. She wins and finishes in 11.3 seconds, correct to the nearest tenth of a second.

What is the fastest possible speed she could have run?

$$Speed = \frac{distance}{time}$$

$$UB(Speed) = \frac{UB(distance)}{LB(time)}$$

$$UB(Speed) = \frac{100.5}{11.25}$$

=8.99m/s

…..………….. **(4)**

7. The maximum load for a crane is 5400kg, measured to the nearest 100 kg. Each crate weighs 20kg, measured to the nearest 10kg.

What is the maximum number of crates the crane can safely take?

$$Max\ number\ of\ cranes = \frac{LB(Max\ load)}{UB(weight\ of\ crate)}$$

$$= \frac{5350}{25}$$

=214 Crates

…..………….. **(4)**

2) Upper and Lower Bounds: Harder

8. The formula for density is

$$D = \frac{M}{V}$$

V is the volume of the object, M is the mass and D the density.

The Volume of a liquid is given as 500ml to the nearest 10ml and the Mass of the liquid is 600g to nearest gram

By considering bounds, give the Density of the drink to a suitable degree of accuracy. You must show all of your working and give a reason for your answer

$$UB(D) = \frac{UB(M)}{LB(V)}$$

$$UB(D) = \frac{505}{599.5} = 0.842369$$

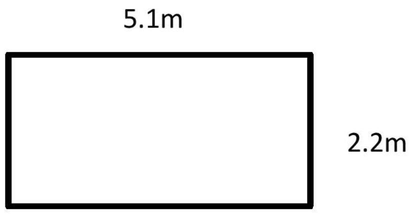
$$LB(D) = \frac{LB(M)}{UB(V)}$$

$$LB(D) = \frac{495}{600.5} = 0.824313$$

The lower bound and the upper bound are the same to one significant figure so 0.8

0.8g/ml
…...............g/ml **(4)**

*9. Sabrina is decorating and is painting a feature wall. The measurements of the wall are shown below to the nearest 0.1m. A pot of paint covers 12m^2 of wall to the nearest 1m^2. By considering bounds, does Sabrina definitely have enough paint to cover the wall with one pot?

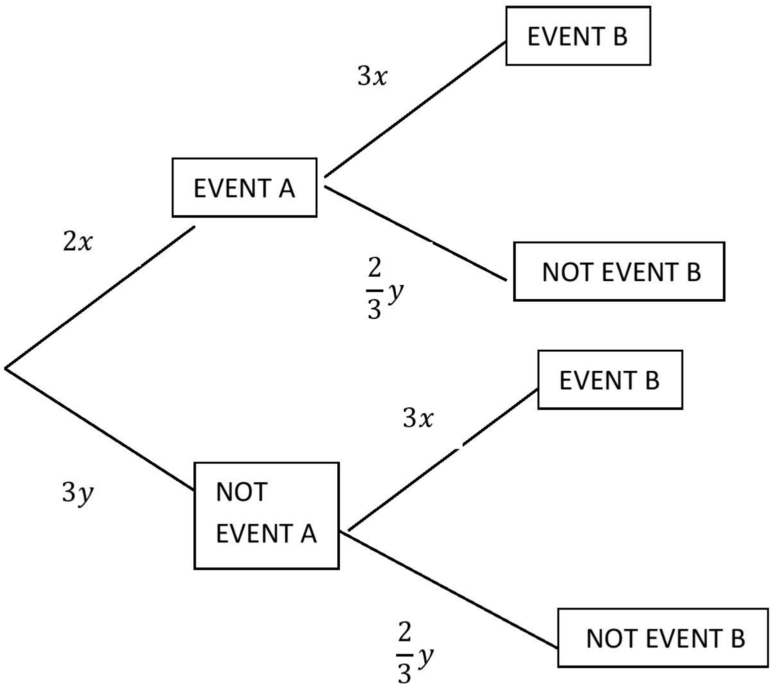


UB (area of wall)= 5.15 x 2.25=11.5875m^2

LB(area paint covers) = 11.5m^2
No she does not definitely have enough as she could only have enough for 11.5m^2 but she could need enough for 11.5875m^2

3) Extention1: Easier

1. The figure below shows a probability tree diagram for two events. What is the value of x and y?



From tree diagram (branches sum to one)

$$2x + 3y = 1$$

$$3x + \frac{2}{3}y = 1$$

Multiplying equations to eliminate x

$$6x + 9y = 3$$

$$6x + \frac{4}{3}y = 2$$

$$\frac{23}{3}y = 1$$

$$y = \frac{3}{23}$$

$$2x + \frac{9}{23} = 1$$

$$x = \frac{7}{23}$$

(4 marks)

3) Extention1: Medium

2. Given that $x^a = \frac{1}{x^b}$, What is the value of $2a + 2b$?

$$x^a = x^{-b}$$

$$a = -b$$

$$a + b = 0$$

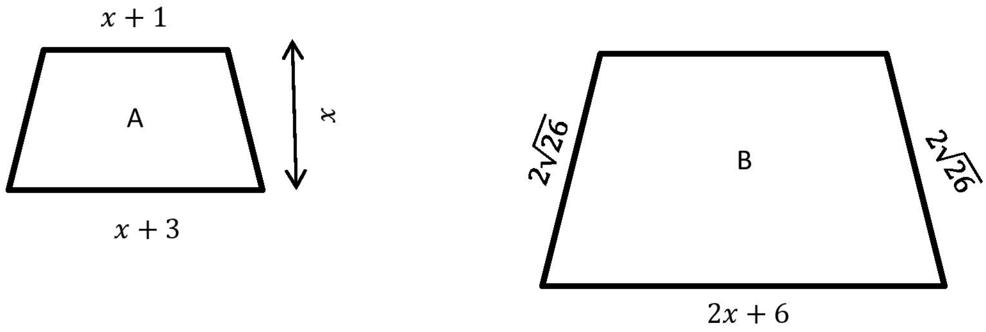
$$2(a + b) = 0$$

$$2a + 2b = 0$$

(3 marks)

3) Extention1: Harder

3. The two trapezia below are similar. The area of trapezium A is 35cm^2. Find the perimeter of trapezium B.



The area of trapezium A is given by $\frac{1}{2}(x + 1 + x + 3) \times x$

$$\frac{1}{2}(2x + 4) \times x = 35cm^2$$

$$x^2 + 2x = 35cm^2$$

$$x^2 + 2x - 35 = 0$$

$$(x - 5)(x + 7) = 0$$

$$x = 5cm, \qquad (as\ x > 0)$$

The perimeter of Trapezium A is

$$2x + 6 + 2x + 2 + 4\sqrt{26}$$

When $x = 5$ $\quad 4(5) + 8 + 4\sqrt{26}$

$$= 18 + \ 4\sqrt{26}$$

(4 marks)

4) Extention2: Easier

4. Given that $9^a = 2$, What are the possible values of 27^a?

$$9^a = 2$$

$$(3^2)^a = 2$$

$$3^{2a} = 2$$

$$(3^a)^2 = 2$$

$$(3^a) = \pm\sqrt{2}$$

$$27^a = (3^3)^a$$

$$= (3^a)^3$$

$$= \left(\pm\sqrt{2}\right)^3$$

$$= \pm 2\sqrt{2}$$

(4 marks)

4) Extention2: Medium

4) Extention2: Harder

5) Extention3: Easier

4. A line $y = mx + 10$ is a tangent to the circle $x^2 + y^2 = 25$, What are the possible values of m?

The line meets the circle when

$$x^2 + (mx + 10)^2 = 25$$

$$x^2 + m^2x^2 + 20mx + 100 = 25$$

$$(1 + m^2)x^2 + 20mx + 75 = 0$$

If it only has one solution $b^2 - 4ac = 0$

$$(20m)^2 - 4\,(1 + m^2)(75) = 0$$

$$400m^2 - 300 - 300m^2 = 0$$

$$100m^2 = 300$$

$$m^2 = 3$$

$$m = \pm\sqrt{3}$$

(5 marks)

5) Extention3: Medium

5) Extention3: Harder

PINPOINT

HOWELL Zulekha

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	14 from 20	1 from 1	4 from 10	5 from 5	3 from 3	1 from 1
A02 and 3	38 from 60	3 from 11	8 from 16	7 from 9	15 from 16	5 from 8
Total	52 from 80	4 from 12	12 from 26	12 from 14	18 from 19	6 from 9

Your Pinpoint Topics

Topic 1: Expressions, identities and equations. MW: 7

Topic 2: Distance Time Graphs. Mathswatch Clip: 143

Topic 3: Simultaneous Equations. Mathswatch Clip: 162

Topic 4: Proportionality. Mathswatch Clip: 199

Topic 5: Counting Methods. Mathswatch Clip: NA

1) Expressions, identities and equations: Easier

1) Fill in the gaps with an appropriate word from the list
EQUATION, IDENTITY, EXPRESSION, TERMS

$$3x + 4 \ is \ an \ expression \ with \ two \ terms$$

$$2(x + 4) \equiv 2x + 8 \ is \ an \ identity$$

$$2x + 3 = 11 \ is \ an \ equation$$

....

(2 Marks)

---

2) Circle the identity

A $5(x + 3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x + 3)$ D $x^2 + 2 = 27$

(1 Mark)

---

3) Circle the expression

A $5(x + 3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x + 3)$ D $x^2 + 2 = 27$

....

(1 Mark)

1) Expressions, identities and equations: Medium

4) Annemarie is asked to form an expression, given the following information.
There are a sweets in every packet. I have 3 packets of sweets. I put all the sweets in one container and eat 2 of them. Form an expression for the number of sweets I have left.

Annemarie writes

3a = -2

Write down one mistake Annemarie has made

She has written an equation, (with an equals) she wasn't told how many sweets there are left just that there are two less than 3 bags so she should have written 3a-2 which is an expression

(1 Mark)

---

5) Insert the correct symbol, = or ≡ in the boxes below

$$2x + 3 \quad \boxed{=} \quad 10$$

$$2a \times 3a^2 \quad \boxed{\equiv} \quad 6a^3$$

$$5(x - 2) \quad \boxed{\equiv} \quad 5x - 10$$

Remember an equation is true for some values of the variable and an identity is true for all values of the variable

....

(3 Marks)

1) Expressions, identities and equations: Harder

6) Jim says that

$$(x + 4)^2 = x^2 + 16$$

is an identity. Paul says it is an equation and not an identity. Who is correct? You must explain your reasoning.

Paul is right, it is an equation, for the value $x = 0$ the equation is true as

$(0 + 4)^2 = 0^2 + 4^2$ as they are both equal to 16

It is not true for all values of x for example for $x = 1$

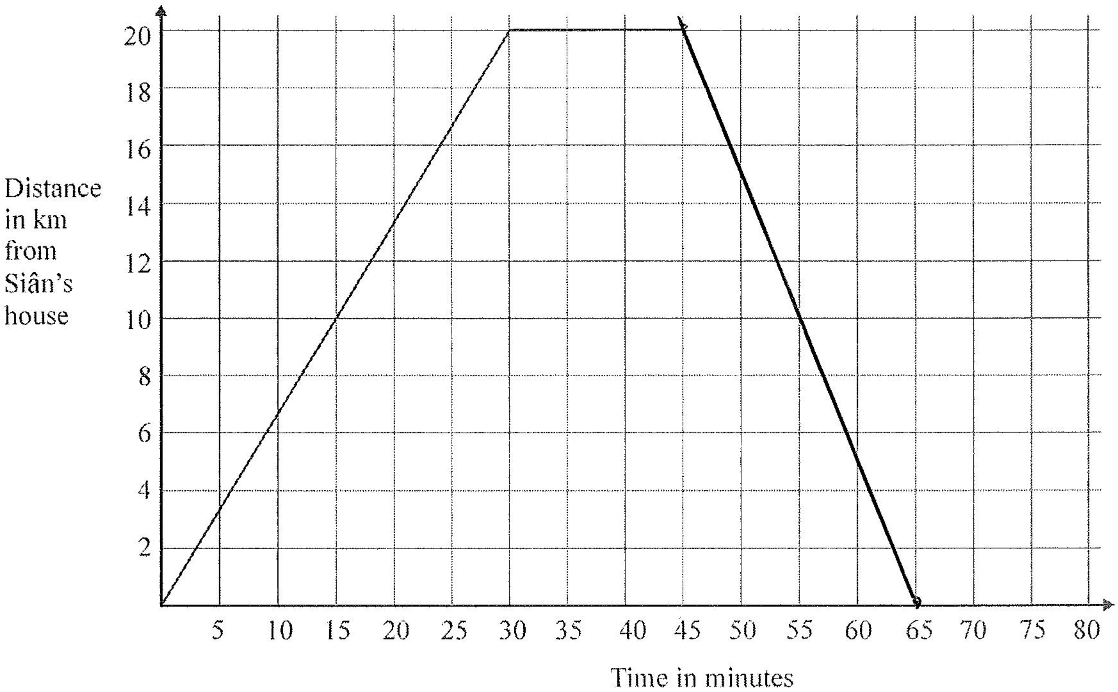
$(1 + 4)^2 = 25$ *and* $1^2 + 16 = 17$ so it does not hold for all values of x

$(x + 4)^2 = x^2 + 8x + 16$ is an identity

(1 Mark)

2) Distance Time Graphs: Easier

1. Here is part of a travel graph of Siân's journey from her house to the shops and back.



(a) Work out Siân's speed for the first 30 minutes of her journey.
Give your answer in km/h.

distance ÷ time 30 minutes = 0.5 hours.

$20 \div 0.5 = 40$

40 .... km/h

(2)

Siân spends 15 minutes at the shops.
She then travels back to her house at 60 km/h.

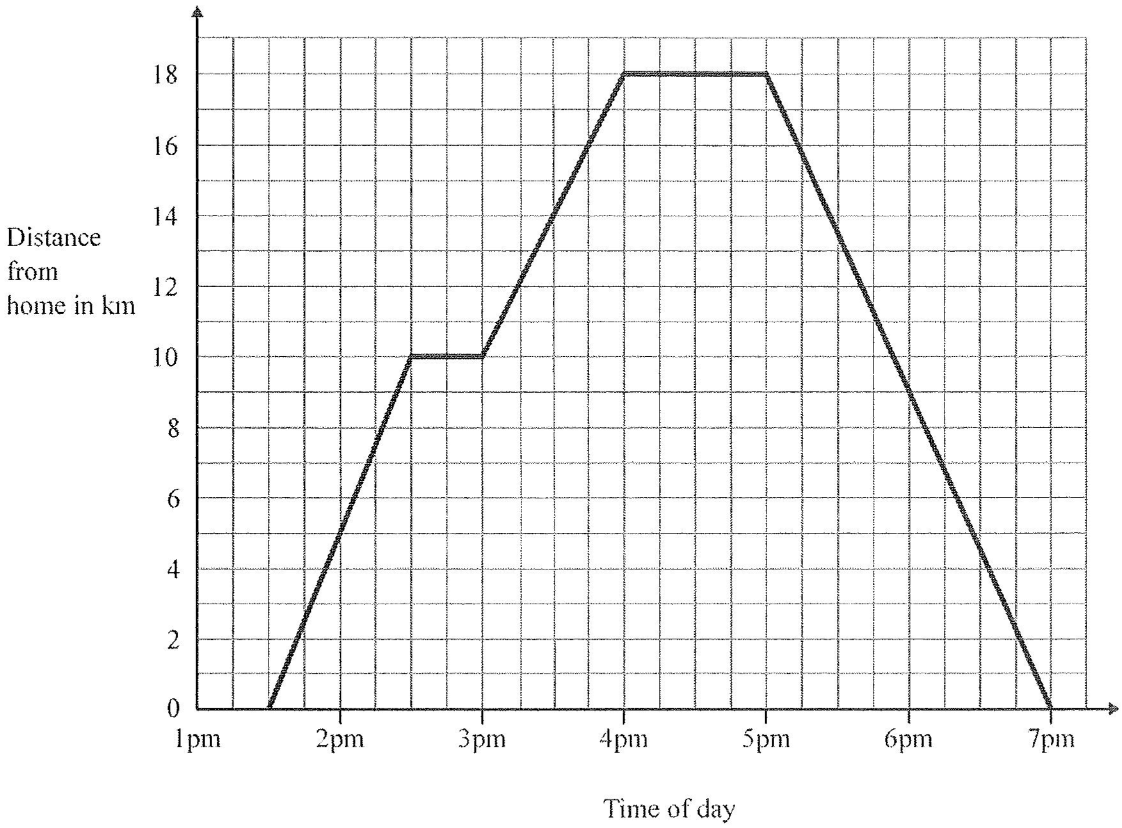
(b) Complete the travel graph.

20 km at 60 km/h
20 in 20 minutes

(2)
(Total 4 marks)

2) Distance Time Graphs: Medium

10. Pete visited his friend and then returned home.
The travel graph shows some information about Pete's journey.



(a) Write down the time that Pete started his journey.

1.30pm

(1)

At 2.30 pm Pete stopped for a rest.

(b) (i) Find his distance from home when he stopped for this rest.

10 km

(ii) How many minutes was this rest?

30 minutes

(2)

Pete stayed with his friend for one hour.
He then returned home.

(c) Work out the total distance travelled by Pete on this journey.

$18 \times 2 = 36$

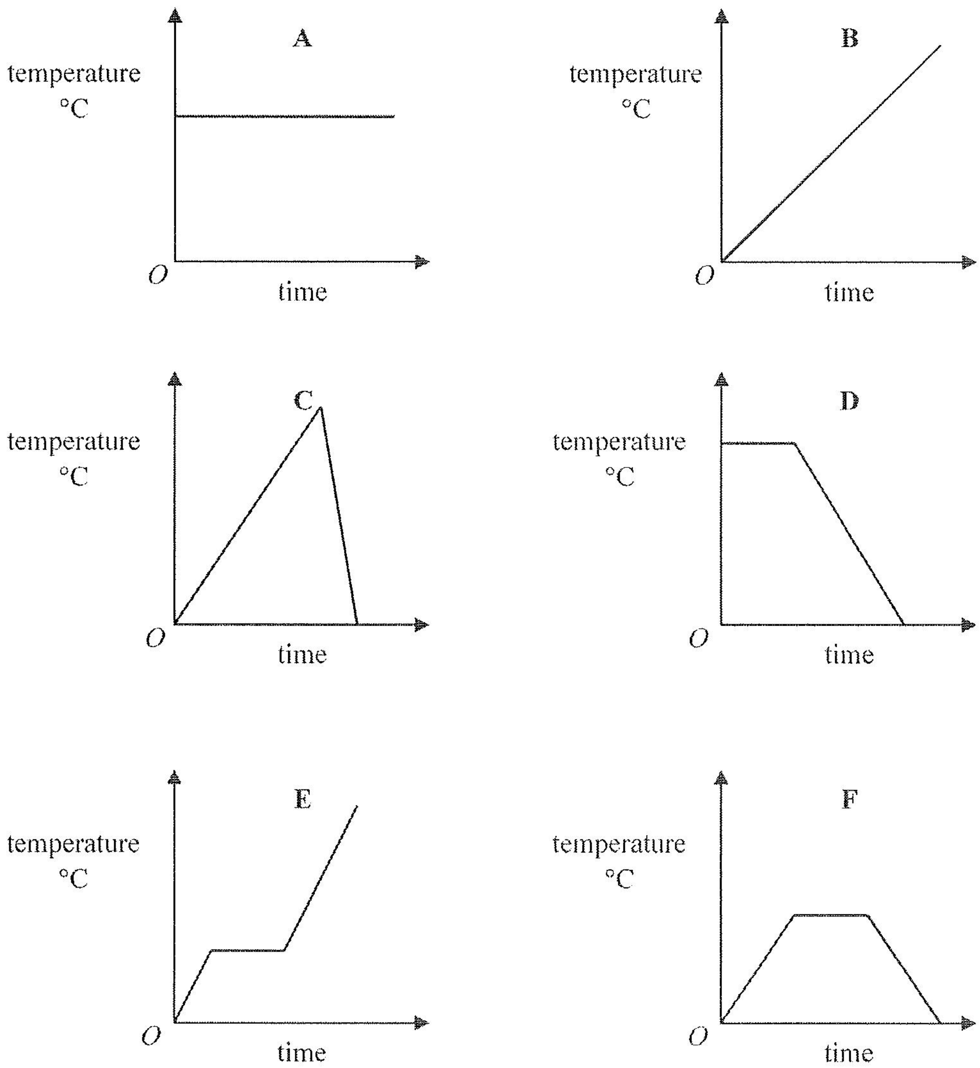
36 km

(2)

(Total 5 marks)

2) Distance Time Graphs: Harder

11. Here are six temperature/time graphs.



Each sentence in the table describes one of the graphs.
Write the letter of the correct graph next to each sentence.

The first one has been done for you.

The temperature starts at 0°C and keeps rising.	**B**
The temperature stays the same for a time and then falls.	D
The temperature rises and then falls quickly.	C
The temperature is always the same.	A
The temperature rises, stays the same for a time and then falls.	F
The temperature rises, stays the same for a time and then rises again.	E

(Total 3 marks)

PINPOINT

3) Simultaneous Equations: Easier

1) Solve the simultaneous equations.

1 $2x + 3y = 9$

2 $5x + 3y = 18$

2 - 1

$5x + 3y = 18$

$2x + 3y = 9$ −

$\frac{3x}{3} = \frac{9}{3}$

$x = 3$

Sub $x = 3$ into 1

$2x + 3y = 9$

$6 + 3y = 9$

$3y = 3$

$y = 1$

x = 3

y = 1

(3 Marks)

2) Solve the simultaneous equations.

1 $4x + 2y = 9$ $\times 2$

2 $8x + 8y = 20$

3 $8x + 4y = 18$

2 - 3

$8x + 8y = 20$

$8x + 4y = 18$ −

$\frac{4y}{4} = \frac{2}{4}$

$y = 0.5$

Sub $y = 0.5$ into 1

$4x + 1 = 9$

$-1 \quad -1$

$\frac{4x}{4} = \frac{8}{4}$

$x = 2$

x = 2

y = 0.5

(4 Marks)

3) Simultaneous Equations: Medium

7) Solve the simultaneous equations.

① $6x + 3y = 15$ $\times 3$

② $4x - 9y = -34$

③ $18x + 9y = 45$

② + ③

$4x - 9y = -34$

$18x + 9y = 45$ +

$\frac{22x}{22} = \frac{11}{22}$

$x = 0.5$

Sub $x = 0.5$ into ①

$3 + 3y = 15$

$-3 \quad\quad -3$

$\frac{3y}{3} = \frac{12}{3}$

$y = 4$

x = 0.5

y = 4

(4 Marks)

8) Solve the simultaneous equations.

① $5x + 2y = 29$ $\times 3$

② $8x - 6y = 51$

③ $15x + 6y = 87$

② + ③

$8x - 6y = 51$

$15x + 6y = 87$ +

$\frac{23x}{23} = \frac{138}{23}$

$x = 6$

Sub $x = 6$ into ①

$30 + 2y = 29$

$-30 \quad\quad -30$

$\frac{2y}{2} = \frac{-1}{2}$

$y = -0.5$

x = 6

y = -0.5

(4 Marks)

3) Simultaneous Equations: Harder

9) Bill goes into a chip shop and buys **3 fish** and **2 portions of chips,** it cost him £5.20

Jenny also goes into the same chip shop. She buys **5 fish** and **6 portions of chips,** it cost her £10.80

What is the cost of a portion of fish and chips?

① $3f + 2p = 5.20$ $\times 3$

② $5f + 6p = 10.80$

③ $9f + 6p = 15.60$

③ − ②

$9f + 6p = 15.60$

$5f + 6p = 10.80$

$4f = 4.8$

$\frac{4f}{4} = \frac{4.80}{4}$

$f = 1.20$

Sub into ①

$3.60 + 2p = 5.20$

$-3.60 \quad -3.60$

$2p = 1.60$

$p = 0.80$

$p + f = £2$

(5 Marks)

10) There are some ducks and some sheep on a farm. Altogether they have 35 heads and 94 feet.
How many ducks and sheep are there?

① $d + s = 35$ (heads) $\times 2$

② $2d + 4s = 94$ (feet)

③ $2d + 2s = 70$

② − ③

$2d + 4s = 94$

$2d + 2s = 70$ −

$2s = 24$

Sub $s = 12$ into ①

$d + 12 = 35$

$-12 \quad -12$

$d = 23$

Ducks = 23
Sheep = 12

(5 Marks)

4) Proportionality: Easier

1) Here is a formula, where V is the volume of a pipe in m^3 and d is the diameter of the pipe in m.

$$V = 8d^2$$

(a) A pipe has volume $2m^3$.
Find the diameter of the pipe.

$2 = 8 \times d^2$
$2 \div 8 = d^2$
$d^2 = 0.25$
$d = \sqrt{0.25} = 0.5$m

(b) Which of these statements is true for the pipe?
Tick one box

- ☐ It has a volume of $4m^3$ with **exactly double** the diameter in part (a)
- ■ It has a volume of $4m^3$ with **less than double** the diameter in part (a)
- ☐ It has a volume of $4m^3$ with **more than double** the diameter in part (a)

You **must** show working to support your answer

$4 = 8 \times d^2$
$d^2 = 0.5$
$d = \sqrt{0.5} = 0.7$m

(5 Marks)

---

2) Here is a formula, where E is the energy of a particle measured in Joules and v is the velocity of the particle measured in m/s.

$$E = 6v^2$$

(a) A moving particle has 54 Joules of energy.
Find the velocity of the particle.

$54 = 6 \times v^2$
$54 \div 6 = v^2$
$v^2 = 9$
$v = \sqrt{9} = 3$m/s

Which of these statements is true for the particle?

Tick one box

- ☐ It has 108J of energy when travelling at **exactly double** the velocity in (a)
- ■ It has 108J of energy when travelling at **less than double** the velocity in (a)
- ☐ It has 108J of energy when travelling at **more than double** the velocity in (a)

You **must** show working to support your answer

$108 = 6 \times v^2$
$108 \div 6 = v^2$
$v^2 = 18$
$v = \sqrt{18} = 4.2$m/s

(5 Marks)

4) Proportionality: Medium

3) The table shows pairs of values x and y.

x	6	7
y	480	560

(a) Tick the correct statement

Trial and error:

Is $y \propto x$?

$480 \div 6 = 80$

$560 \div 7 = 80$

$y \propto x$ …Yes…..

$y \propto x^2$ …………..

$y \propto x^3$ …………..

(b) Write a formula for y in terms of x.

$y = kx$

$480 = 6k$

$k = 480 \div 6$

$k = 80$ => $y = 80x$

(3 Marks)

4) The table shows pairs of values x and y.

x	4	5
y	48	75

(i) Tick the correct statement

Trial and error:

Is $y \propto x$?

$48 \div 4 = 12$

$75 \div 5 = 15$

No

Is $y \propto x^2$?

$48 \div 4^2 = 3$

$75 \div 5^2 = 3$

Yes

$y \propto x$ …………..

$y \propto x^2$ … Yes …..

$y \propto x^3$ …………..

(ii) Write a formula for y in terms of x.

$y = kx^2$

$48 = 4^2k$

$k = 48 \div 16$

$k = 3$ => $y = 3x$

(3 Marks)

4) Proportionality: Harder

5) The table shows pairs of values x and y.

x	3	4
y	8	6

(i) Tick the correct statement

As x increases y decreases (no further reasoning necessary)

$y \propto x$ …………..

$y \propto x^2$ …………..

$y \propto \frac{1}{x}$ …Yes…..

(ii) Write a formula for y in terms of x.

$y = \frac{k}{x}$

$8 = \frac{k}{3}$

k = 8 × 3

k = 24 => $y = \frac{24}{x}$

(3 Marks)

6) The table shows pairs of values x and y.

x	2	3
y	9	4

(i) Tick the correct statement

Trial and error:

Is $y \propto \frac{1}{x}$?

$9 \times 2 = 18$

$4 \times 3 = 12$

No

Is $y \propto \frac{1}{x^2}$?

$9 \times 2^2 = 36$

$4 \times 3^2 = 36$

Yes

$y \propto \frac{1}{x}$ …………..

$y \propto \frac{1}{x^2}$ …Yes…..

$y \propto \frac{1}{x^3}$ …………..

(ii) Write a formula for y in terms of x.

$y = \frac{k}{x^2}$

$k = 4 \times 3^2 = 36$ => $y = \frac{36}{x^2}$

(3 Marks)

5) Counting Methods: Easier

1) Ryan has four shorts of different colours, blue, red, green and yellow.
He has three different T-shirts of different colours, black, white and orange.

Blue shorts and a black T-Shirt would be one possible outfit.
How many different outfits of Shorts and T-Shirts can Ryan wear?

4 shorts × 3 T-shirts = 12 possible outfits

____

(2 Marks)

---

2) There are 13 boys and 10 girls in a class.
Work out the total number of ways that 1 boy and 1 girl can be chosen from the class.

13 × 10 = 130 ways

____

(2 Marks)

---

3) There are 7 boys and 10 girls in a class.
Work out the total number of ways that 1 boys and 2 girls can be chosen from the class.

7 × 10 × 9 = 630 ways

____

(2 Marks)

5) Counting Methods: Medium

4) Mason's bank secret pin code is a four digit number and each digit can be the numbers 0, 1, 2, 3, 4, 5, 6 , 7, 8, or 9. For example one possible pin number could be 9021.

a) Mason's bank card is stolen. What is the probability with one guess only that someone correctly guesses Mason's pin number? Leave your answer as a fraction.

$10 \times 10 \times 10 \times 10 = 10000$ possibilities.

Probability of guessing first time = $\frac{1}{10000}$

____

(2 Marks)

Ishmael's bank does not allow any digit to be repeated in his secret pin number. For example 7762 would not be allowed, nor would 5075.

b) Ishmael's bank card is stolen. What is the probability with one guess only that someone correctly guesses Ishmael's pin number? Leave your answer as a fraction.

$10 \times 9 \times 8 \times 7 = 5040$ possibilities.

Probability of guessing first time = $\frac{1}{5040}$

____

(3 Marks)

5) Counting Methods: Harder

5) A restaurant menu has 6 starters, 10 mains and 6 desserts.
A customer can choose from the following meals

- a starter and a main,
- a main and a dessert,
- a starter, a main and a dessert.

Show that there are 480 different ways of choosing a meal at this restaurant.

$$(6 \times 10) + (10 \times 6) + (6 \times 10 \times 6)$$

$$= 60 + 60 + 360$$

= 480 ways

____

(3 Marks)

6) A simple computer password only allows you to use two letters a and b.
"abaab" would be an example of one password which consists of 5 letters.
How many letters must your password contain such that the probability of someone randomly guessing it first time is less than 1 in a 1000?

Use Trial and Improvement:

2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 1024 ways with 10 letters.

Therefore a password of <u>10 letters</u> is needed as $\frac{1}{1024} < \frac{1}{1000}$

____

(3 Marks)

HUGHES Mia

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	20 from 20	1 from 1	10 from 10	5 from 5	3 from 3	1 from 1
A02 and 3	55 from 60	10 from 11	14 from 16	9 from 9	14 from 16	8 from 8
Total	75 from 80	11 from 12	24 from 26	14 from 14	17 from 19	9 from 9

Your Pinpoint Topics

Topic 1: Distance Time Graphs. Mathswatch Clip: 143

Topic 2: Proof. Mathswatch Clip: 193

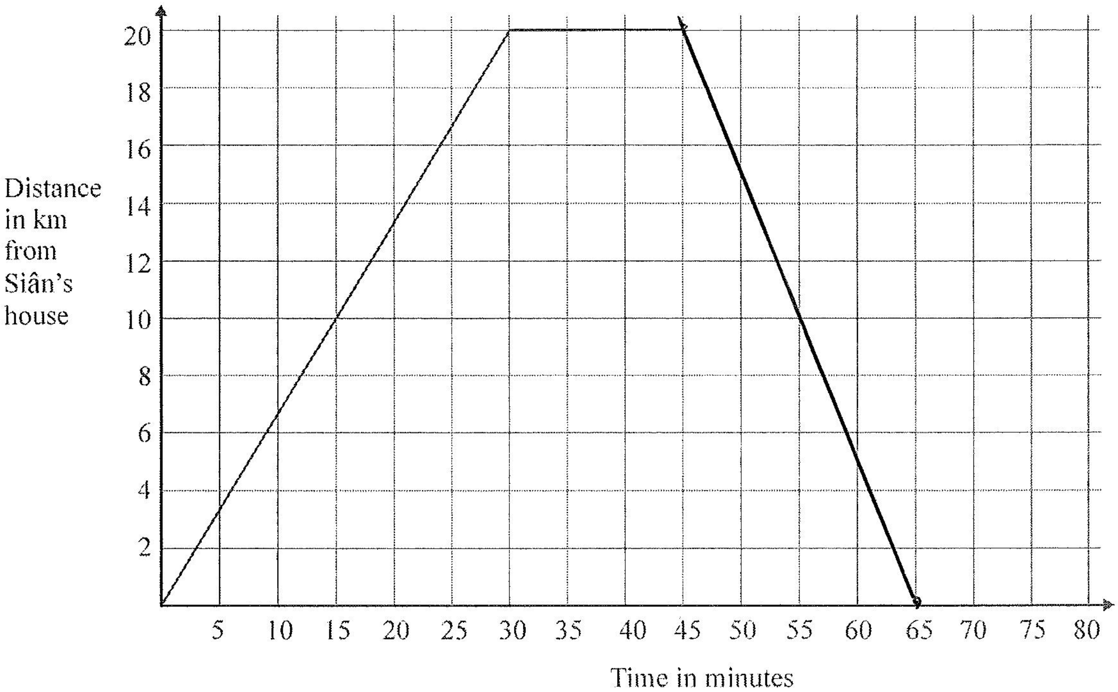
Topic 3: Extention1. Mathswatch Clip:

Topic 4: Extention2. Mathswatch Clip:

Topic 5: Extention3. Mathswatch Clip:

1) Distance Time Graphs: Easier

1. Here is part of a travel graph of Siân's journey from her house to the shops and back.



(a) Work out Siân's speed for the first 30 minutes of her journey.
Give your answer in km/h.

distance ÷ time   30 minutes = 0.5 hours.

20 ÷ 0.5 = 40

40 km/h

(2)

Siân spends 15 minutes at the shops.
She then travels back to her house at 60 km/h.

(b) Complete the travel graph.

20km at 60 km/h

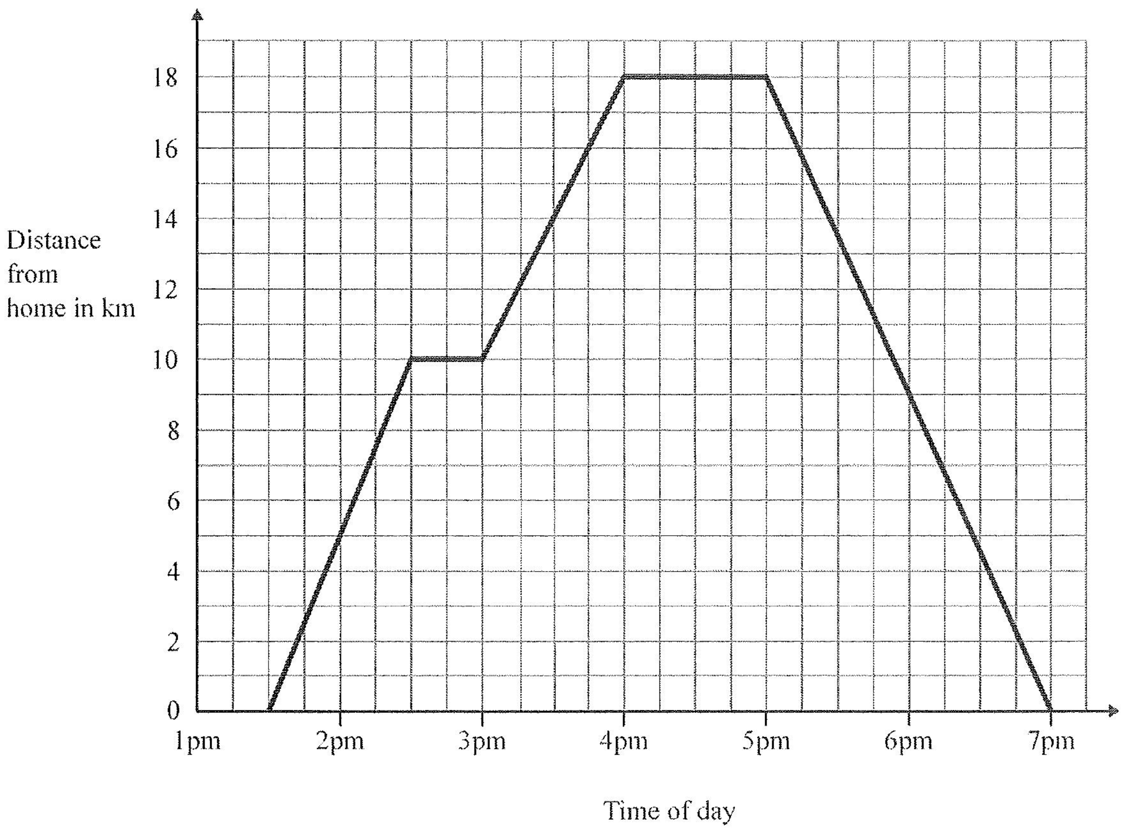
20 in 20minutes

(2)

(Total 4 marks)

1) Distance Time Graphs: Medium

10. Pete visited his friend and then returned home.
The travel graph shows some information about Pete's journey.



(a) Write down the time that Pete started his journey.

1.30pm

(1)

At 2.30 pm Pete stopped for a rest.

(b) (i) Find his distance from home when he stopped for this rest.

10 km

(ii) How many minutes was this rest?

30 minutes

(2)

Pete stayed with his friend for one hour.
He then returned home.

(c) Work out the total distance travelled by Pete on this journey.

$18 \times 2 = 36$

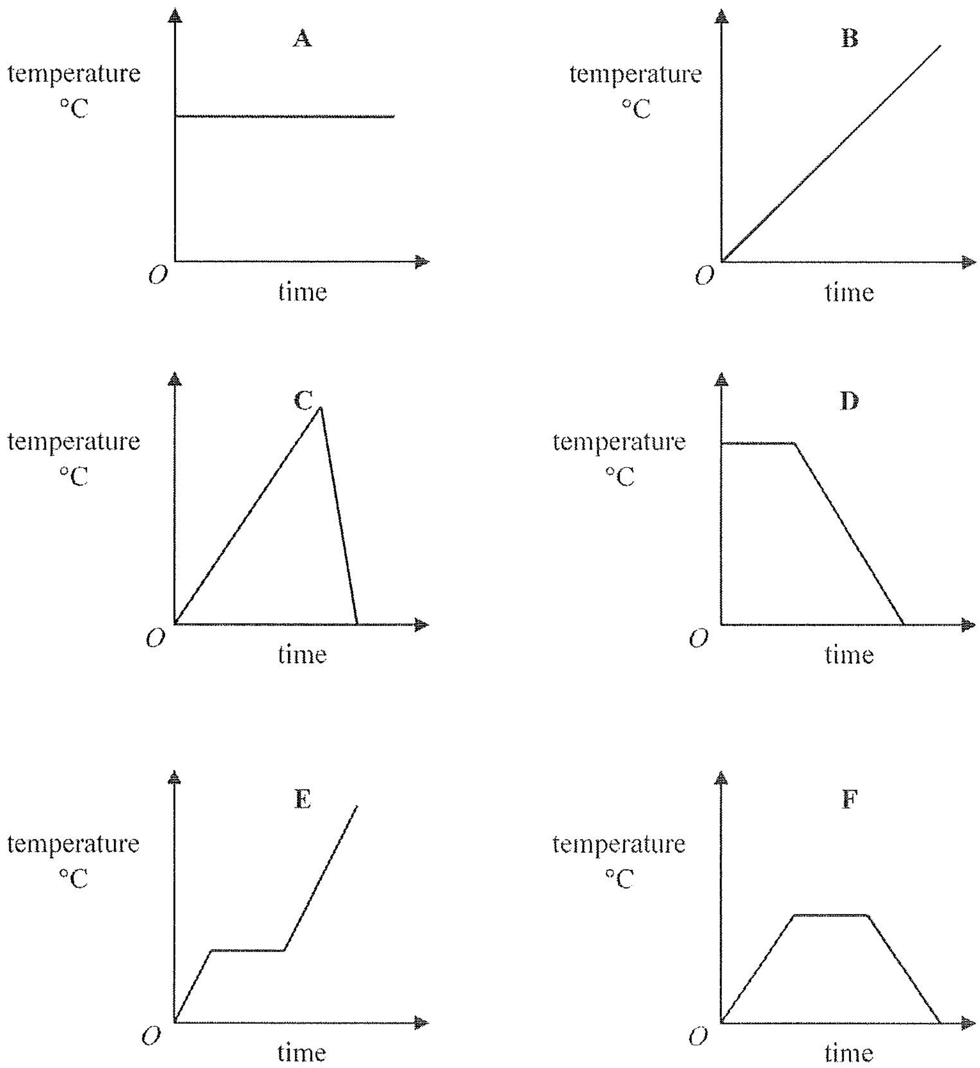
36 km

(2)

(Total 5 marks)

1) Distance Time Graphs: Harder

11. Here are six temperature/time graphs.



Each sentence in the table describes one of the graphs.
Write the letter of the correct graph next to each sentence.

The first one has been done for you.

The temperature starts at 0°C and keeps rising.	**B**
The temperature stays the same for a time and then falls.	D
The temperature rises and then falls quickly.	C
The temperature is always the same.	A
The temperature rises, stays the same for a time and then falls.	F
The temperature rises, stays the same for a time and then rises again.	E

(Total 3 marks)

PINPOINT

2) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As $2n$ is even

$2n+1$ will be odd and so $2n+2$ is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

2) Proof: Medium

8. Prove that

$(n + 1)^2 - (n - 1)^2 + 1$ is always odd for all positive integer values of n.

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$

$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$

$= 4n + 1$

$4n$ is a multiple of 4 so it must be even which means $4n+1$ is odd.

(3 marks)

2) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and n+1

$n^2 + (n+1)^2$

$= n^2 + n^2 + 2n + 1$

$= 2n^2 + 2n + 1$

$= 2n(n+1) + 1$

n(n+1) is the product of 2 consecutive numbers. As one of them is even the product must be even.

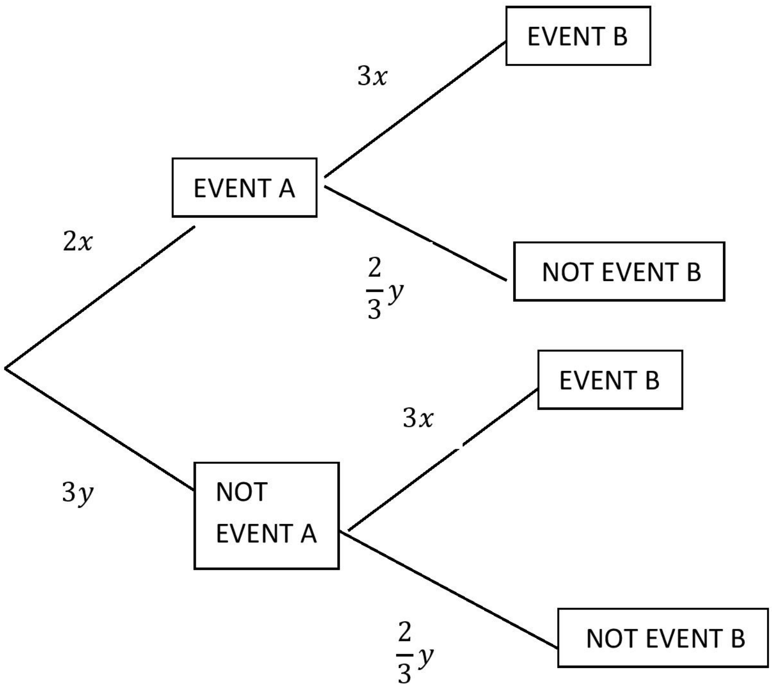
2n(n+1) is 2 x an even number which has to be a multiple of 4

So 2n(n+1) + 1 is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

3) Extention1: Easier

1. The figure below shows a probability tree diagram for two events. What is the value of x and y?



From tree diagram (branches sum to one)

$$2x + 3y = 1$$

$$3x + \frac{2}{3}y = 1$$

Multiplying equations to eliminate x

$$6x + 9y = 3$$

$$6x + \frac{4}{3}y = 2$$

$$\frac{23}{3}y = 1$$

$$y = \frac{3}{23}$$

$$2x + \frac{9}{23} = 1$$

$$x = \frac{7}{23}$$

(4 marks)

3) Extention1: Medium

2. Given that $x^a = \frac{1}{x^b}$, What is the value of $2a + 2b$?

$$x^a = x^{-b}$$

$$a = -b$$

$$a + b = 0$$

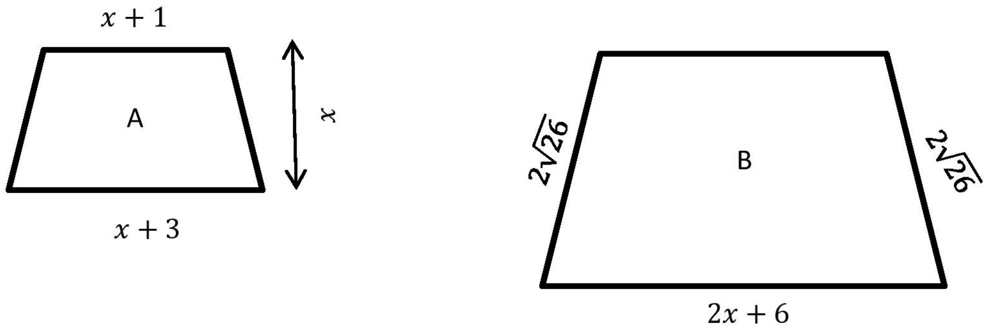
$$2(a + b) = 0$$

$$2a + 2b = 0$$

(3 marks)

3) Extention1: Harder

3. The two trapezia below are similar. The area of trapezium A is 35cm^2. Find the perimeter of trapezium B.



The area of trapezium A is given by $\frac{1}{2}(x+1+x+3)\times x$

$$\frac{1}{2}(2x+4)\times x = 35cm^2$$

$$x^2+2x = 35cm^2$$

$$x^2+2x-35 = 0$$

$$(x-5)(x+7) = 0$$

$$x = 5cm, \qquad (as\ x > 0)$$

The perimeter of Trapezium A is

$$2x+6+2x+2+4\sqrt{26}$$

When $x = 5$ $\qquad 4(5)+8+4\sqrt{26}$

$$= 18 + \ 4\sqrt{26}$$

(4 marks)

4) Extention2: Easier

4. Given that $9^a = 2$, What are the possible values of 27^a?

$$9^a = 2$$

$$(3^2)^a = 2$$

$$3^{2a} = 2$$

$$(3^a)^2 = 2$$

$$(3^a) = \pm\sqrt{2}$$

$$27^a = (3^3)^a$$

$$= (3^a)^3$$

$$= \left(\pm\sqrt{2}\right)^3$$

$$= \pm 2\sqrt{2}$$

(4 marks)

4) Extention2: Medium

4) Extention2: Harder

5) Extention3: Easier

4. A line $y = mx + 10$ is a tangent to the circle $x^2 + y^2 = 25$,
What are the possible values of m?

The line meets the circle when

$$x^2 + (mx + 10)^2 = 25$$

$$x^2 + m^2x^2 + 20mx + 100 = 25$$

$$(1 + m^2)x^2 + 20mx + 75 = 0$$

If it only has one solution $b^2 - 4ac = 0$

$$(20m)^2 - 4\,(1 + m^2)(75) = 0$$

$$400m^2 - 300 - 300m^2 = 0$$

$$100m^2 = 300$$

$$m^2 = 3$$

$$m = \pm\sqrt{3}$$

(5 marks)

5) Extention3: Medium

5) Extention3: Harder

JAMES-KEEP India

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	16 from 20	1 from 1	6 from 10	5 from 5	3 from 3	1 from 1
A02 and 3	34 from 60	6 from 11	10 from 16	5 from 9	6 from 16	7 from 8
Total	50 from 80	7 from 12	16 from 26	10 from 14	9 from 19	8 from 9

Your Pinpoint Topics

Topic 1: Loci and Construction. Mathswatch Clip: 165

Topic 2: Distance Time Graphs. Mathswatch Clip: 143

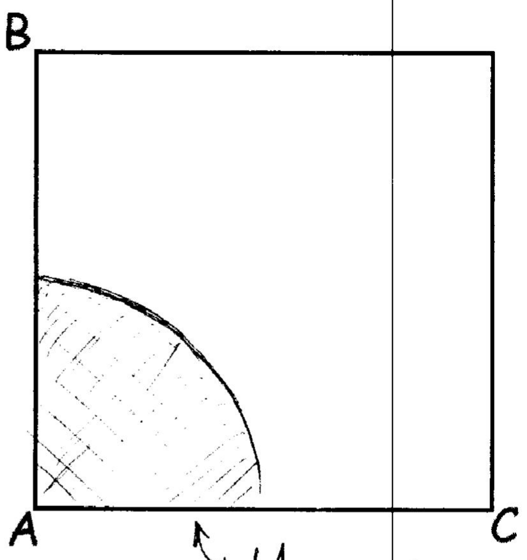
Topic 3: Simultaneous Equations. Mathswatch Clip: 162

Topic 4: Proportionality. Mathswatch Clip: 199

Topic 5: Box plots. Mathswatch Clip: 187

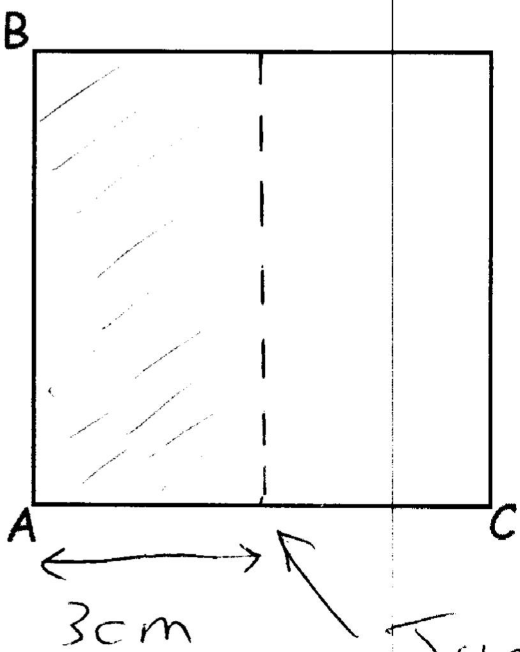
1) Loci and Construction: Easier

1) Shade the area closer than 3cm to point A within the square below:



Use compass at 3cm

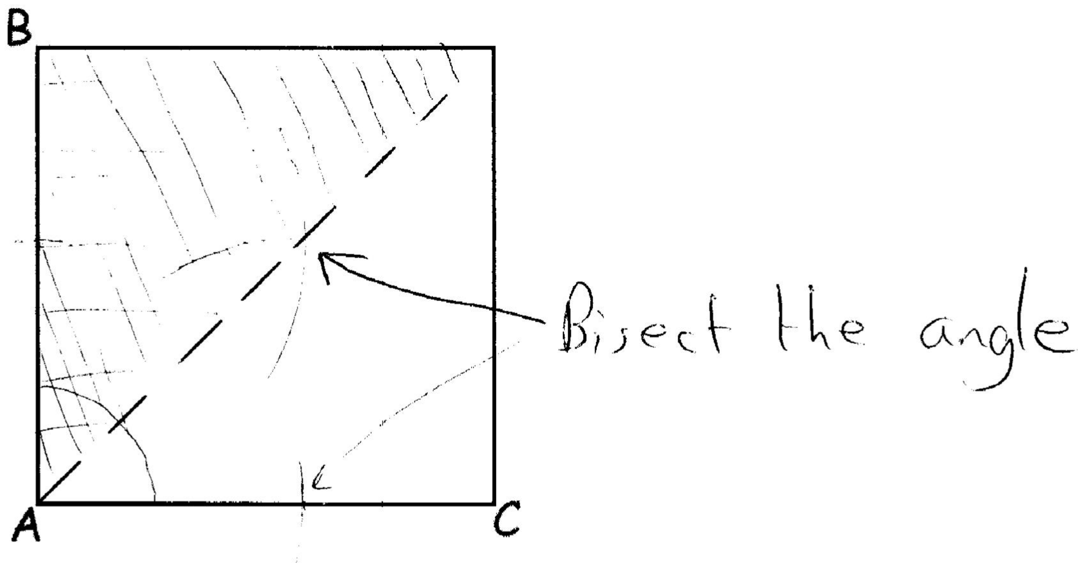
2) Shade the area closer than 3cm to the line AB within the square below:



Just mesure 3cm with your ruler

1) Loci and Construction: Medium

3) Shade the area closer to the line AB than AC within the square below:

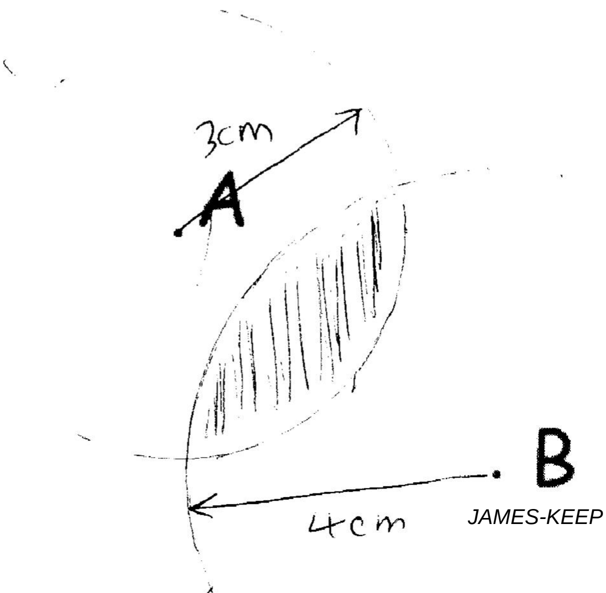


4) Two mobile phone stations transmit a signal.

Mobile phone station A transmits its signal ~~5~~ 3 miles.

Mobile phone station B transmits its signal 4 miles.

When you can receive both signals you experience interference on your phone. Shade below the area of interference.



Scale: 1 cm represents 1 mile

1) Loci and Construction: Harder

5) Mariam wants to plant a flower:

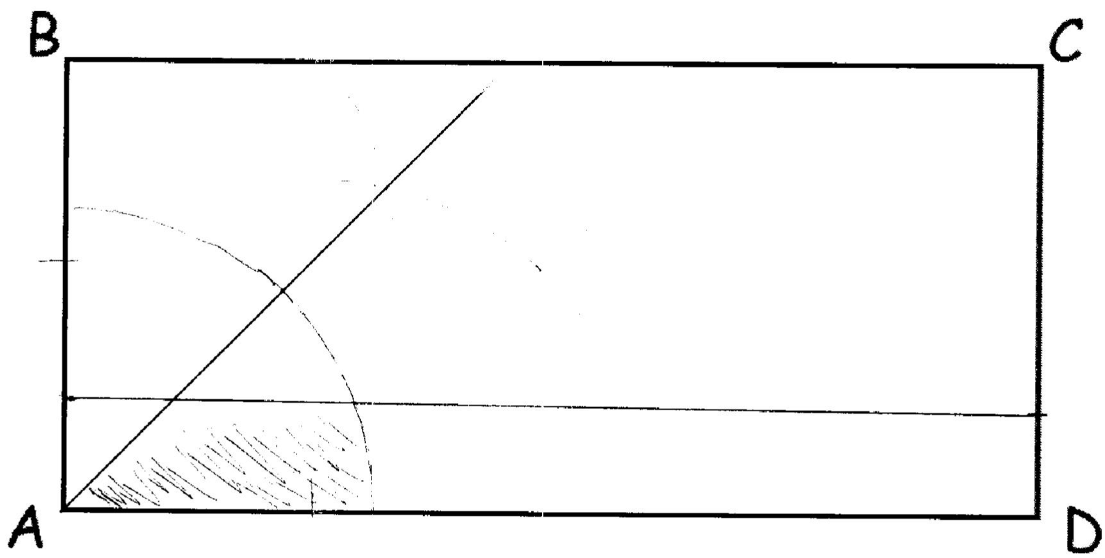
Within 4m of A

Closer to AD than AB

Less than 1.5m from AD.

Shade below the region where Mariam should plant her flower.

Show any construction lines your draw.

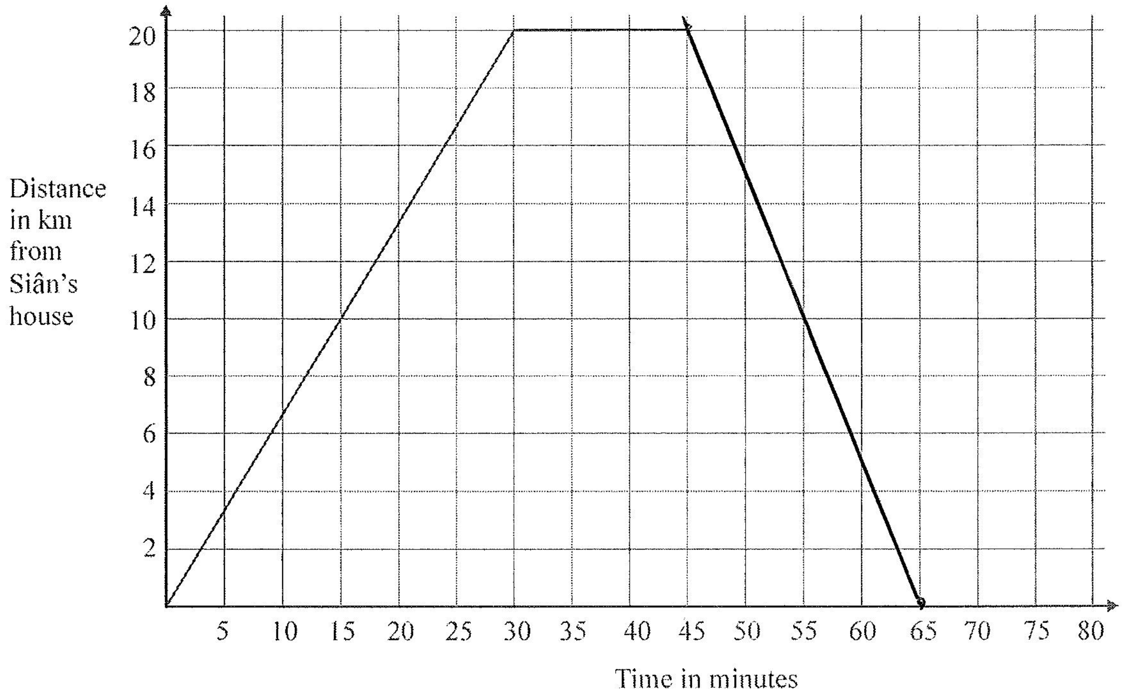


Scale: 1 cm represents 1 metre

PINPOINT

2) Distance Time Graphs: Easier

1. Here is part of a travel graph of Siân's journey from her house to the shops and back.



(a) Work out Siân's speed for the first 30 minutes of her journey.
Give your answer in km/h.

distance ÷ time   30 minutes = 0.5 hours.

20 ÷ 0.5 = 40

40 km/h

(2)

Siân spends 15 minutes at the shops.
She then travels back to her house at 60 km/h.

(b) Complete the travel graph.

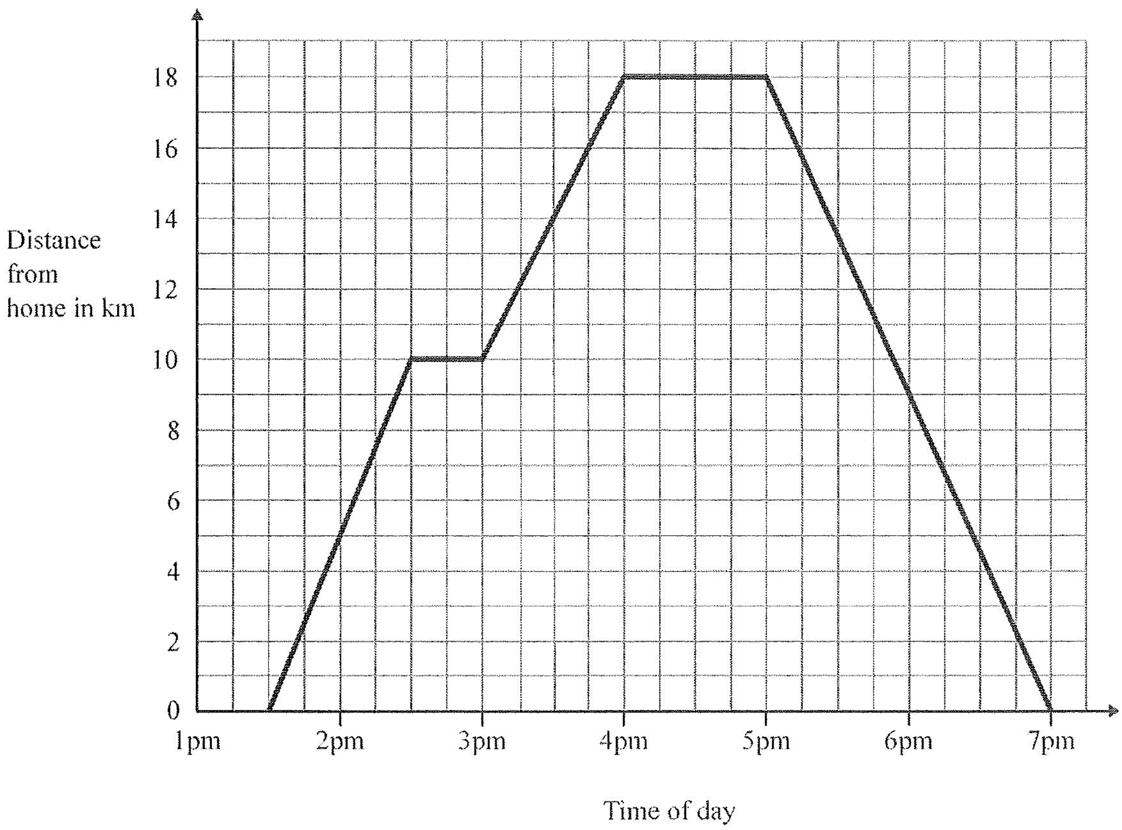
20km at 60 km/h

20 in 20 minutes

(2)
(Total 4 marks)

2) Distance Time Graphs: Medium

10. Pete visited his friend and then returned home.
The travel graph shows some information about Pete's journey.



(a) Write down the time that Pete started his journey.

1.30pm

(1)

At 2.30 pm Pete stopped for a rest.

(b) (i) Find his distance from home when he stopped for this rest.

10 km

(ii) How many minutes was this rest?

30 minutes

(2)

Pete stayed with his friend for one hour.
He then returned home.

(c) Work out the total distance travelled by Pete on this journey.

$18 \times 2 = 36$

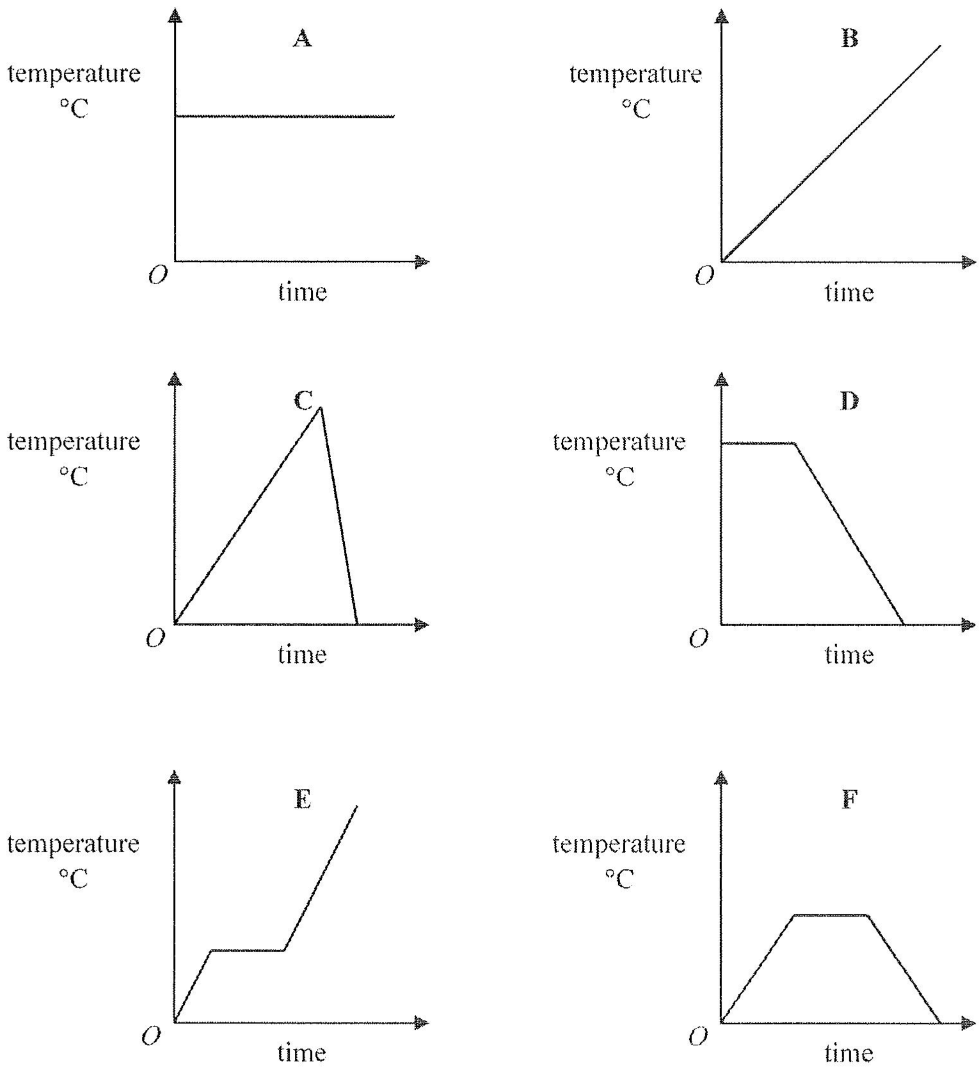
36 km

(2)

(Total 5 marks)

2) Distance Time Graphs: Harder

11. Here are six temperature/time graphs.



Each sentence in the table describes one of the graphs.
Write the letter of the correct graph next to each sentence.

The first one has been done for you.

The temperature starts at 0°C and keeps rising.	**B**
The temperature stays the same for a time and then falls.	D
The temperature rises and then falls quickly.	C
The temperature is always the same.	A
The temperature rises, stays the same for a time and then falls.	F
The temperature rises, stays the same for a time and then rises again.	E

(Total 3 marks)

3) Simultaneous Equations: Easier

1) Solve the simultaneous equations.

① $2x + 3y = 9$

② $5x + 3y = 18$

② − ①

$5x + 3y = 18$

$2x + 3y = 9$ −

$\frac{3x}{3} = \frac{9}{3}$

$x = 3$

Sub $x = 3$ into ①

$2x + 3y = 9$

$6 + 3y = 9$

$3y = 3$

$y = 1$

x = 3

y = 1

(3 Marks)

---

2) Solve the simultaneous equations.

① $4x + 2y = 9$ ×2

② $8x + 8y = 20$

③ $8x + 4y = 18$

② − ③

$8x + 8y = 20$

$8x + 4y = 18$ −

$\frac{4y}{4} = \frac{2}{4}$

$y = 0.5$

Sub $y = 0.5$ into ①

$4x + 1 = 9$

$-1 \quad -1$

$\frac{4x}{4} = \frac{8}{4}$

$x = 2$

x = 2

y = 0.5

(4 Marks)

3) Simultaneous Equations: Medium

7) Solve the simultaneous equations.

① $6x + 3y = 15$ $\times 3$

② $4x - 9y = -34$

③ $18x + 9y = 45$

② + ③

$$4x - 9y = -34$$
$$18x + 9y = 45 \; +$$
$$\frac{22x}{22} = \frac{11}{22}$$
$$x = 0.5$$

Sub $x = 0.5$ into ①

$$3 + 3y = 15$$
$$-3 \qquad -3$$
$$\frac{3y}{3} = \frac{12}{3}$$
$$y = 4$$

x = 0.5

y = 4

(4 Marks)

---

8) Solve the simultaneous equations.

① $5x + 2y = 29$ $\times 3$

② $8x - 6y = 51$

③ $15x + 6y = 87$

② + ③

$$8x - 6y = 51$$
$$15x + 6y = 87 \; +$$
$$\frac{23x}{23} = \frac{138}{23}$$
$$x = 6$$

Sub $x = 6$ into ①

$$30 + 2y = 29$$
$$-30 \qquad -30$$
$$\frac{2y}{2} = \frac{-1}{2}$$
$$y = -0.5$$

x = 6

y = −0.5

(4 Marks)

3) Simultaneous Equations: Harder

9) Bill goes into a chip shop and buys **3 fish** and **2 portions of chips,** it cost him £5.20

Jenny also goes into the same chip shop. She buys **5 fish** and **6 portions of chips,** it cost her £10.80

What is the cost of a portion of fish and chips?

① $3f + 2p = 5.20$ $\times 3$

② $5f + 6p = 10.80$

③ $9f + 6p = 15.60$

③ − ②

$9f + 6p = 15.60$

$5f + 6p = 10.80$

$4f = 4.8$

$\frac{4f}{4} = \frac{4.80}{4}$

$f = 1.20$

Sub into ①

$3.60 + 2p = 5.20$

$-3.60 \quad -3.60$

$2p = 1.60$

$p = 0.80$

$p + f = £2$

(5 Marks)

10) There are some ducks and some sheep on a farm. Altogether they have 35 heads and 94 feet.
How many ducks and sheep are there?

① $d + s = 35$ (heads) $\times 2$

② $2d + 4s = 94$ (feet)

③ $2d + 2s = 70$

② − ③

$2d + 4s = 94$

$2d + 2s = 70$ −

$2s = 24$

Sub $s = 12$ into ①

$d + 12 = 35$

$-12 \quad -12$

$d = 23$

Ducks = 23

Sheep = 12

(5 Marks)

4) Proportionality: Easier

1) Here is a formula, where V is the volume of a pipe in m^3 and d is the diameter of the pipe in m.

$$V = 8d^2$$

(a) A pipe has volume $2m^3$.
Find the diameter of the pipe.

$2 = 8 \times d^2$
$2 \div 8 = d^2$
$d^2 = 0.25$
$d = \sqrt{0.25} = 0.5$m

(b) Which of these statements is true for the pipe?
Tick one box

- [ ] It has a volume of $4m^3$ with **exactly double** the diameter in part (a)
- [x] It has a volume of $4m^3$ with **less than double** the diameter in part (a)
- [ ] It has a volume of $4m^3$ with **more than double** the diameter in part (a)

You **must** show working to support your answer

$4 = 8 \times d^2$
$d^2 = 0.5$
$d = \sqrt{0.5} = 0.7$m

(5 Marks)

---

2) Here is a formula, where E is the energy of a particle measured in Joules and v is the velocity of the particle measured in m/s.

$$E = 6v^2$$

(a) A moving particle has 54 Joules of energy.
Find the velocity of the particle.

$54 = 6 \times v^2$
$54 \div 6 = v^2$
$v^2 = 9$
$v = \sqrt{9} = 3$m/s

Which of these statements is true for the particle?

Tick one box

- [ ] It has 108J of energy when travelling at **exactly double** the velocity in (a)
- [x] It has 108J of energy when travelling at **less than double** the velocity in (a)
- [ ] It has 108J of energy when travelling at **more than double** the velocity in (a)

You **must** show working to support your answer

$108 = 6 \times v^2$
$108 \div 6 = v^2$
$v^2 = 18$
$v = \sqrt{18} = 4.2$m/s

(5 Marks)

---

4) Proportionality: Medium

3) The table shows pairs of values x and y.

x	6	7
y	480	560

(a) Tick the correct statement

Trial and error:

Is $y \propto x$?

$480 \div 6 = 80$

$560 \div 7 = 80$

$y \propto x$ …Yes…..

$y \propto x^2$ …………..

$y \propto x^3$ …………..

(b) Write a formula for y in terms of x.

$y = \text{k}x$

$480 = 6\text{k}$

$\text{k} = 480 \div 6$

$\text{k} = 80$ => $y = 80x$

(3 Marks)

4) The table shows pairs of values x and y.

x	4	5
y	48	75

(i) Tick the correct statement

Trial and error:

Is $y \propto x$?

$48 \div 4 = 12$

$75 \div 5 = 15$

No

Is $y \propto x^2$?

$48 \div 4^2 = 3$

$75 \div 5^2 = 3$

Yes

$y \propto x$ …………..

$y \propto x^2$ … Yes …..

$y \propto x^3$ …………..

(ii) Write a formula for y in terms of x.

$y = \text{k}x^2$

$48 = 4^2\text{k}$

$\text{k} = 48 \div 16$

$\text{k} = 3$ => $y = 3x$

(3 Marks)

PINPOINT

4) Proportionality: Harder

5) The table shows pairs of values x and y.

x	3	4
y	8	6

(i) Tick the correct statement

As x increases y decreases (no further reasoning necessary)

$y \propto x$ …………..

$y \propto x^2$ …………..

$y \propto \frac{1}{x}$ …Yes…..

(ii) Write a formula for y in terms of x.

$y = \frac{k}{x}$

$8 = \frac{k}{3}$

k = 8 × 3

k = 24 => $y = \frac{24}{x}$

(3 Marks)

6) The table shows pairs of values x and y.

x	2	3
y	9	4

(i) Tick the correct statement

Trial and error:

Is $y \propto \frac{1}{x}$?
$9 \times 2 = 18$
$4 \times 3 = 12$
No

Is $y \propto \frac{1}{x^2}$?
$9 \times 2^2 = 36$
$4 \times 3^2 = 36$
Yes

$y \propto \frac{1}{x}$ …………..

$y \propto \frac{1}{x^2}$ …Yes…..

$y \propto \frac{1}{x^3}$ …………..

(ii) Write a formula for y in terms of x.

$y = \frac{k}{x^2}$

$k = 4 \times 3^2 = 36$ => $y = \frac{36}{x^2}$

(3 Marks)

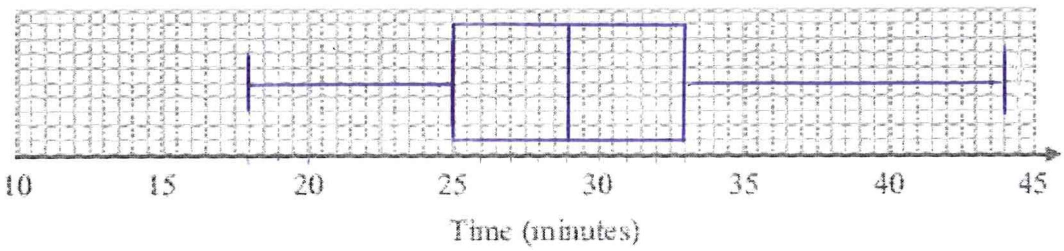
5) Box plots: Easier

2. Sameena recorded the times, in minutes, some girls took to do a jigsaw puzzle.

Sameena used her results to work out the information in this table.

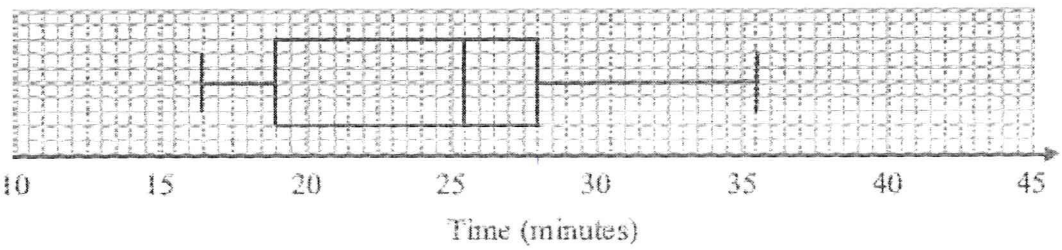
	Minutes
Shortest time	18
Lower quartile	25
Median	29
Upper quartile	33
Longest time	44

(a) On the grid, draw a box plot to show the information in the table.



(2)

The box plot below shows information about the times, in minutes, some boys took to do the same jigsaw puzzle.



(b) Compare the distributions of the girls' times and the boys' times.

The boys median time was less than that of the girls; Boys 25.5mins, Girls 29 mins.

The spread of data for the interquartile range is smaller for the girls (8 mins) than for the boys (9 mins)

(2)

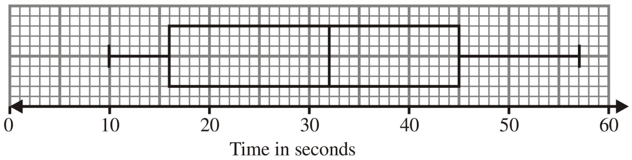
(4 marks)

5) Box plots: Medium

2. (a) 32 1

B1 for 32 (accept 31.5 to 33.5 inclusive)

(b) 3



B1 for ends of whiskers at 9 and 57 (with a box)
B1 for ends of box at 16 and 45/46 (±0.5)
B1for median marked at "32"or complete box and whisker diagram drawn with a median inside the box

(c) Median(B)>Median(G); on average boys take longer
IQR(B)>IQR(G); times for boys have a greater spread 2

B1 eg for comparison of medians (ft on diagrams)
B1 eg for comparison of (interquartile) ranges (ft on diagram)

[6]

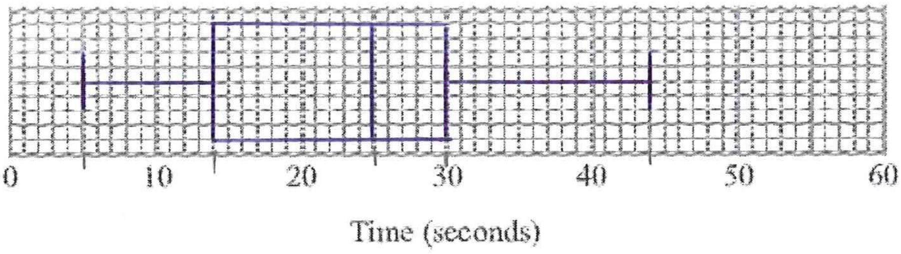
5) Box plots: Harder

7. Here are the times, in seconds, that 15 people waited to be served at Rose's garden centre.

5 9 11 $\boxed{14}$ 15 20 22 $\boxed{25}$ 27 27 28 $\boxed{30}$ 32 35 44

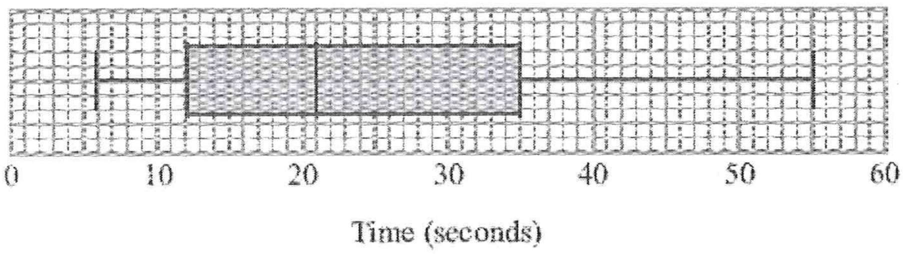
LQ Median UQ.

(a) On the grid, draw a box plot for this information.



(3)

The box plot below shows the distribution of the times that people waited to be served at Green's garden centre.



(b) Compare the distribution of the times that people waited at Rose's garden centre and the distribution of the times that people waited at Green's garden centre.

There was a greater spread of waiting times in the interquartile range for Green's Garden Centre than Rose's Garden centre

The median waiting time is shorter at Greens ~~Roses~~ than Roses Garden centre.

(2)

(5 marks)

JANSON Eleanor

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
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Your Pinpoint Topics

Topic 1: Loci and Construction. Mathswatch Clip: 165

Topic 2: Similar Shapes Volume and Area SF. MW: 200

Topic 3: Proportionality. Mathswatch Clip: 199

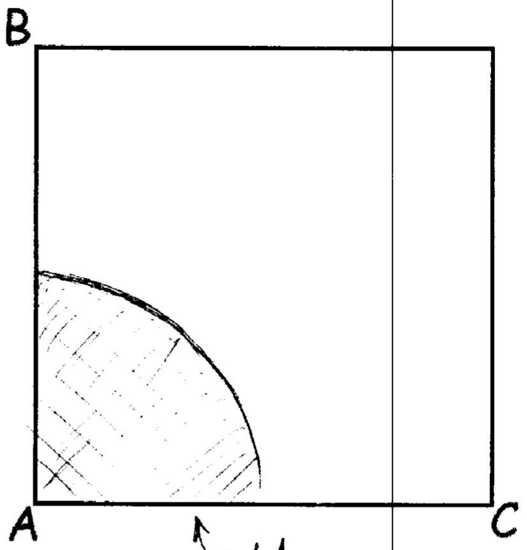
Topic 4: Direct and Inverse Proportion. Mathswatch Clip: 199

Topic 5: Box plots. Mathswatch Clip: 187

PINPOINT

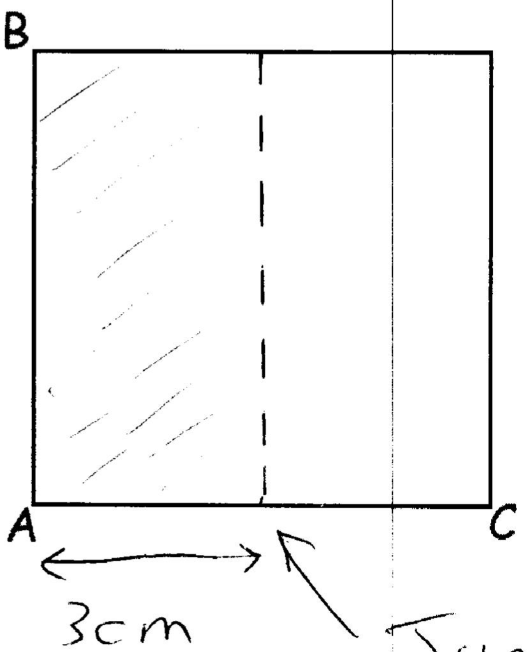
1) Loci and Construction: Easier

1) Shade the area closer than 3cm to point A within the square below:



Use compass at 3cm

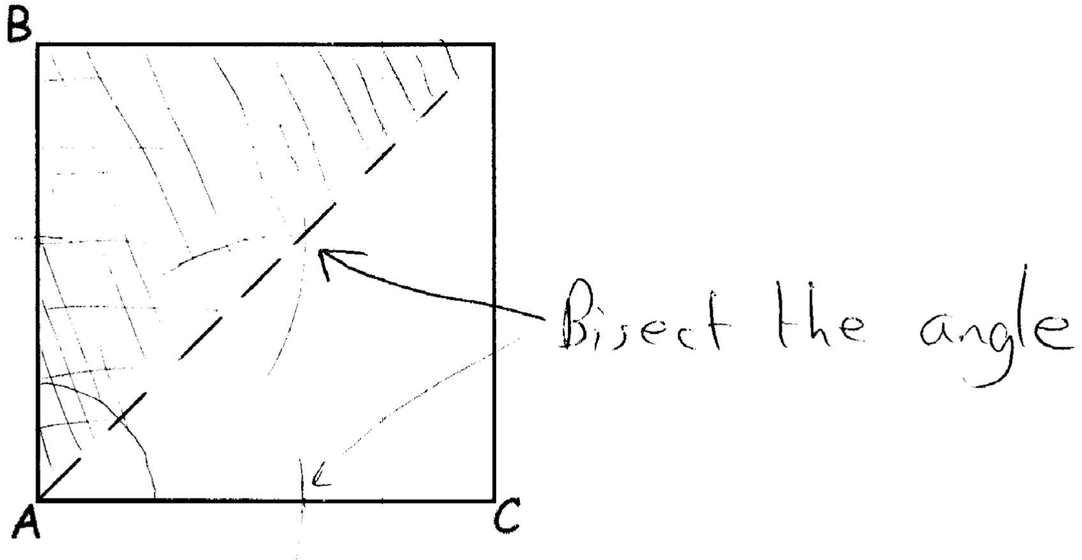
2) Shade the area closer than 3cm to the line AB within the square below:



Just mesure 3cm with your ruler

1) Loci and Construction: Medium

3) Shade the area closer to the line AB than AC within the square below:

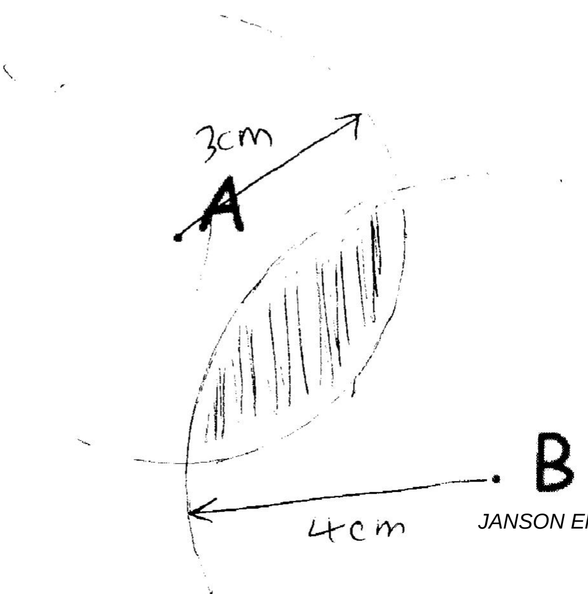


4) Two mobile phone stations transmit a signal.

Mobile phone station A transmits its signal ~~5~~ 3 miles.

Mobile phone station B transmits its signal 4 miles.

When you can receive both signals you experience interference on your phone. Shade below the area of interference.



Scale: 1 cm represents 1 mile

1) Loci and Construction: Harder

5) Mariam wants to plant a flower:

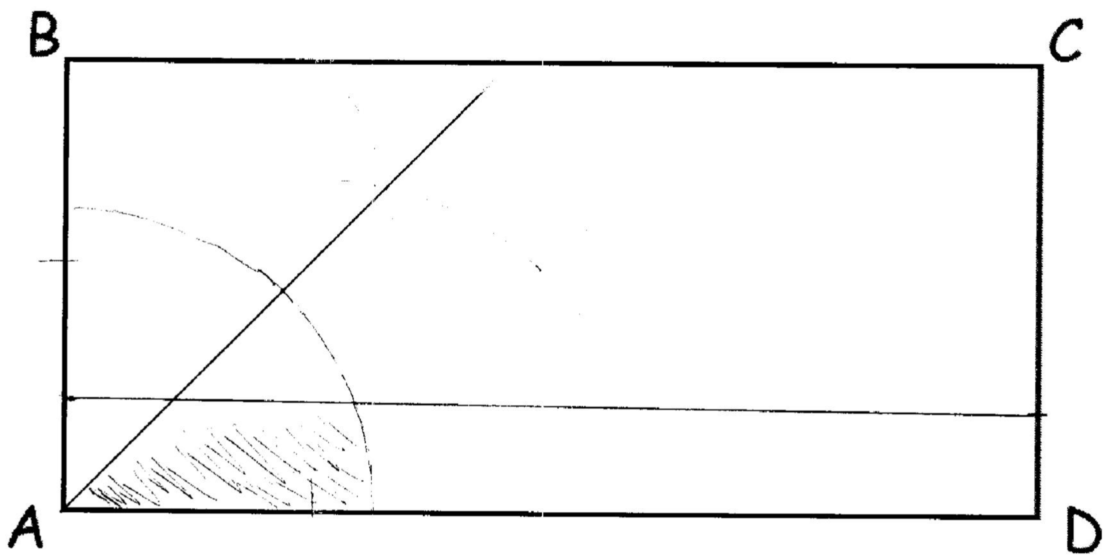
Within 4m of A

Closer to AD than AB

Less than 1.5m from AD.

Shade below the region where Mariam should plant her flower.

Show any construction lines your draw.



Scale: 1 cm represents 1 metre

2) Similar Shapes Volume and Area SF: Easier

Solution for Question 1:

Scale factor: $\frac{9}{3} = 3$

Area of Quadrilateral B: $24 \times 3^2 = 216\text{cm}^2$

Solution for Question 2:

Scale factor: $\frac{14}{7} = 2$

Volume of Cuboid D: $35 \times 2^3 = 280\text{m}^3$

Solution for Question 3:

$\frac{243}{75} = 3.24$

$\sqrt{3.24} = 1.8$

$\text{h} = 10\text{cm} \times 1.8$

18cm

2) Similar Shapes Volume and Area SF: Medium

Solution for Question 4:

$\frac{343}{125} = 2.744$

$\sqrt[3]{2.744} = 1.4$

$x = 20 \times 1.4$

$x = 28\text{cm}$

$y = \frac{56}{1.4}$

$y = 40\text{cm}$

Solution for Question 5:

$\frac{200\pi}{8\pi} = 25$

$\sqrt{25} = 5$

$7\pi \times 5^3$

$875\pi\ \text{cm}^3$

2) Similar Shapes Volume and Area SF: Harder

Solution for Question 6:

$\frac{175}{7} = 25$

$\sqrt{25} = 5$

$5 \times 5^3 = 625$ kg

$\frac{625}{10} = 62.5$ packs

Therefore 63 packs are required.

Solution for Question 7:

(1) 0.5 x AB x BC = 7
(2) 0.5 x BD x BC = 175
(3)

(2) / (1)

Gives

$\frac{BD}{AB} = 25$

$BD = 25AB$

Therefore AD = 25AB + AB = 26AB

Scale Factor between ADF and ABC:

$\frac{AD}{AB} = \frac{26AB}{AB} = 26$

Area of CDE: $7 \times 26^2 - 7 - 175 = \underline{4550\text{cm}^2}$

3) Proportionality: Easier

1) Here is a formula, where V is the volume of a pipe in m^3 and d is the diameter of the pipe in m.

$$V = 8d^2$$

(a) A pipe has volume $2m^3$.
Find the diameter of the pipe.

$2 = 8 \times d^2$
$2 \div 8 = d^2$
$d^2 = 0.25$
$d = \sqrt{0.25} = 0.5\text{m}$

(b) Which of these statements is true for the pipe?
Tick one box

☐ It has a volume of $4m^3$ with **exactly double** the diameter in part (a)
■ It has a volume of $4m^3$ with **less than double** the diameter in part (a)
☐ It has a volume of $4m^3$ with **more than double** the diameter in part (a)

You **must** show working to support your answer

$4 = 8 \times d^2$
$d^2 = 0.5$
$d = \sqrt{0.5} = 0.7\text{m}$

(5 Marks)

---

2) Here is a formula, where E is the energy of a particle measured in Joules and v is the velocity of the particle measured in m/s.

$$E = 6v^2$$

(a) A moving particle has 54 Joules of energy.
Find the velocity of the particle.

$54 = 6 \times v^2$
$54 \div 6 = v^2$
$v^2 = 9$
$v = \sqrt{9} = 3\text{m/s}$

Which of these statements is true for the particle?

Tick one box

☐ It has 108J of energy when travelling at **exactly double** the velocity in (a)
■ It has 108J of energy when travelling at **less than double** the velocity in (a)
☐ It has 108J of energy when travelling at **more than double** the velocity in (a)

You **must** show working to support your answer

$108 = 6 \times v^2$
$108 \div 6 = v^2$
$v^2 = 18$
$v = \sqrt{18} = 4.2\text{m/s}$

(5 Marks)

3) Proportionality: Medium

3) The table shows pairs of values x and y.

x	6	7
y	480	560

(a) Tick the correct statement

Trial and error:

Is $y \propto x$?

$480 \div 6 = 80$

$560 \div 7 = 80$

$y \propto x$ …Yes…..

$y \propto x^2$ …………..

$y \propto x^3$ …………..

(b) Write a formula for y in terms of x.

$y = \mathrm{k}x$

$480 = 6\mathrm{k}$

$\mathrm{k} = 480 \div 6$

$\mathrm{k} = 80$ => $y = 80x$

(3 Marks)

---

4) The table shows pairs of values x and y.

x	4	5
y	48	75

(i) Tick the correct statement

Trial and error:

Is $y \propto x$?

$48 \div 4 = 12$

$75 \div 5 = 15$

No

Is $y \propto x^2$?

$48 \div 4^2 = 3$

$75 \div 5^2 = 3$

Yes

$y \propto x$ …………..

$y \propto x^2$ … Yes …..

$y \propto x^3$ …………..

(ii) Write a formula for y in terms of x.

$y = \mathrm{k}x^2$

$48 = 4^2\mathrm{k}$

$\mathrm{k} = 48 \div 16$

$\mathrm{k} = 3$ => $y = 3x$

(3 Marks)

3) Proportionality: Harder

5) The table shows pairs of values x and y.

x	3	4
y	8	6

(i) Tick the correct statement

As x increases y decreases (no further reasoning necessary)

$y \propto x$ …………..

$y \propto x^2$ …………..

$y \propto \frac{1}{x}$ …Yes…..

(ii) Write a formula for y in terms of x.

$$y = \frac{k}{x}$$

$$8 = \frac{k}{3}$$

$k = 8 \times 3$

$k = 24$ => $y = \frac{24}{x}$

(3 Marks)

6) The table shows pairs of values x and y.

x	2	3
y	9	4

(i) Tick the correct statement

Trial and error:

Is $y \propto \frac{1}{x}$?

$9 \times 2 = 18$

$4 \times 3 = 12$

No

Is $y \propto \frac{1}{x^2}$?

$9 \times 2^2 = 36$

$4 \times 3^2 = 36$

Yes

$y \propto \frac{1}{x}$ …………..

$y \propto \frac{1}{x^2}$ …Yes…..

$y \propto \frac{1}{x^3}$ …………..

(ii) Write a formula for y in terms of x.

$$y = \frac{k}{x^2}$$

$k = 4 \times 3^2 = 36$ => $y = \frac{36}{x^2}$

(3 Marks)

4) Direct and Inverse Proportion: Easier

1. The weight of a piece of wire is directly proportional to its length.

A piece of wire is 25 cm long and has a weight of 6 grams.
Another piece of the same wire is 30 cm long.

Calculate the weight of the 30 cm piece of wire.

$W = kl$

$6 = 25k$

$k = 0.24$

$W = 0.24l$

$W = 0.24 \times 30$

$W = 7.2$

7.2 grams

(Total 2 marks)

2. A ball falls vertically after being dropped.
The ball falls a distance *d* metres in a time of *t* seconds.
d is directly proportional to the square of *t*.

$d = kt^2$

The ball falls 20 metres in a time of 2 seconds.

(a) Find a formula for *d* in terms of *t*.

$20 = k \times 2^2$

$20 = 4k$

$k = 5$

$d = 5t^2$

(3)

(b) Calculate the distance the ball falls in 3 seconds.

$d = 5 \times 3^2$

$d = 5 \times 9 = 45$

45 m

(1)

(c) Calculate the time the ball takes to fall 605 m.

$d = 5t^2$

$605 = 5t^2$

$t^2 = 121$

$t = \pm 11$

(ignore −11 as time can't be −ve)

11 seconds

(3)

(Total 7 marks)

PINPOINT

4) Direct and Inverse Proportion: Medium

16. P is inversely proportional to V. $P = \frac{k}{V}$

When $V = 8$, $P = 5$

(a) Find a formula for P in terms of V.

$5 = \frac{k}{8}$

$k = 5 \times 8$

$k = 40$

$P = \frac{40}{V}$

(3)

(b) Calculate the value of P when $V = 2$

$P = \frac{40}{2}$

$P = 20$

20

(1)

(Total 4 marks)

17. The force, F, between two magnets is inversely proportional to the square of the distance, x, between them.

$F = \frac{k}{x^2}$

When $x = 3$, $F = 4$.

(a) Calculate F when $x = 2$.

$4 = \frac{k}{9}$

$k = 36$

$F = \frac{36}{x^2}$

$F = \frac{36}{2^2}$

$F = \frac{36}{4} = 9$

$F = 9$

(4)

(b) Calculate x when $F = 64$.

$F = \frac{36}{x^2}$

$64 = \frac{36}{x^2}$

$64x^2 = 36$

$x^2 = \frac{36}{64}$

$x = \pm \frac{6}{8}$

$x = \frac{3}{4}$

(2)

(Total 6 marks)

4) Direct and Inverse Proportion: Harder

1) A is inversely proportional to the square root of B. Jim says if B is very large A will be negative. Is he right?

Solution: $A \alpha \frac{1}{\sqrt{B}}$

$A = \frac{k}{\sqrt{B}}$

Jim is wrong. If B is very large $\sqrt{B}$ will be positive, therefore A will also be positive.

(As B becomes very large, A becomes very small)

____

(4 Marks)

---

2) If Sally drives to work 25% faster than she did yesterday. What would be her percentage decrease in the time taken to get to work?

Solution: $Time = \frac{Distance}{Speed}$

$Time = \frac{D}{1.25}$

$Time = \frac{1}{1.25}$

$Time = \frac{4}{5}$

$\frac{4}{5} = 80\%$

She will get there 20% faster.

____

(4Marks)

---

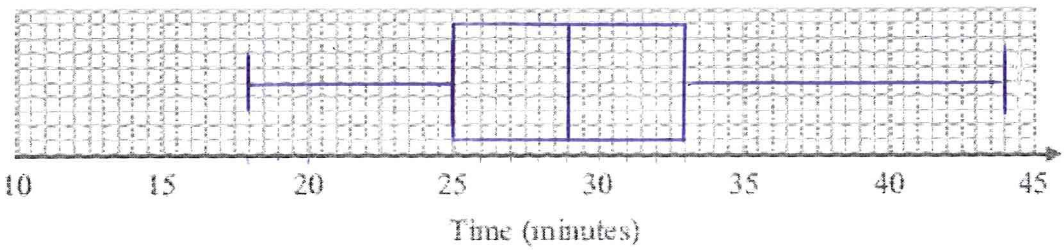
5) Box plots: Easier

2. Sameena recorded the times, in minutes, some girls took to do a jigsaw puzzle.

Sameena used her results to work out the information in this table.

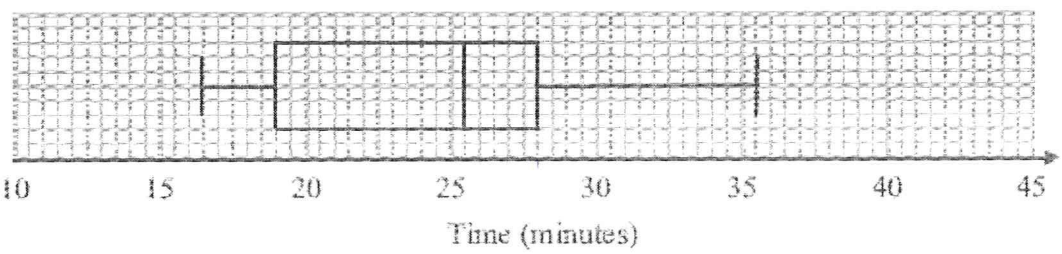
	Minutes
Shortest time	18
Lower quartile	25
Median	29
Upper quartile	33
Longest time	44

(a) On the grid, draw a box plot to show the information in the table.



(2)

The box plot below shows information about the times, in minutes, some boys took to do the same jigsaw puzzle.



(b) Compare the distributions of the girls' times and the boys' times.

The boys median time was less than that of the girls; Boys 25.5mins, Girls 29 mins.

The spread of data for the interquartile range is smaller for the girls (8 mins) than for the boys (9 mins)

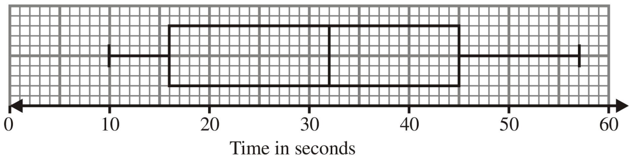
(2)

(4 marks)

5) Box plots: Medium

2. (a) 32 — 1

B1 for 32 (accept 31.5 to 33.5 inclusive)

(b) 

— 3

B1 for ends of whiskers at 9 and 57 (with a box)
B1 for ends of box at 16 and 45/46 (±0.5)
B1for median marked at "32" or complete box and whisker diagram drawn with a median inside the box

(c) Median(B)>Median(G); on average boys take longer
IQR(B)>IQR(G); times for boys have a greater spread — 2

B1 eg for comparison of medians (ft on diagrams)
B1 eg for comparison of (interquartile) ranges (ft on diagram)

[6]

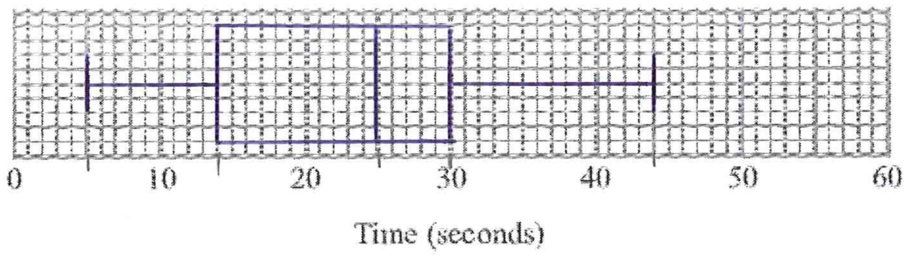
5) Box plots: Harder

7. Here are the times, in seconds, that 15 people waited to be served at Rose's garden centre.

5 9 11 $\boxed{14}$ 15 20 22 $\boxed{25}$ 27 27 28 $\boxed{30}$ 32 35 44

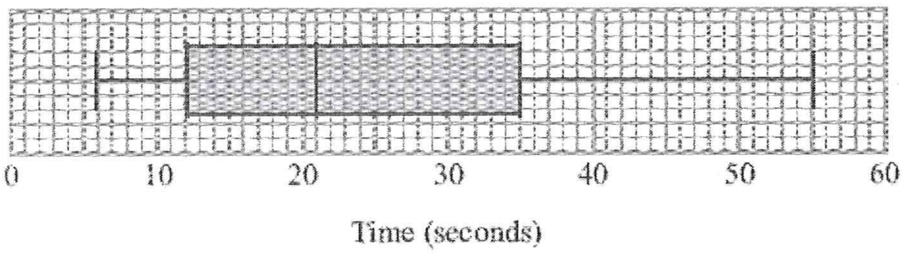
LQ Median UQ.

(a) On the grid, draw a box plot for this information.



(3)

The box plot below shows the distribution of the times that people waited to be served at Green's garden centre.



(b) Compare the distribution of the times that people waited at Rose's garden centre and the distribution of the times that people waited at Green's garden centre.

There was a greater spread of waiting times in the interquartile range for Green's Garden Centre than Rose's Garden centre

Greens

The median waiting time is shorter at ~~Rose's~~ than Roses Garden centre.

(2)

(5 marks)

KANE Emily

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	13 from 20	1 from 1	6 from 10	2 from 5	3 from 3	1 from 1
A02 and 3	45 from 60	6 from 11	9 from 16	7 from 9	16 from 16	7 from 8
Total	58 from 80	7 from 12	15 from 26	9 from 14	19 from 19	8 from 9

Your Pinpoint Topics

Topic 1: Distance Time Graphs. Mathswatch Clip: 143

Topic 2: Simultaneous Equations. Mathswatch Clip: 162

Topic 3: Box plots. Mathswatch Clip: 187

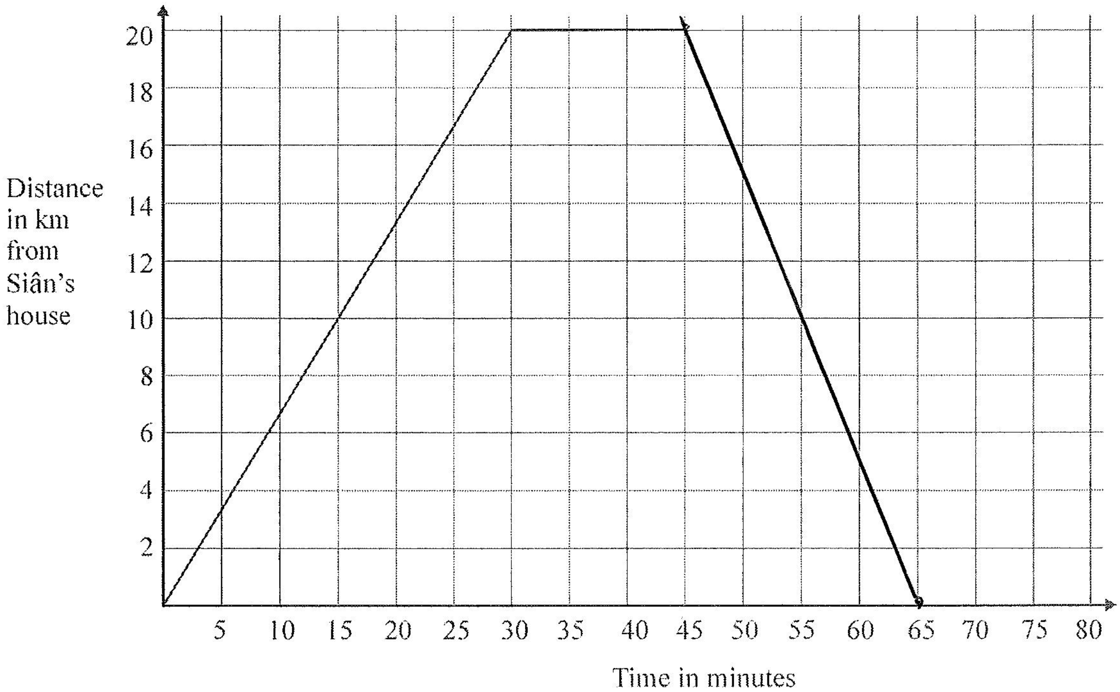
Topic 4: Proof. Mathswatch Clip: 193

Topic 5: Completing the Square. Mathswatch Clip: 209

PINPOINT

1) Distance Time Graphs: Easier

1. Here is part of a travel graph of Siân's journey from her house to the shops and back.



(a) Work out Siân's speed for the first 30 minutes of her journey.
Give your answer in km/h.

distance ÷ time 30 minutes = 0.5 hours.

20 ÷ 0.5 = 40

40 km/h

(2)

Siân spends 15 minutes at the shops.
She then travels back to her house at 60 km/h.

(b) Complete the travel graph.

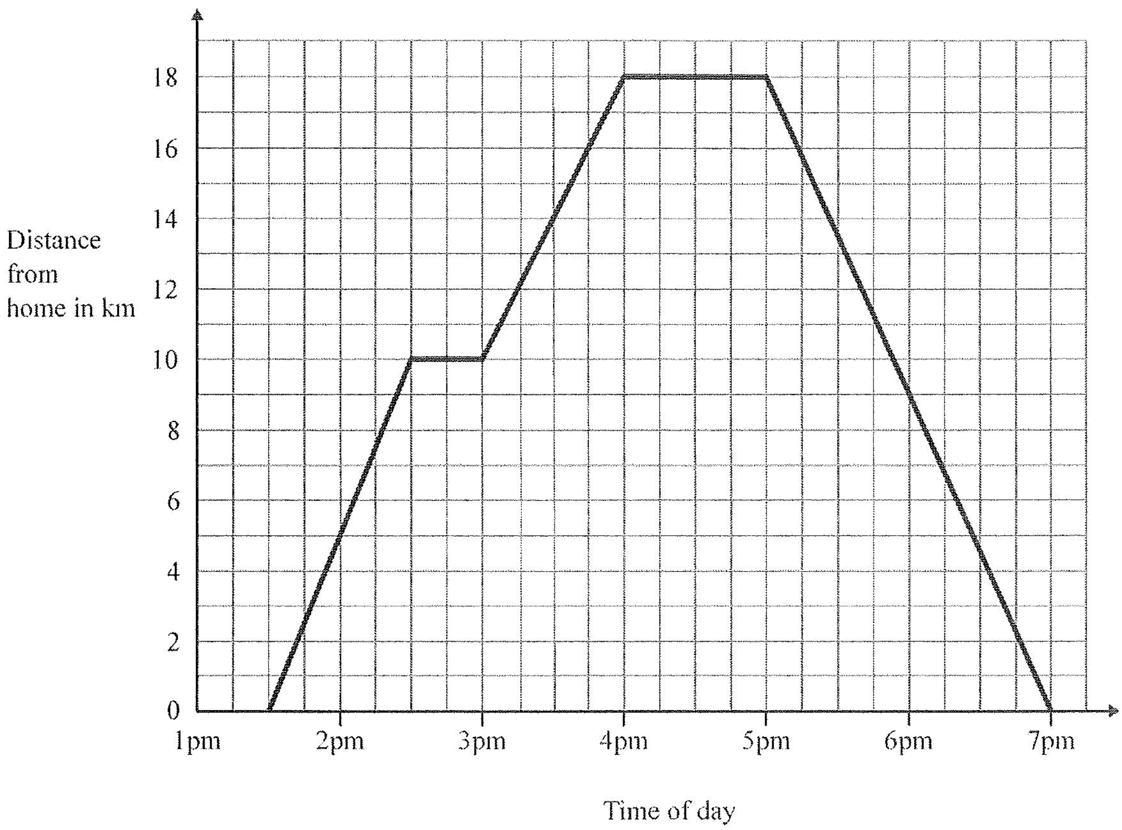
20km at 60 km/h

20 in 20minutes

(2)
(Total 4 marks)

1) Distance Time Graphs: Medium

10. Pete visited his friend and then returned home.
The travel graph shows some information about Pete's journey.



(a) Write down the time that Pete started his journey.

1.30pm

(1)

At 2.30 pm Pete stopped for a rest.

(b) (i) Find his distance from home when he stopped for this rest.

10 km

(ii) How many minutes was this rest?

30 minutes

(2)

Pete stayed with his friend for one hour.
He then returned home.

(c) Work out the total distance travelled by Pete on this journey.

$18 \times 2 = 36$

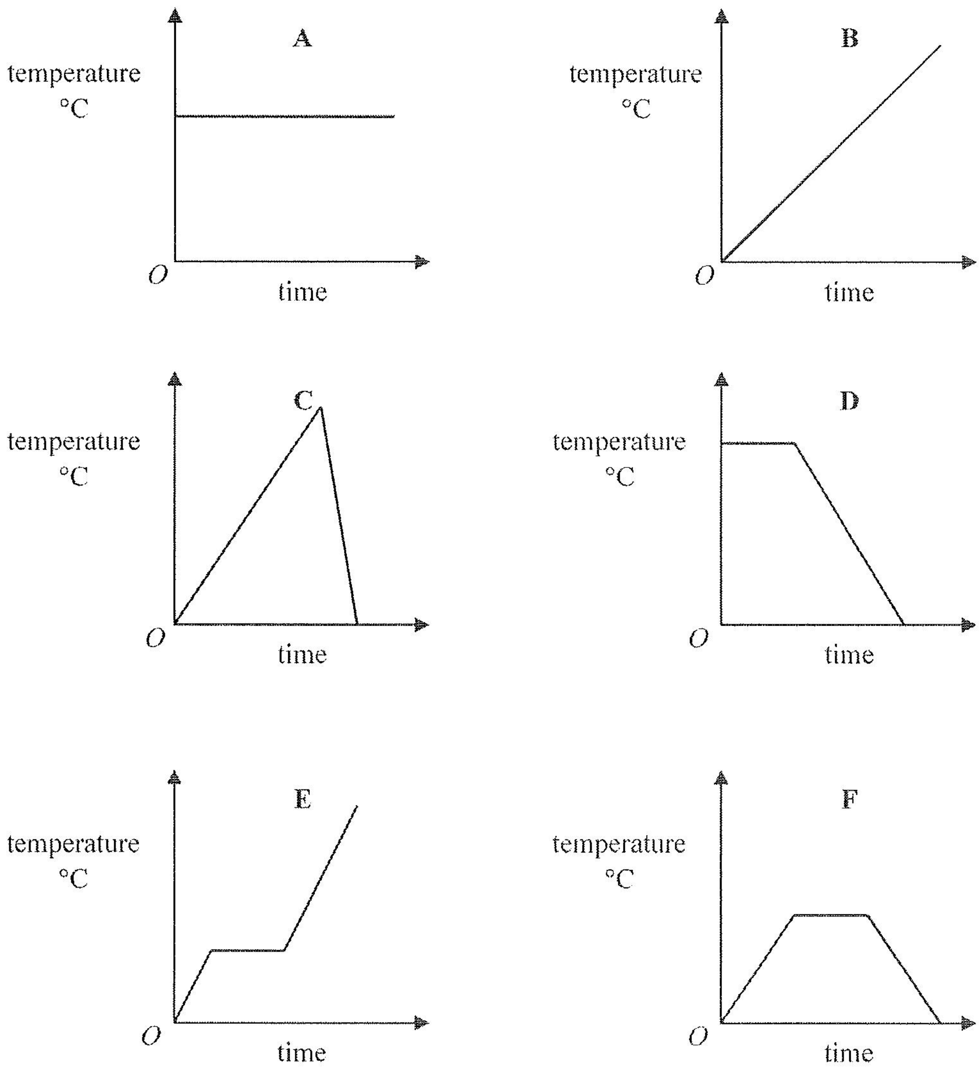
36 km

(2)

(Total 5 marks)

1) Distance Time Graphs: Harder

11. Here are six temperature/time graphs.



Each sentence in the table describes one of the graphs.
Write the letter of the correct graph next to each sentence.

The first one has been done for you.

The temperature starts at 0°C and keeps rising.	**B**
The temperature stays the same for a time and then falls.	D
The temperature rises and then falls quickly.	C
The temperature is always the same.	A
The temperature rises, stays the same for a time and then falls.	F
The temperature rises, stays the same for a time and then rises again.	E

(Total 3 marks)

2) Simultaneous Equations: Easier

1) Solve the simultaneous equations.

$$\text{①} \quad 2x + 3y = 9$$

$$\text{②} \quad 5x + 3y = 18$$

② − ①

$$5x + 3y = 18$$
$$2x + 3y = 9 \quad -$$
$$\frac{3x}{3} = \frac{9}{3}$$
$$x = 3$$

Sub $x = 3$ into ①

$$2x + 3y = 9$$
$$6 + 3y = 9$$
$$3y = 3$$
$$y = 1$$

x = 3

y = 1

(3 Marks)

2) Solve the simultaneous equations.

$$\text{①} \quad 4x + 2y = 9 \quad \times 2$$

$$\text{②} \quad 8x + 8y = 20$$

$$\text{③} \quad 8x + 4y = 18$$

② − ③

$$8x + 8y = 20$$
$$8x + 4y = 18 \quad -$$
$$\frac{4y}{4} = \frac{2}{4}$$
$$y = 0.5$$

Sub $y = 0.5$ into ①

$$4x + 1 = 9$$
$$-1 \qquad -1$$
$$\frac{4x}{4} = \frac{8}{4}$$
$$x = 2$$

x = 2

y = 0.5

(4 Marks)

2) Simultaneous Equations: Medium

7) Solve the simultaneous equations.

① $6x + 3y = 15$ $\times 3$

② $4x - 9y = -34$

③ $18x + 9y = 45$

② + ③

$4x - 9y = -34$

$18x + 9y = 45$ +

$\frac{22x}{22} = \frac{11}{22}$

$x = 0.5$

Sub $x = 0.5$ into ①

$3 + 3y = 15$

$-3 \quad -3$

$\frac{3y}{3} = \frac{12}{3}$

$y = 4$

x = 0.5

y = 4

(4 Marks)

8) Solve the simultaneous equations.

① $5x + 2y = 29$ $\times 3$

② $8x - 6y = 51$

③ $15x + 6y = 87$

② + ③

$8x - 6y = 51$

$15x + 6y = 87$ +

$\frac{23x}{23} = \frac{138}{23}$

$x = 6$

Sub $x = 6$ into ①

$30 + 2y = 29$

$-30 \quad -30$

$\frac{2y}{2} = \frac{-1}{2}$

$y = -0.5$

x = 6

y = -0.5

(4 Marks)

2) Simultaneous Equations: Harder

9) Bill goes into a chip shop and buys **3 fish** and **2 portions of chips,** it cost him £5.20

Jenny also goes into the same chip shop. She buys **5 fish** and **6 portions of chips,** it cost her £10.80

What is the cost of a portion of fish and chips?

① $3f + 2p = 5.20 \quad \times 3$

② $5f + 6p = 10.80$

③ $9f + 6p = 15.60$

③ − ②

$9f + 6p = 15.60$

$5f + 6p = 10.80$

$4f = 4.8$

$\frac{4f}{4} = \frac{4.80}{4}$

$f = 1.20$

Sub into ①

$3.60 + 2p = 5.20$

$-3.60 \quad -3.60$

$2p = 1.60$

$p = 0.80$

$p + f = £2$

(5 Marks)

10) There are some ducks and some sheep on a farm. Altogether they have 35 heads and 94 feet.
How many ducks and sheep are there?

① $d + s = 35$ (heads) $\times 2$

② $2d + 4s = 94$ (feet)

③ $2d + 2s = 70$

② − ③

$2d + 4s = 94$

$2d + 2s = 70$ −

$2s = 24$

Sub $s = 12$ into ①

$d + 12 = 35$

$-12 \quad -12$

$d = 23$

Ducks = 23

Sheep = 12

(5 Marks)

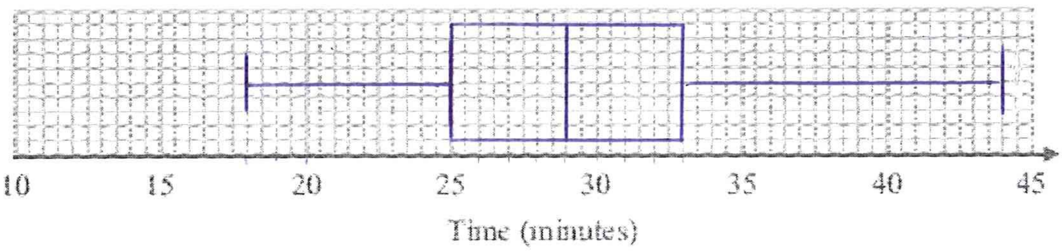
3) Box plots: Easier

2. Sameena recorded the times, in minutes, some girls took to do a jigsaw puzzle.

Sameena used her results to work out the information in this table.

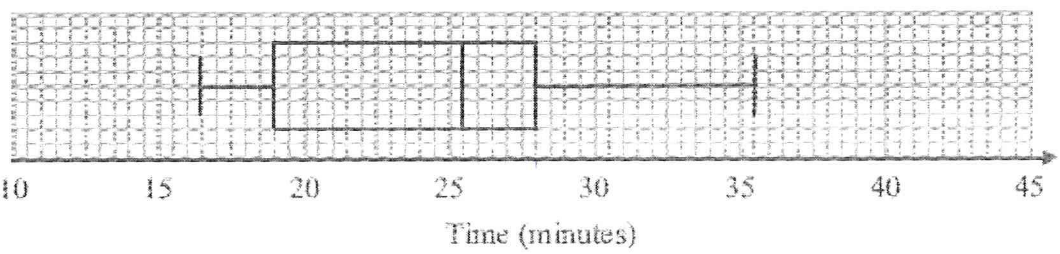
	Minutes
Shortest time	18
Lower quartile	25
Median	29
Upper quartile	33
Longest time	44

(a) On the grid, draw a box plot to show the information in the table.



(2)

The box plot below shows information about the times, in minutes, some boys took to do the same jigsaw puzzle.



(b) Compare the distributions of the girls' times and the boys' times.

The boys median time was less than that of the girls. Boys 25.5mins, Girls 29 mins.

The spread of data for the interquartile range is smaller for the girls (8 mins) than for the boys (9 mins)

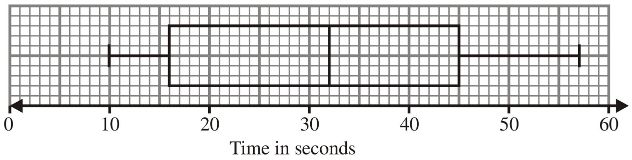
(2)

(4 marks)

3) Box plots: Medium

2. (a) 32 — 1

B1 for 32 (accept 31.5 to 33.5 inclusive)

(b) 

— 3

B1 for ends of whiskers at 9 and 57 (with a box)
B1 for ends of box at 16 and 45/46 (±0.5)
B1for median marked at "32"or complete box and whisker diagram drawn with a median inside the box

(c) Median(B)>Median(G); on average boys take longer
IQR(B)>IQR(G); times for boys have a greater spread — 2

B1 eg for comparison of medians (ft on diagrams)
B1 eg for comparison of (interquartile) ranges (ft on diagram)

[6]

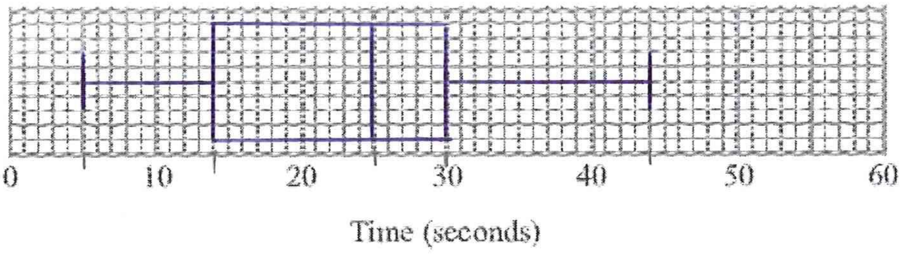
3) Box plots: Harder

7. Here are the times, in seconds, that 15 people waited to be served at Rose's garden centre.

5 9 11 $\boxed{14}$ 15 20 22 $\boxed{25}$ 27 27 28 $\boxed{30}$ 32 35 44

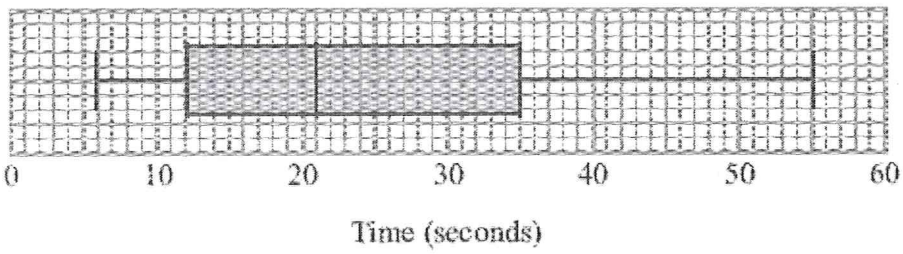
LQ Median UQ.

(a) On the grid, draw a box plot for this information.



(3)

The box plot below shows the distribution of the times that people waited to be served at Green's garden centre.



(b) Compare the distribution of the times that people waited at Rose's garden centre and the distribution of the times that people waited at Green's garden centre.

There was a greater spread of waiting times in the interquartile range for Green's Garden Centre than Rose's Garden centre

The median waiting time is shorter at ~~Rose's~~ Greens than Roses Garden centre.

(2)

(5 marks)

4) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As $2n$ is even $2n+1$ will be odd and so $2n+2$ is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

4) Proof: Medium

8. Prove that

$(n + 1)^2 - (n - 1)^2 + 1$ is always odd for all positive integer values of n.

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$

$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$

$= 4n + 1$

$4n$ is a multiple of 4 so it must be even which means $4n+1$ is odd.

(3 marks)

4) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$$n^2 + (n+1)^2$$

$$= n^2 + n^2 + 2n + 1$$

$$= 2n^2 + 2n + 1$$

$$= 2n(n+1) + 1$$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

$2n(n+1)$ is 2 x an even number which has to be a multiple of 4

So $2n(n+1) + 1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

5) Completing the Square: Easier

1) Express $x^2 + 6x + 10$ in the form $(x + p)^2 + q$

$$(x+3)^2 - 3^2 + 10$$

$$= (x+3)^2 - 9 + 10$$

$$= (x+3)^2 + 1$$

$$\boxed{\begin{array}{l} p = 3 \\ q = 1 \end{array}}$$

5) Completing the Square: Medium

2) Express $x^2 - 3x + 5$ in the form $(x + a)^2 + b$

$$(x-1.5)^2 - 1.5^2 + 5$$

$$= (x-1.5)^2 - 2.25 + 5$$

$$= (x-1.5)^2 + 2.75$$

$a = -1.5, b = 2.75$

5) Completing the Square: Harder

3) What is the minimum value of $(x-2)^2 + 5$?

5, which occurs when $x=2$.

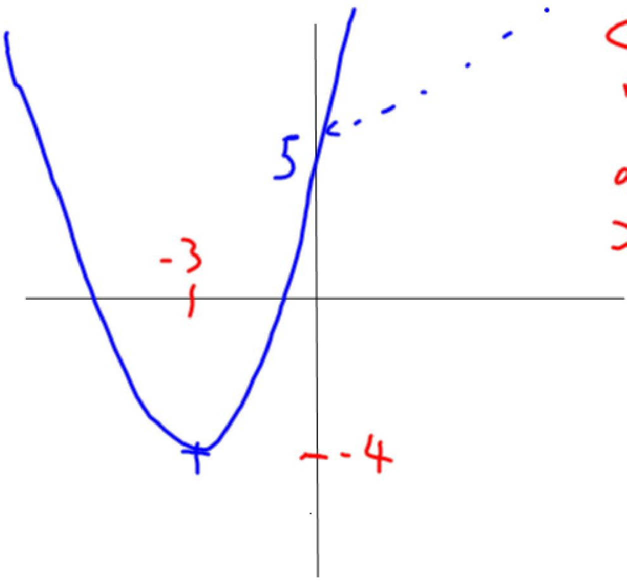
$(x-2)^2$ can never be negative.

4) a) Express $x^2 + 6x + 5$ in the form of $(x + a)^2 + b$

$(x+3)^2 - 3^2 + 5$

$= (x+3)^2 - 4$

b) Now sketch the graph of $y = x^2 + 6x + 5$ stating the minimum point of the graph and where it crosses the axis



min point at $x=-3, y=-4$

LEE Yasmin

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	16 from 20	1 from 1	7 from 10	4 from 5	3 from 3	1 from 1
A02 and 3	39 from 60	8 from 11	13 from 16	5 from 9	5 from 16	8 from 8
Total	55 from 80	9 from 12	20 from 26	9 from 14	8 from 19	9 from 9

Your Pinpoint Topics

Topic 1: Loci and Construction. Mathswatch Clip: 165

Topic 2: Box plots. Mathswatch Clip: 187

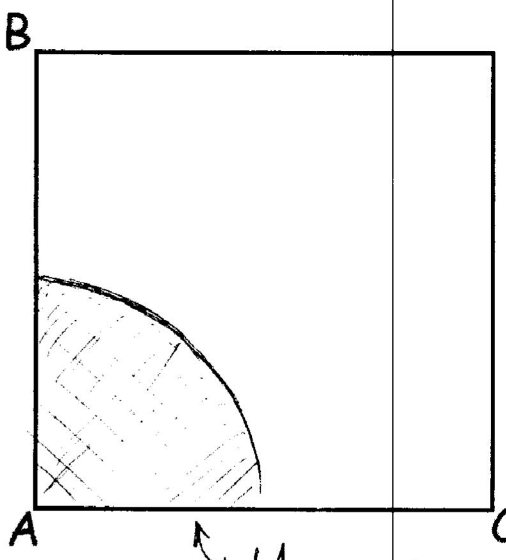
Topic 3: Counting Methods. Mathswatch Clip: NA

Topic 4: Proof. Mathswatch Clip: 193

Topic 5: Iterative processes. Mathswatch Clip: 180

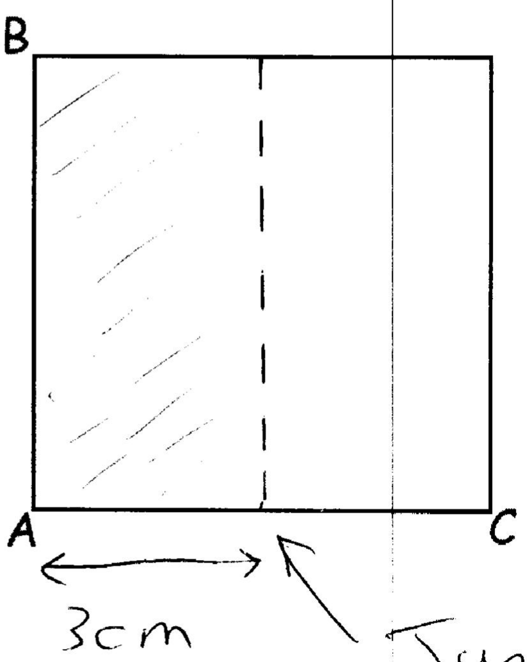
1) Loci and Construction: Easier

1) Shade the area closer than 3cm to point A within the square below:



Use compass at 3cm

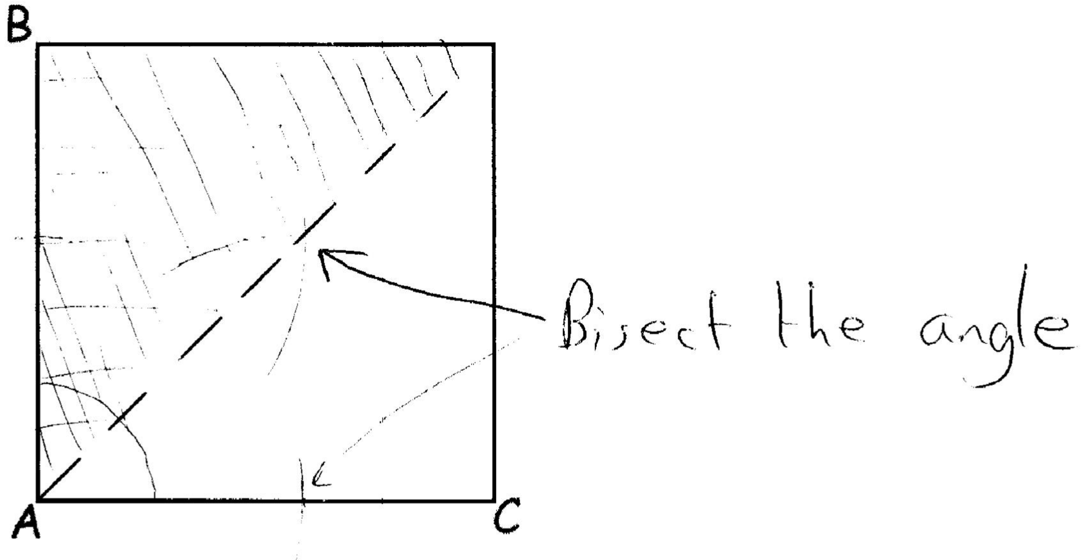
2) Shade the area closer than 3cm to the line AB within the square below:



Just measure 3cm with your ruler

1) Loci and Construction: Medium

3) Shade the area closer to the line AB than AC within the square below:

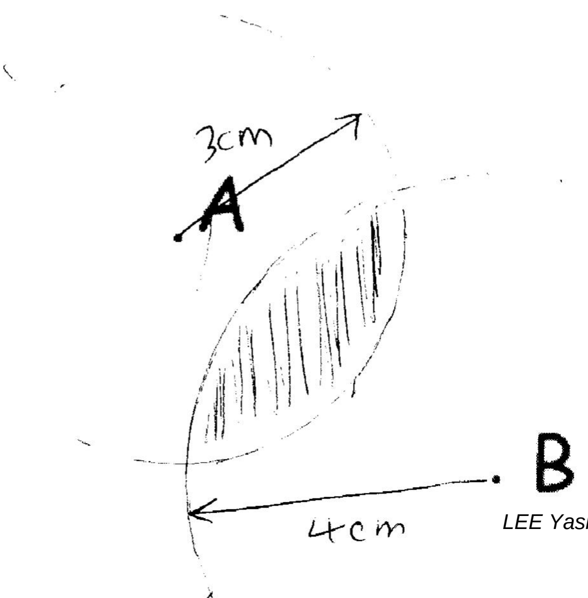


4) Two mobile phone stations transmit a signal.

Mobile phone station A transmits its signal ~~5~~ 3 miles.

Mobile phone station B transmits its signal 4 miles.

When you can receive both signals you experience interference on your phone. Shade below the area of interference.



Scale: 1 cm represents 1 mile

1) Loci and Construction: Harder

5) Mariam wants to plant a flower:

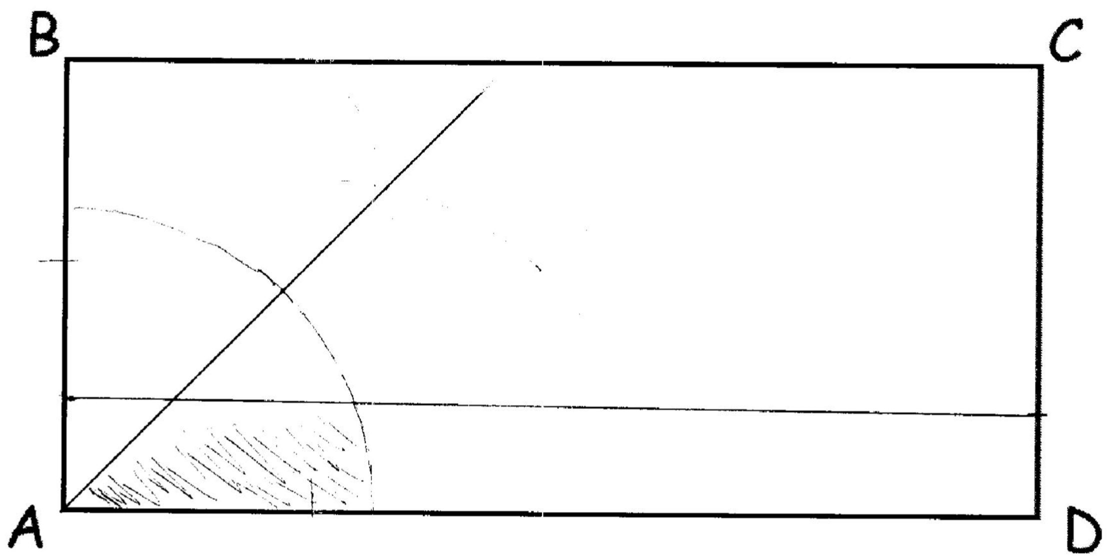
Within 4m of A

Closer to AD than AB

Less than 1.5m from AD.

Shade below the region where Mariam should plant her flower.

Show any construction lines your draw.



Scale: 1 cm represents 1 metre

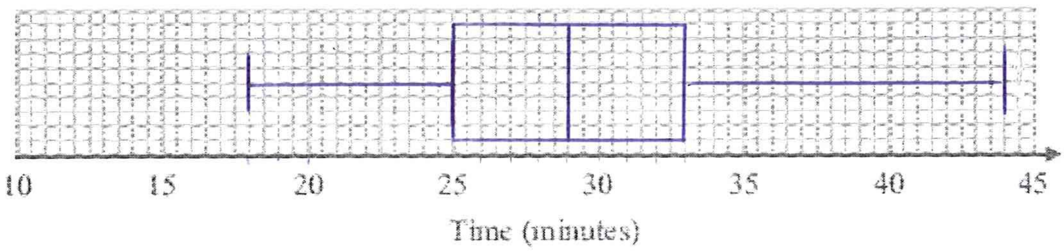
2) Box plots: Easier

2. Sameena recorded the times, in minutes, some girls took to do a jigsaw puzzle.

Sameena used her results to work out the information in this table.

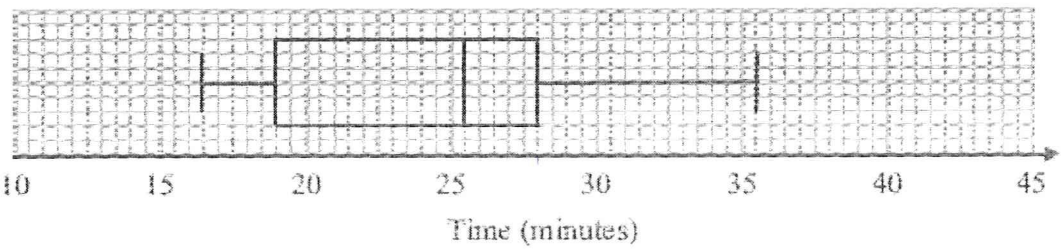
	Minutes
Shortest time	18
Lower quartile	25
Median	29
Upper quartile	33
Longest time	44

(a) On the grid, draw a box plot to show the information in the table.



(2)

The box plot below shows information about the times, in minutes, some boys took to do the same jigsaw puzzle.



(b) Compare the distributions of the girls' times and the boys' times.

The boys median time was less than that of the girls; Boys 25.5mins, Girls 29 mins.

The spread of data for the interquartile range is smaller for the girls (8 mins) than for the boys (9 mins)

(2)

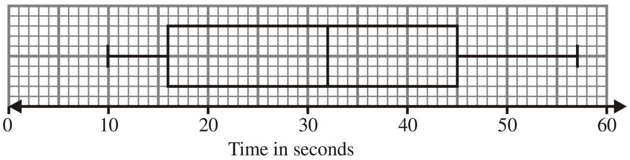
(4 marks)

2) Box plots: Medium

2. (a) 32 — 1

B1 for 32 (accept 31.5 to 33.5 inclusive)

(b) — 3



B1 for ends of whiskers at 9 and 57 (with a box)
B1 for ends of box at 16 and 45/46 (± 0.5)
B1for median marked at "32"or complete box and whisker diagram drawn with a median inside the box

(c) Median(B)>Median(G); on average boys take longer
IQR(B)>IQR(G); times for boys have a greater spread — 2

B1 eg for comparison of medians (ft on diagrams)
B1 eg for comparison of (interquartile) ranges (ft on diagram)

[6]

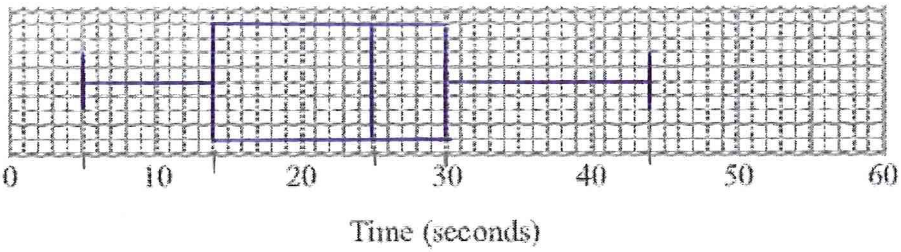
2) Box plots: Harder

7. Here are the times, in seconds, that 15 people waited to be served at Rose's garden centre.

5 9 11 $\boxed{14}$ 15 20 22 $\boxed{25}$ 27 27 28 $\boxed{30}$ 32 35 44

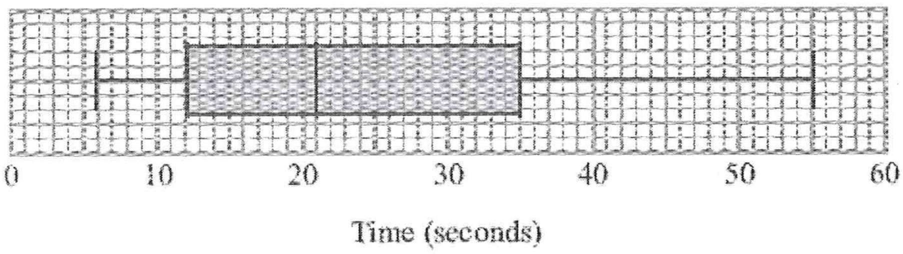
LQ Median UQ.

(a) On the grid, draw a box plot for this information.



(3)

The box plot below shows the distribution of the times that people waited to be served at Green's garden centre.



(b) Compare the distribution of the times that people waited at Rose's garden centre and the distribution of the times that people waited at Green's garden centre.

There was a greater spread of waiting times in the interquartile range for Green's Garden Centre than Rose's Garden centre

The median waiting time is shorter at ~~Rose's~~ Greens than Roses Garden centre.

(2)

(5 marks)

3) Counting Methods: Easier

1) Ryan has four shorts of different colours, blue, red, green and yellow.
He has three different T-shirts of different colours, black, white and orange.

Blue shorts and a black T-Shirt would be one possible outfit.
How many different outfits of Shorts and T-Shirts can Ryan wear?

4 shorts × 3 T-shirts = 12 possible outfits

____

(2 Marks)

---

2) There are 13 boys and 10 girls in a class.
Work out the total number of ways that 1 boy and 1 girl can be chosen from the class.

$13 \times 10 = 130$ ways

____

(2 Marks)

---

3) There are 7 boys and 10 girls in a class.
Work out the total number of ways that 1 boys and 2 girls can be chosen from the class.

$7 \times 10 \times 9 = 630$ ways

____

(2 Marks)

3) Counting Methods: Medium

4) Mason's bank secret pin code is a four digit number and each digit can be the numbers 0, 1, 2, 3, 4, 5, 6 , 7, 8, or 9. For example one possible pin number could be 9021.

a) Mason's bank card is stolen. What is the probability with one guess only that someone correctly guesses Mason's pin number? Leave your answer as a fraction.

$10 \times 10 \times 10 \times 10 = 10000$ possibilities.

Probability of guessing first time = $\frac{1}{10000}$

____

(2 Marks)

Ishmael's bank does not allow any digit to be repeated in his secret pin number. For example 7762 would not be allowed, nor would 5075.

b) Ishmael's bank card is stolen. What is the probability with one guess only that someone correctly guesses Ishmael's pin number? Leave your answer as a fraction.

$10 \times 9 \times 8 \times 7 = 5040$ possibilities.

Probability of guessing first time = $\frac{1}{5040}$

____

(3 Marks)

3) Counting Methods: Harder

5) A restaurant menu has 6 starters, 10 mains and 6 desserts.
A customer can choose from the following meals

- a starter and a main,
- a main and a dessert,
- a starter, a main and a dessert.

Show that there are 480 different ways of choosing a meal at this restaurant.

$(6 \times 10) + (10 \times 6) + (6 \times 10 \times 6)$

$= 60 + 60 + 360$

$= 480$ ways

____

(3 Marks)

6) A simple computer password only allows you to use two letters a and b.
"abaab" would be an example of one password which consists of 5 letters.
How many letters must your password contain such that the probability of someone randomly guessing it first time is less than 1 in a 1000?

Use Trial and Improvement:

2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 1024 ways with 10 letters.

Therefore a password of 10 letters is needed as $\frac{1}{1024} < \frac{1}{1000}$

____

(3 Marks)

4) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As $2n$ is even $2n+1$ will be odd and so $2n+2$ is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

4) Proof: Medium

8. Prove that

$$(n+1)^2 - (n-1)^2 + 1 \text{ is always odd for all positive integer values of } n.$$

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$

$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$

$= 4n + 1$

$4n$ is a multiple of 4 so it must be even which means $4n+1$ is odd.

(3 marks)

4) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$$n^2 + (n+1)^2$$

$$= n^2 + n^2 + 2n + 1$$

$$= 2n^2 + 2n + 1$$

$$= 2n(n+1) + 1$$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

$2n(n+1)$ is $2 \times$ an even number which has to be a multiple of 4

So $2n(n+1)+1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

5) Iterative processes: Easier

Solution for Question 1:

$$U_1 = 2$$

$$U_2 = 2(2) + 3 = 4 + 3$$

$$U_2 = 7$$

$$U_3 = 2(7) + 3 = 14 + 3$$

$$U_3 = 17$$

$$U_4 = 2(17) + 3 = 34 + 3$$

$$U_4 = 37$$

Solution for Question 2:

$$x_0 = 2$$

$$x_1 = (3(2) - 1)^{\frac{1}{3}}$$

$$x_1 = 5^{\frac{1}{3}} = 1.70996 \ldots$$

$$x_2 = \left(3\left(5^{\frac{1}{3}}\right) - 1\right)^{\frac{1}{3}}$$

$$x_2 = 1.60441 \ldots$$

$$x_3 = (3(1.60441 \ldots) - 1)^{\frac{1}{3}}$$

$$x_3 = 1.5623 \ldots$$

Solution for Question 3:

a) $5x - x^3 = 2$

Add x^3 to both sides: $5x = 2 + x^3$

Dividing both sides by 5 will give: $x = \frac{2}{5} + \frac{x^3}{5}$

b) $x_0 = 0.3$

$$x_1 = \frac{2}{5} + \frac{(0.3)^3}{5}$$

$$x_1 = 0.4054$$

$$x_2 = \frac{2}{5} + \frac{(0.4054)^3}{5}$$

$$x_2 = 0.413325 \ldots$$

$$x_3 = \frac{2}{5} + \frac{(0.413325 \ldots)^3}{5}$$

5) Iterative processes: Medium

$$x_3 = 0.414122\ldots$$

$$x_4 = \frac{2}{5} + \frac{(0.414122\ldots)^3}{5}$$

$$x_4 = 0.41420\ldots$$

c) Root of $5x - x^3 = 2$ to two decimal places: $x = 0.41$

Solution for Question 4:

a) $x^3 + 3x^2 - 2 = 0$

Sub in $x = -2$: $(-2)^3 + 3(-2)^2 - 2 = 2$

Sub in $x = -3$: $(-3)^3 + 3(-3)^2 - 2 = -2$

Since there is a change in sign from where $x = -2$ to $x = -3$, there is a root between -2 and -3

b) $x^3 + 3x^2 - 2 = 0$

Add 2 to both sides: $x^3 + 3x^2 = 2$

Take away $3x^2$ from both sides: $x^3 = 2 - 3x^2$

Dividing both sides by x^2 gives: $x = \frac{2}{x^2} - 3$

c) $x_0 = 0.5$

$$x_1 = \frac{2}{0.5^2} - 3,\ x_1 = 5$$

$$x_2 = \frac{2}{5^2} - 3,\ x_2 = -2.92$$

$$x_3 = \frac{2}{(-2.92)^2} - 3,\ x_3 = -2.765\ldots$$

$$x_4 = \frac{2}{(-2.765\ldots)^2} - 3,\ x_4 = -2.738\ldots$$

$$x_5 = \frac{2}{(-2.738\ldots)^2} - 3,\ x_5 = -2.733\ldots$$

$$x_6 = \frac{2}{(-2.733\ldots)^2} - 3,\ x_6 = -2.732\ldots$$

$$x_7 = \frac{2}{(-2.732)^2} - 3,\ x_7 = -2.732\ldots$$

Therefore, to three decimal places, the root of $x^3 + 3x^2 - 2 = 0$: $x = -2.732$

5) Iterative processes: Harder

Solution for Question 5:

Number of Tadpoles in 2016: $P_0 = 50$
Number of Tadpoles in 2017: $P_1 = 1.02(50 + 6),\ P_1 = 57.12$
Number of Tadpoles in 2018: $P_2 = 1.02(57.12 + 6),\ P_2 = 64.38\ldots$
Number of Tadpoles in 2019: $P_3 = 1.02(64.38\ldots + 6),\ P_3 = 71.79\ldots$
Number of Tadpoles in 2020: $P_4 = 1.02(71.79\ldots + 6),\ P_4 = 79.35\ldots$

Predicted number of Tadpoles at the start of 2020: 79

LEIGH-VALERO Nadia

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	17 from 20	1 from 1	7 from 10	5 from 5	3 from 3	1 from 1
A02 and 3	53 from 60	11 from 11	14 from 16	9 from 9	11 from 16	8 from 8
Total	70 from 80	12 from 12	21 from 26	14 from 14	14 from 19	9 from 9

Your Pinpoint Topics

Topic 1: Expressions, identities and equations. MW: 7

Topic 2: Loci and Construction. Mathswatch Clip: 165

Topic 3: Proof. Mathswatch Clip: 193

Topic 4: Extention1. Mathswatch Clip:

Topic 5: Extention2. Mathswatch Clip:

1) Expressions, identities and equations: Easier

1) Fill in the gaps with an appropriate word from the list
EQUATION, IDENTITY, EXPRESSION, TERMS

$$3x + 4 \ is \ an \ expression \ with \ two \ terms$$

$$2(x + 4) \equiv 2x + 8 \ is \ an \ identity$$

$$2x + 3 = 11 \ is \ an \ equation$$

....

(2 Marks)

---

2) Circle the identity

A $5(x + 3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x + 3)$ D $x^2 + 2 = 27$

(1 Mark)

---

3) Circle the expression

A $5(x + 3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x + 3)$ D $x^2 + 2 = 27$

....

(1 Mark)

1) Expressions, identities and equations: Medium

4) Annemarie is asked to form an expression, given the following information.
There are a sweets in every packet. I have 3 packets of sweets. I put all the sweets in one container and eat 2 of them. Form an expression for the number of sweets I have left.

Annemarie writes

3a = -2

Write down one mistake Annemarie has made

She has written an equation, (with an equals) she wasn't told how many sweets there are left just that there are two less than 3 bags so she should have written 3a-2 which is an expression

(1 Mark)

---

5) Insert the correct symbol, = or ≡ in the boxes below

$$2x + 3 \quad \boxed{=} \quad 10$$

$$2a \times 3a^2 \quad \boxed{\equiv} \quad 6a^3$$

$$5(x-2) \quad \boxed{\equiv} \quad 5x - 10$$

Remember an equation is true for some values of the variable and an identity is true for all values of the variable

....

(3 Marks)

6) Jim says that

$$(x+4)^2 = x^2 + 16$$

is an identity. Paul says it is an equation and not an identity. Who is correct? You must explain your reasoning.

Paul is right, it is an equation, for the value $x = 0$ the equation is true as

$(0+4)^2 = 0^2 + 4^2$ as they are both equal to 16

It is not true for all values of x for example for $x = 1$

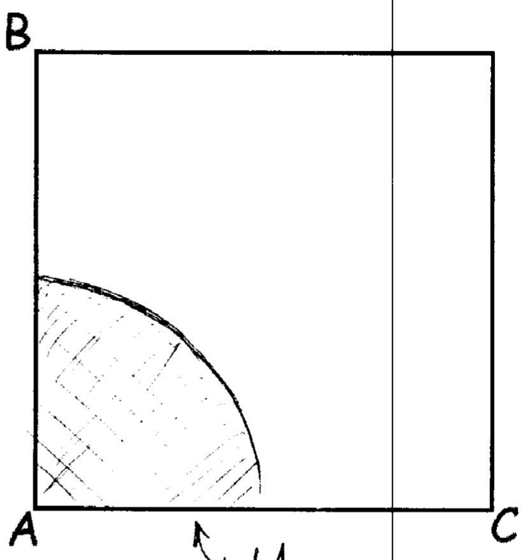
$(1+4)^2 = 25$ *and* $1^2 + 16 = 17$ so it does not hold for all values of x

$(x+4)^2 = x^2 + 8x + 16$ is an identity

(1 Mark)

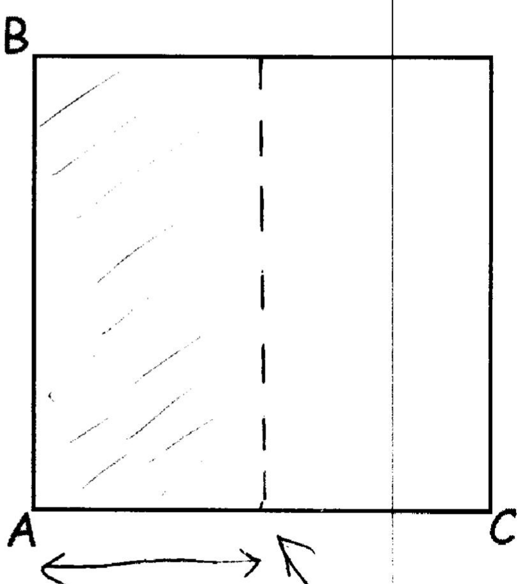
2) Loci and Construction: Easier

1) Shade the area closer than 3cm to point A within the square below:



Use compass at 3cm

2) Shade the area closer than 3cm to the line AB within the square below:

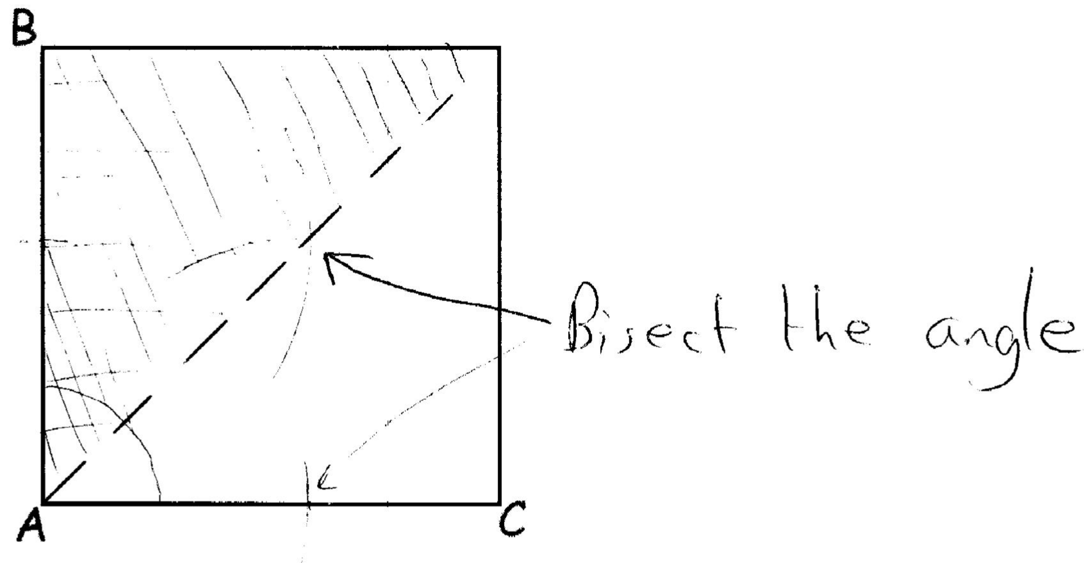


3cm

Just measure 3cm with your ruler

2) Loci and Construction: Medium

3) Shade the area closer to the line AB than AC within the square below:

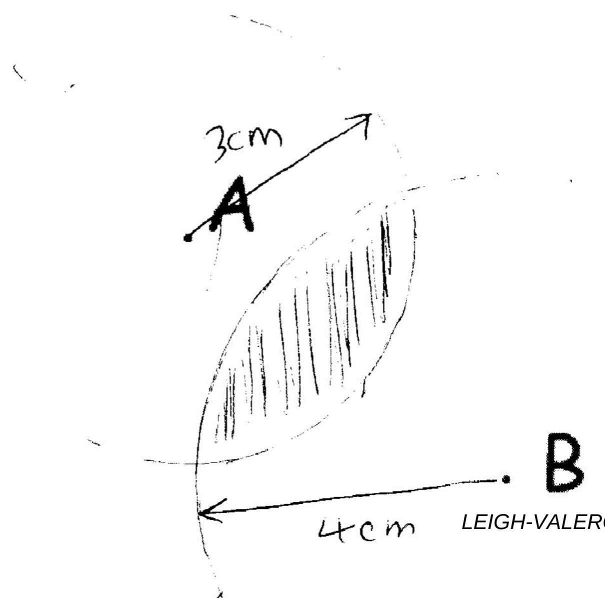


4) Two mobile phone stations transmit a signal.

Mobile phone station A transmits its signal ~~5~~ 3 miles.

Mobile phone station B transmits its signal 4 miles.

When you can receive both signals you experience interference on your phone. Shade below the area of interference.



Scale: 1 cm represents 1 mile

2) Loci and Construction: Harder

5) Mariam wants to plant a flower:

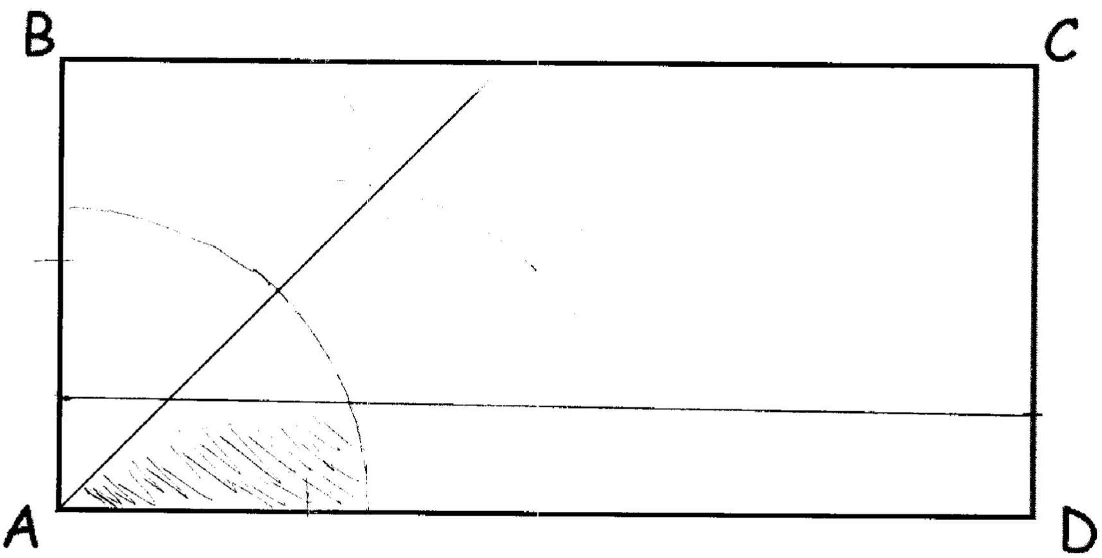
Within 4m of A

Closer to AD than AB

Less than 1.5m from AD.

Shade below the region where Mariam should plant her flower.

Show any construction lines your draw.



Scale: 1 cm represents 1 metre

3) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As $2n$ is even $2n+1$ will be odd and so $2n+2$ is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

3) Proof: Medium

8. Prove that

$(n+1)^2 - (n-1)^2 + 1$ is always odd for all positive integer values of n.

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$$
$$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$$
$$= 4n + 1$$

4n is a multiple of 4 so it must be even which means 4n+1 is odd.

(3 marks)

3) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and n+1

$n^2 + (n+1)^2$

$= n^2 + n^2 + 2n + 1$

$= 2n^2 + 2n + 1$

$= 2n(n+1) + 1$

n(n+1) is the product of 2 consecutive numbers. As one of them is even the product must be even.

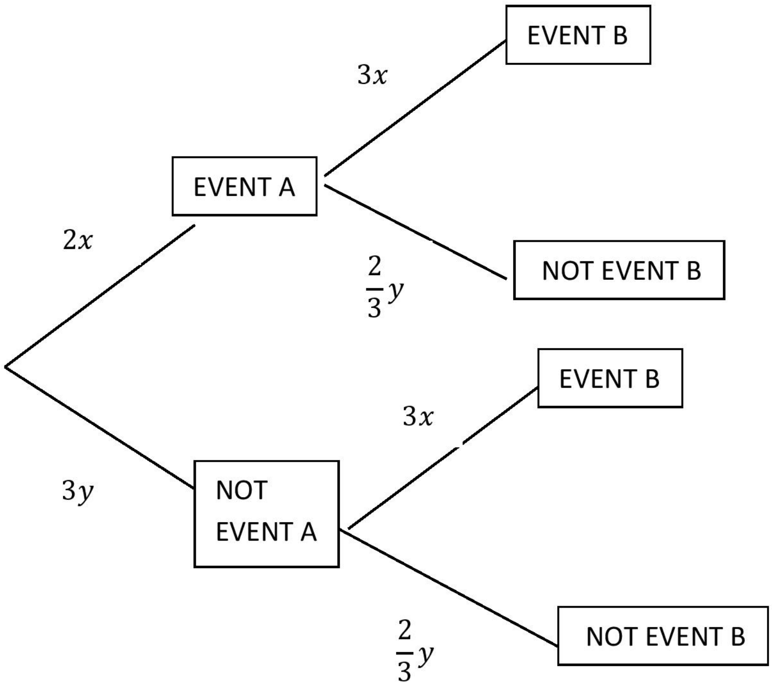
2n(n+1) is 2 x an even number which has to be a multiple of 4

So 2n(n+1) + 1 is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

4) Extention1: Easier

1. The figure below shows a probability tree diagram for two events. What is the value of x and y?



From tree diagram (branches sum to one)

$$2x + 3y = 1$$

$$3x + \frac{2}{3}y = 1$$

Multiplying equations to eliminate x

$$6x + 9y = 3$$

$$6x + \frac{4}{3}y = 2$$

$$\frac{23}{3}y = 1$$

$$y = \frac{3}{23}$$

$$2x + \frac{9}{23} = 1$$

$$x = \frac{7}{23}$$

(4 marks)

4) Extention1: Medium

2. Given that $x^a = \frac{1}{x^b}$, What is the value of $2a + 2b$?

$$x^a = x^{-b}$$

$$a = -b$$

$$a + b = 0$$

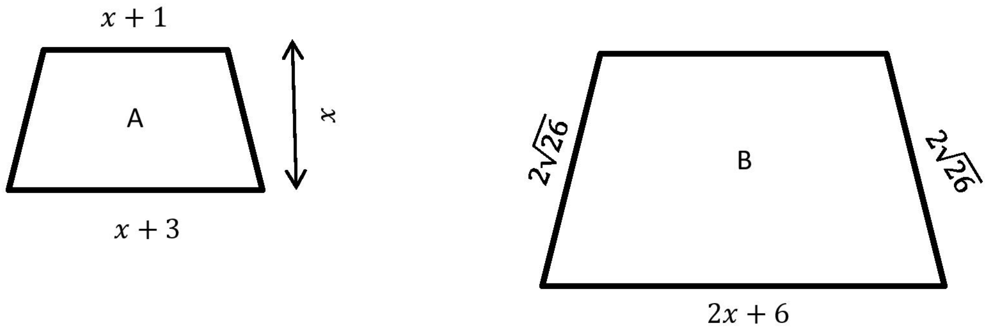
$$2(a + b) = 0$$

$$2a + 2b = 0$$

(3 marks)

4) Extention1: Harder

3. The two trapezia below are similar. The area of trapezium A is 35cm^2. Find the perimeter of trapezium B.



The area of trapezium A is given by $\frac{1}{2}(x+1+x+3)\times x$

$$\frac{1}{2}(2x+4)\times x = 35cm^2$$

$$x^2+2x = 35cm^2$$

$$x^2+2x-35=0$$

$$(x-5)(x+7)=0$$

$$x = 5cm, \qquad (as\ x>0)$$

The perimeter of Trapezium A is

$$2x+6+2x+2+4\sqrt{26}$$

When $x = 5$ $\quad 4(5)+8+4\sqrt{26}$

$$= 18 + \ 4\sqrt{26}$$

(4 marks)

5) Extention2: Easier

4. Given that $9^a = 2$, What are the possible values of 27^a?

$$9^a = 2$$

$$(3^2)^a = 2$$

$$3^{2a} = 2$$

$$(3^a)^2 = 2$$

$$(3^a) = \pm\sqrt{2}$$

$$27^a = (3^3)^a$$

$$= (3^a)^3$$

$$= \left(\pm\sqrt{2}\right)^3$$

$$= \pm 2\sqrt{2}$$

(4 marks)

5) Extention2: Medium

5) Extention2: Harder

PINPOINT

LEIGH-VALERO Tori

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	20 from 20	1 from 1	10 from 10	5 from 5	3 from 3	1 from 1
A02 and 3	51 from 60	8 from 11	14 from 16	9 from 9	13 from 16	7 from 8
Total	71 from 80	9 from 12	24 from 26	14 from 14	16 from 19	8 from 9

Your Pinpoint Topics

Topic 1: Loci and Construction. Mathswatch Clip: 165

Topic 2: Distance Time Graphs. Mathswatch Clip: 143

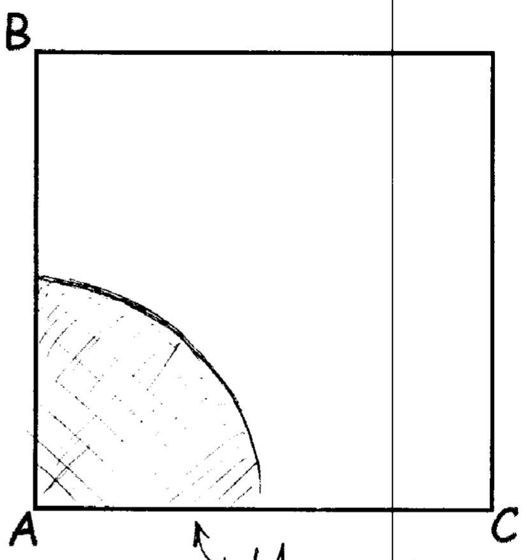
Topic 3: Proof. Mathswatch Clip: 193

Topic 4: Upper and Lower Bounds. Mathswatch Clip: 206

Topic 5: Extention1. Mathswatch Clip:

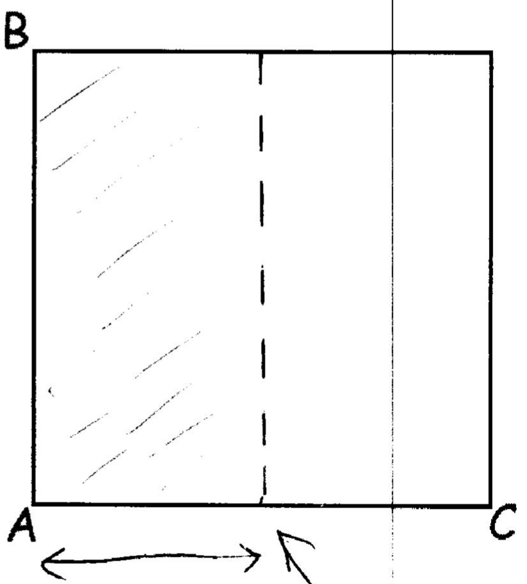
1) Loci and Construction: Easier

1) Shade the area closer than 3cm to point A within the square below:



Use compass at 3cm

2) Shade the area closer than 3cm to the line AB within the square below:

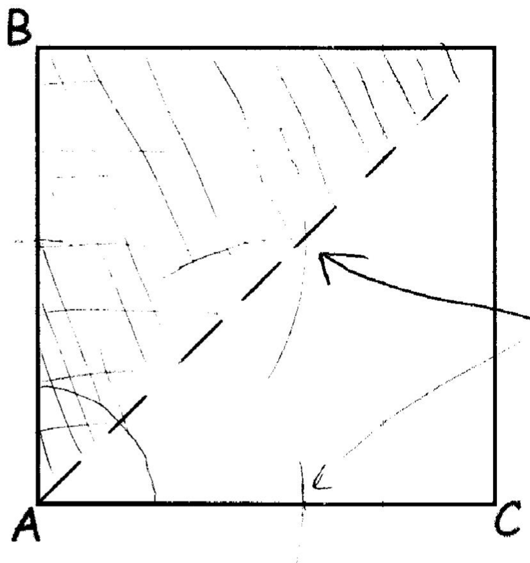


3cm

Just measure 3cm
with your ruler

1) Loci and Construction: Medium

3) Shade the area closer to the line AB than AC within the square below:



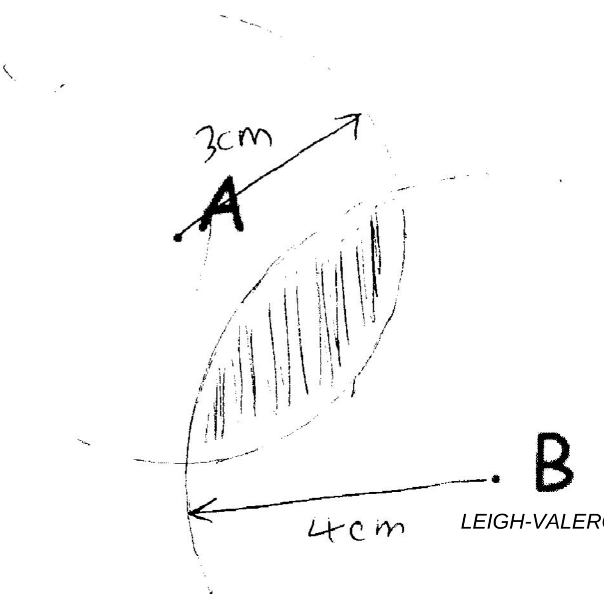
Bisect the angle

4) Two mobile phone stations transmit a signal.

Mobile phone station A transmits its signal ~~5~~ 3 miles.

Mobile phone station B transmits its signal 4 miles.

When you can receive both signals you experience interference on your phone. Shade below the area of interference.



Scale: 1 cm represents 1 mile

1) Loci and Construction: Harder

5) Mariam wants to plant a flower:

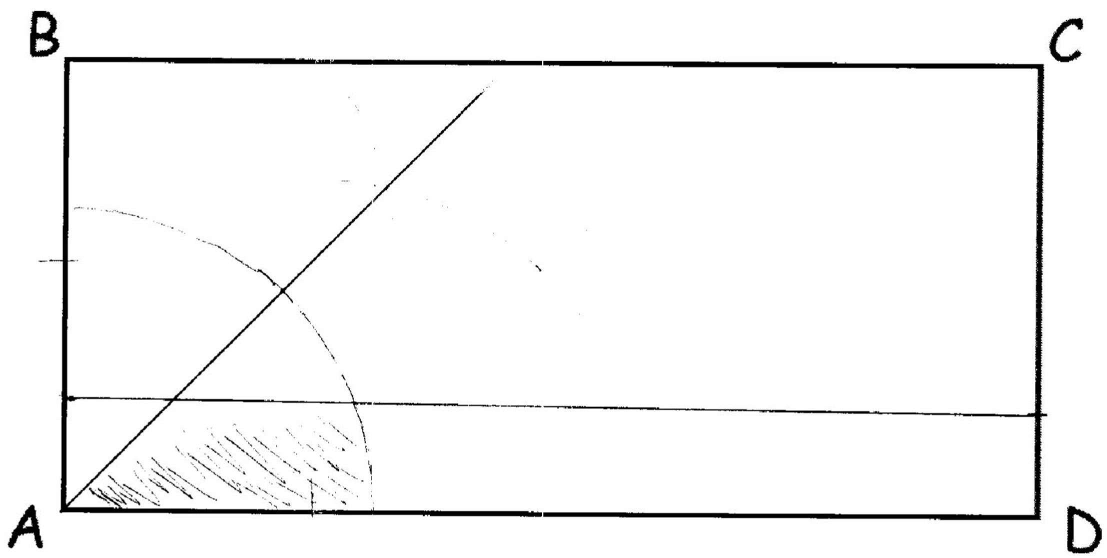
Within 4m of A

Closer to AD than AB

Less than 1.5m from AD.

Shade below the region where Mariam should plant her flower.

Show any construction lines your draw.



Scale: 1 cm represents 1 metre

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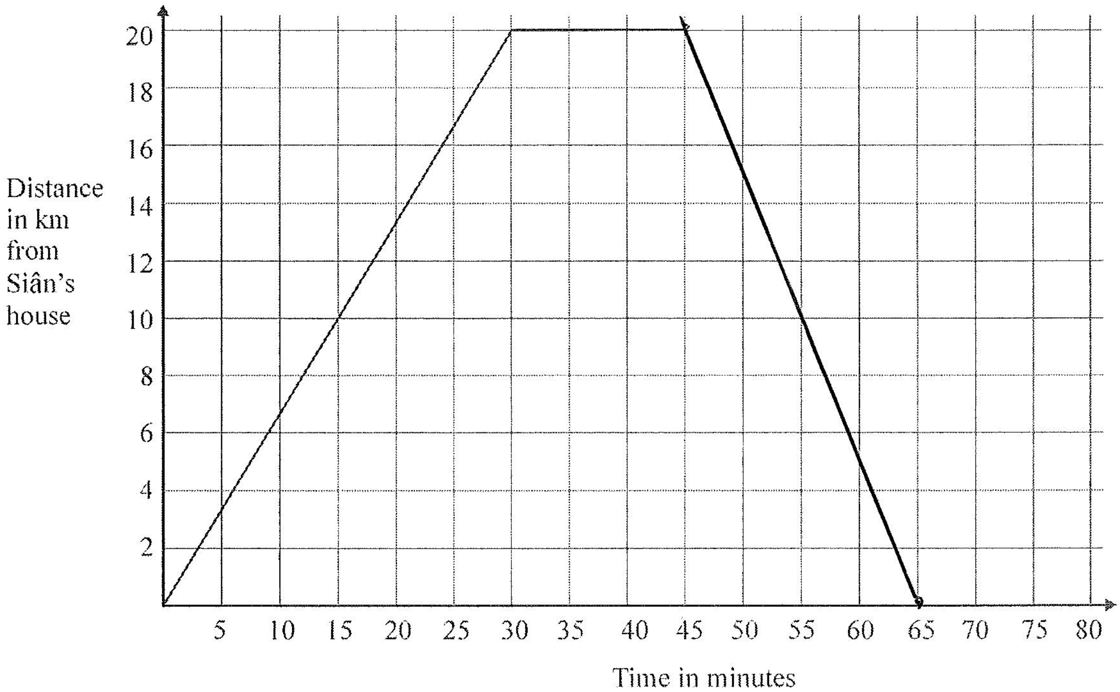
2) Distance Time Graphs: Easier

1. Here is part of a travel graph of Siân's journey from her house to the shops and back.



(a) Work out Siân's speed for the first 30 minutes of her journey.
Give your answer in km/h.

distance ÷ time 30 minutes = 0.5 hours.
20 ÷ 0.5 = 40

40 km/h

(2)

Siân spends 15 minutes at the shops.
She then travels back to her house at 60 km/h.

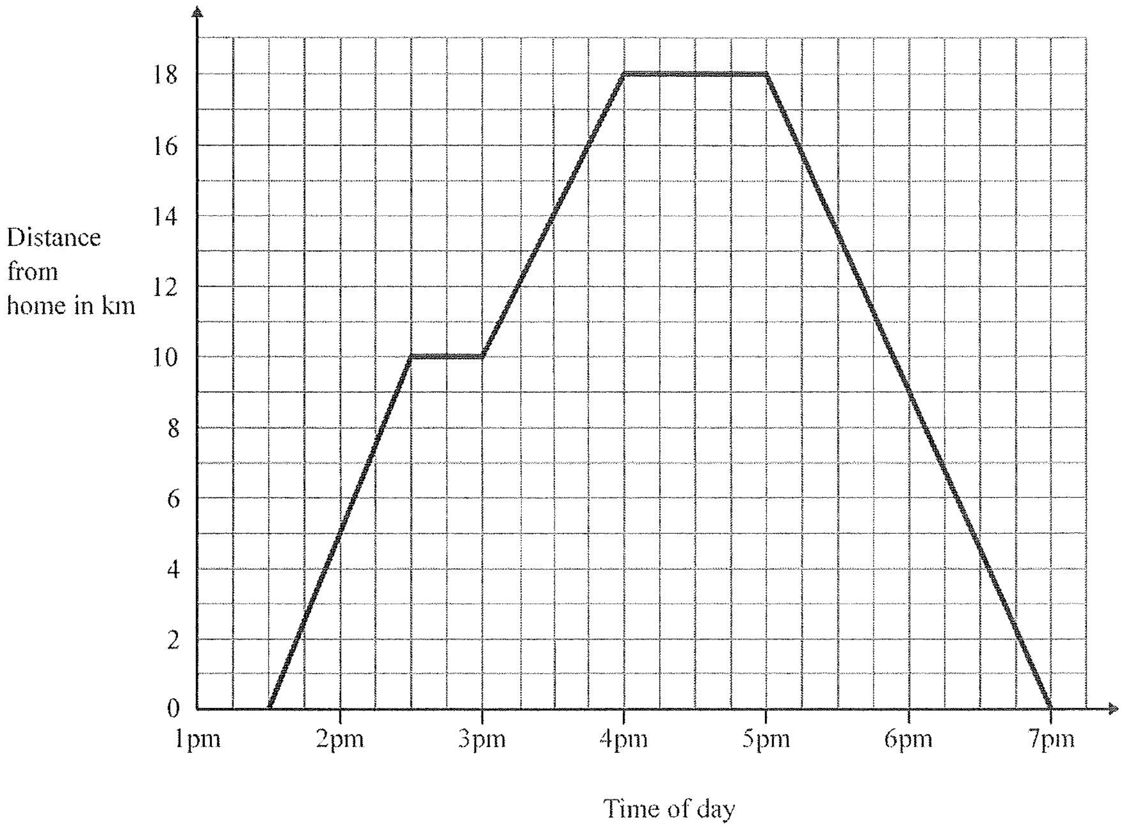
(b) Complete the travel graph.

20km at 60 km/h
20 in 20minutes

(2)
(Total 4 marks)

2) Distance Time Graphs: Medium

10. Pete visited his friend and then returned home.
The travel graph shows some information about Pete's journey.



(a) Write down the time that Pete started his journey.

1.30pm

(1)

At 2.30 pm Pete stopped for a rest.

(b) (i) Find his distance from home when he stopped for this rest.

10 km

(ii) How many minutes was this rest?

30 minutes

(2)

Pete stayed with his friend for one hour.
He then returned home.

(c) Work out the total distance travelled by Pete on this journey.

$18 \times 2 = 36$

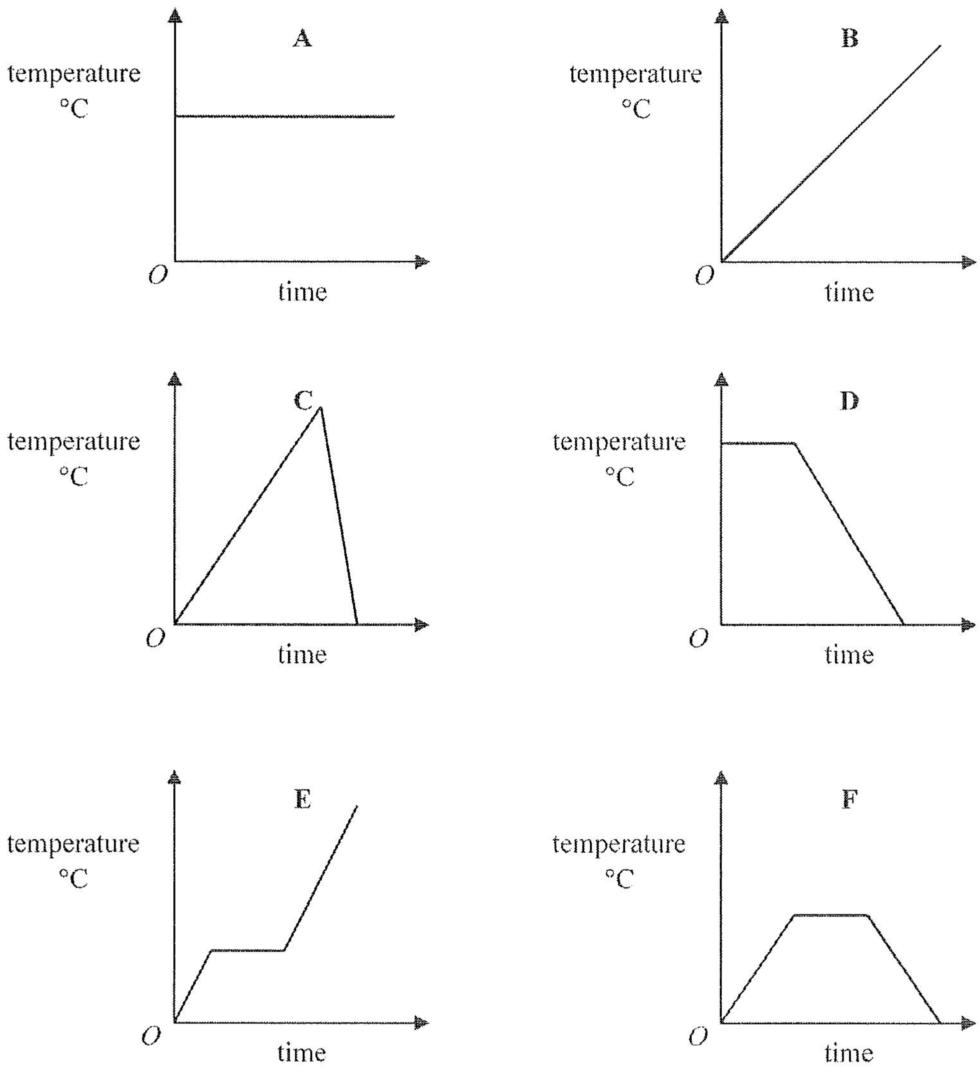
36 km

(2)

(Total 5 marks)

2) Distance Time Graphs: Harder

11. Here are six temperature/time graphs.



Each sentence in the table describes one of the graphs.
Write the letter of the correct graph next to each sentence.

The first one has been done for you.

The temperature starts at 0°C and keeps rising.	**B**
The temperature stays the same for a time and then falls.	D
The temperature rises and then falls quickly.	C
The temperature is always the same.	A
The temperature rises, stays the same for a time and then falls.	F
The temperature rises, stays the same for a time and then rises again.	E

(Total 3 marks)

3) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As $2n$ is even

$2n+1$ will be odd and so $2n+2$ is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

3) Proof: Medium

8. Prove that

$(n + 1)^2 - (n - 1)^2 + 1$ is always odd for all positive integer values of n.

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$

$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$

$= 4n + 1$

$4n$ is a multiple of 4 so it must be even which means $4n+1$ is odd.

(3 marks)

3) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$$n^2 + (n+1)^2$$

$$= n^2 + n^2 + 2n + 1$$

$$= 2n^2 + 2n + 1$$

$$= 2n(n+1) + 1$$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

$2n(n+1)$ is $2 \times$ an even number which has to be a multiple of 4

So $2n(n+1) + 1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

4) Upper and Lower Bounds: Easier

1. The weight of a plasma TV is 12kg to the nearest kg.

a) What is the smallest possible weight of the TV?

11.5Kg

………………… **(1)**

b) What is the largest possible weight of the TV?

12.5Kg

………………… **(1)**

2. The height of a wardrobe is given as 253 cm to the nearest cm. What is the maximum height the wardrobe could be?

253.5cm

………………… **(1)**

3. The number of people that attended a football fixture is given as 3200 to two significant figures. What is the minimum number of people that could have attended?

3250

………………… **(1)**

4) Upper and Lower Bounds: Medium

6. On sports day a girl runs 100m, to the nearest metre. She wins and finishes in 11.3 seconds, correct to the nearest tenth of a second.

What is the fastest possible speed she could have run?

$$Speed = \frac{distance}{time}$$

$$UB(Speed) = \frac{UB(distance)}{LB(time)}$$

$$UB(Speed) = \frac{100.5}{11.25}$$

=8.99m/s

…..…………… **(4)**

7. The maximum load for a crane is 5400kg, measured to the nearest 100 kg. Each crate weighs 20kg, measured to the nearest 10kg.

What is the maximum number of crates the crane can safely take?

$$Max\ number\ of\ cranes = \frac{LB(Max\ load)}{UB(weight\ of\ crate)}$$

$$= \frac{5350}{25}$$

=214 Crates

…..…………… **(4)**

4) Upper and Lower Bounds: Harder

8. The formula for density is

$$D = \frac{M}{V}$$

V is the volume of the object, M is the mass and D the density.

The Volume of a liquid is given as 500ml to the nearest 10ml and the Mass of the liquid is 600g to nearest gram

By considering bounds, give the Density of the drink to a suitable degree of accuracy. You must show all of your working and give a reason for your answer

$$UB(D) = \frac{UB(M)}{LB(V)}$$

$$UB(D) = \frac{505}{599.5} = 0.842369$$

$$LB(D) = \frac{LB(M)}{UB(V)}$$

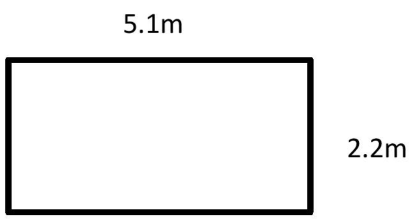
$$LB(D) = \frac{495}{600.5} = 0.824313$$

The lower bound and the upper bound are the same to one significant figure so 0.8

0.8g/ml

……..…………g/ml **(4)**

*9. Sabrina is decorating and is painting a feature wall. The measurements of the wall are shown below to the nearest 0.1m. A pot of paint covers 12m^2 of wall to the nearest 1m^2. By considering bounds, does Sabrina definitely have enough paint to cover the wall with one pot?



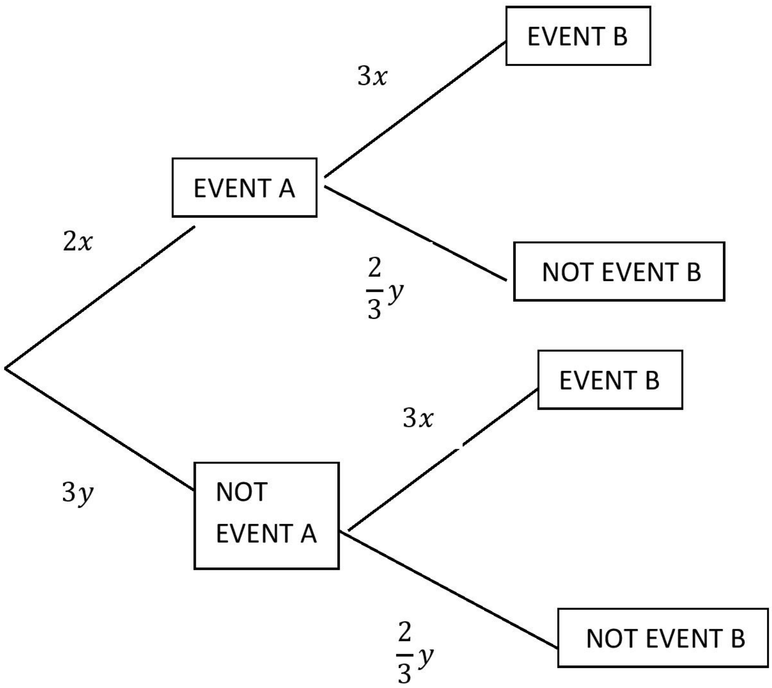
UB (area of wall)= 5.15 x 2.25=11.5875m^2

LB(area paint covers) = 11.5m^2

No she does not definitely have enough as she could only have enough for 11.5m^2 but she could need enough for 11.5875m^2

5) Extention1: Easier

1. The figure below shows a probability tree diagram for two events. What is the value of x and y?



From tree diagram (branches sum to one)

$$2x + 3y = 1$$

$$3x + \frac{2}{3}y = 1$$

Multiplying equations to eliminate x

$$6x + 9y = 3$$

$$6x + \frac{4}{3}y = 2$$

$$\frac{23}{3}y = 1$$

$$y = \frac{3}{23}$$

$$2x + \frac{9}{23} = 1$$

$$x = \frac{7}{23}$$

(4 marks)

5) Extention1: Medium

2. Given that $x^a = \frac{1}{x^b}$, What is the value of $2a + 2b$?

$$x^a = x^{-b}$$

$$a = -b$$

$$a + b = 0$$

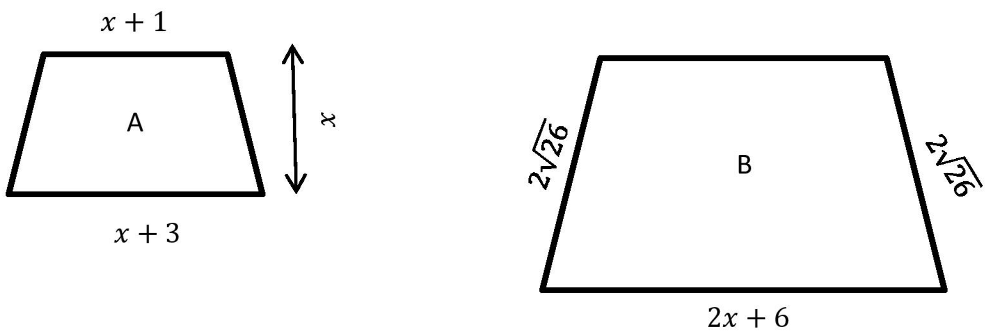
$$2(a + b) = 0$$

$$2a + 2b = 0$$

(3 marks)

5) Extention1: Harder

3. The two trapezia below are similar. The area of trapezium A is 35cm^2. Find the perimeter of trapezium B.



The area of trapezium A is given by $\frac{1}{2}(x + 1 + x + 3) \times x$

$$\frac{1}{2}(2x + 4) \times x = 35cm^2$$

$$x^2 + 2x = 35cm^2$$

$$x^2 + 2x - 35 = 0$$

$$(x - 5)(x + 7) = 0$$

$$x = 5cm, \qquad (as\ x > 0)$$

The perimeter of Trapezium A is

$$2x + 6 + 2x + 2 + 4\sqrt{26}$$

When $x = 5$ $\qquad 4(5) + 8 + 4\sqrt{26}$

$$= 18 + \ 4\sqrt{26}$$

(4 marks)

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Topic 2: Proof. Mathswatch Clip: 193

Topic 3: Completing the Square. Mathswatch Clip: 209

Topic 4: Upper and Lower Bounds. Mathswatch Clip: 206

Topic 5: Extention1. Mathswatch Clip:

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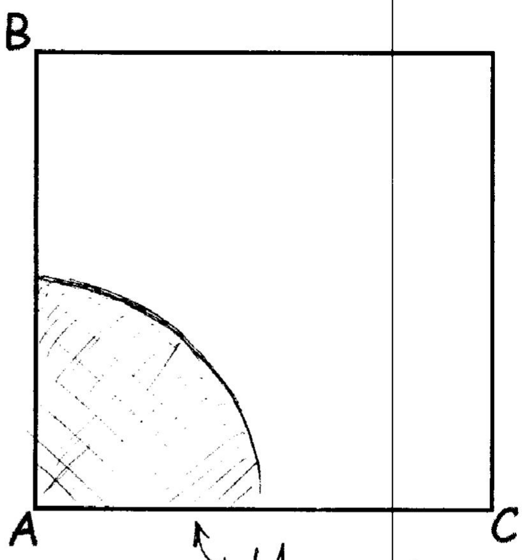
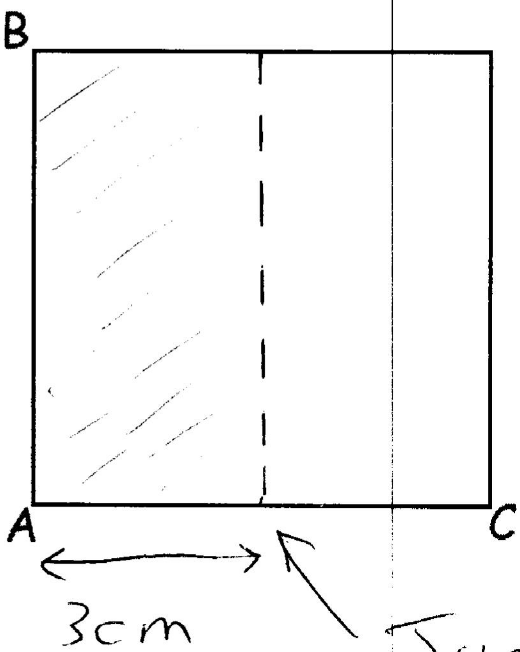


Use compass at 3cm

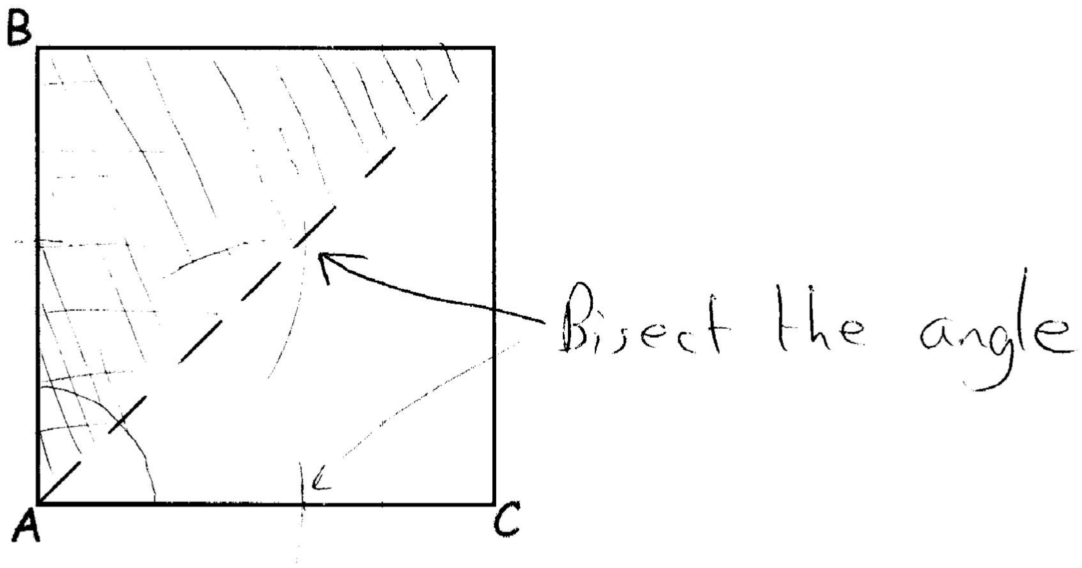
2) Shade the area closer than 3cm to the line AB within the square below:



Just measure 3cm with your ruler

1) Loci and Construction: Medium

3) Shade the area closer to the line AB than AC within the square below:



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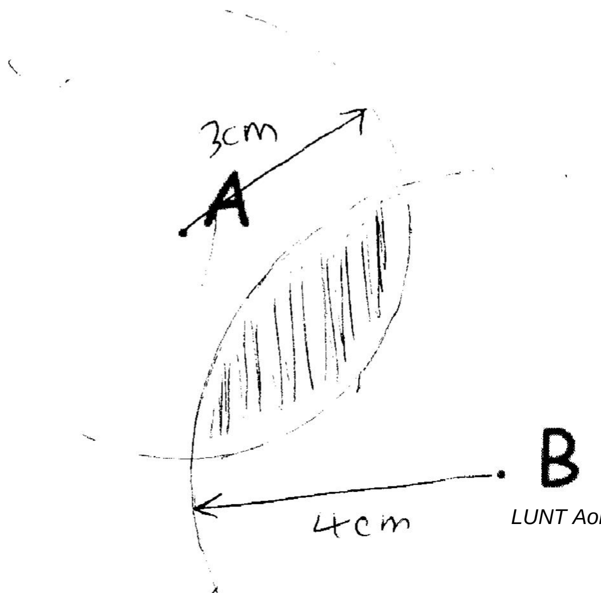
Mobile phone station A transmits its signal ~~5~~ 3 miles.

Mobile phone station B transmits its signal 4 miles.

When you can receive both signals you experience interference on your phone. Shade below the area of interference.



Scale: 1 cm represents 1 mile

1) Loci and Construction: Harder

5) Mariam wants to plant a flower:

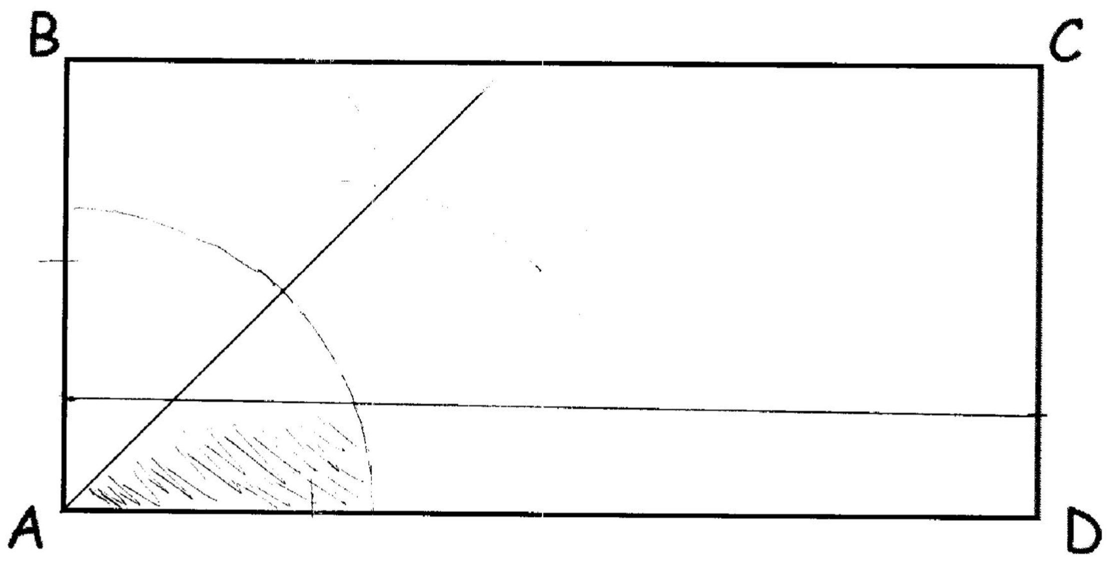
Within 4m of A

Closer to AD than AB

Less than 1.5m from AD.

Shade below the region where Mariam should plant her flower.

Show any construction lines your draw.



Scale: 1 cm represents 1 metre

PINPOINT

2) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As $2n$ is even $2n+1$ will be odd and so $2n+2$ is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

2) Proof: Medium

8. Prove that

$$(n+1)^2 - (n-1)^2 + 1 \text{ is always odd for all positive integer values of } n.$$

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$

$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$

$= 4n + 1$

4n is a multiple of 4 so it must be even which means 4n+1 is odd.

(3 marks)

2) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$$n^2 + (n+1)^2$$

$$= n^2 + n^2 + 2n + 1$$

$$= 2n^2 + 2n + 1$$

$$= 2n(n+1) + 1$$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

$2n(n+1)$ is $2 \times$ an even number which has to be a multiple of 4

So $2n(n+1) + 1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

3) Completing the Square: Easier

1) Express $x^2 + 6x + 10$ in the form $(x + p)^2 + q$

$$(x+3)^2 - 3^2 + 10$$

$$= (x+3)^2 - 9 + 10$$

$$= (x+3)^2 + 1$$

$$\boxed{\begin{matrix} p=3 \\ q=1 \end{matrix}}$$

3) Completing the Square: Medium

2) Express $x^2 - 3x + 5$ in the form $(x + a)^2 + b$

$$(x-1.5)^2 - 1.5^2 + 5$$

$$= (x-1.5)^2 - 2.25 + 5$$

$$= (x-1.5)^2 + 2.75$$

$a = -1.5, b = 2.75$

3) Completing the Square: Harder

3) What is the minimum value of

$(x-2)^2 + 5$?

5, which occurs when $x = 2$.

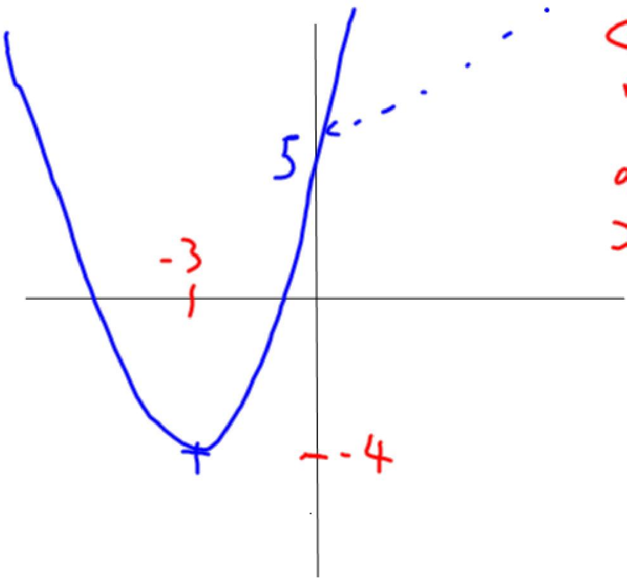
$(x-2)^2$ can never be negative.

4) a) Express $x^2 + 6x + 5$ in the form of $(x + a)^2 + b$

$(x+3)^2 - 3^2 + 5$

$= (x+3)^2 - 4$

b) Now sketch the graph of $y = x^2 + 6x + 5$ stating the minimum point of the graph and where it crosses the axis



min point at $x = -3, y = -4$

4) Upper and Lower Bounds: Easier

1. The weight of a plasma TV is 12kg to the nearest kg.

a) What is the smallest possible weight of the TV?

11.5Kg

.... **(1)**

b) What is the largest possible weight of the TV?

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2. The height of a wardrobe is given as 253 cm to the nearest cm. What is the maximum height the wardrobe could be?

253.5cm

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0.8g/ml

……..…………g/ml **(4)**

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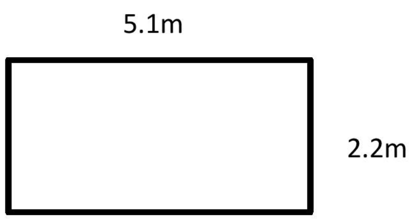

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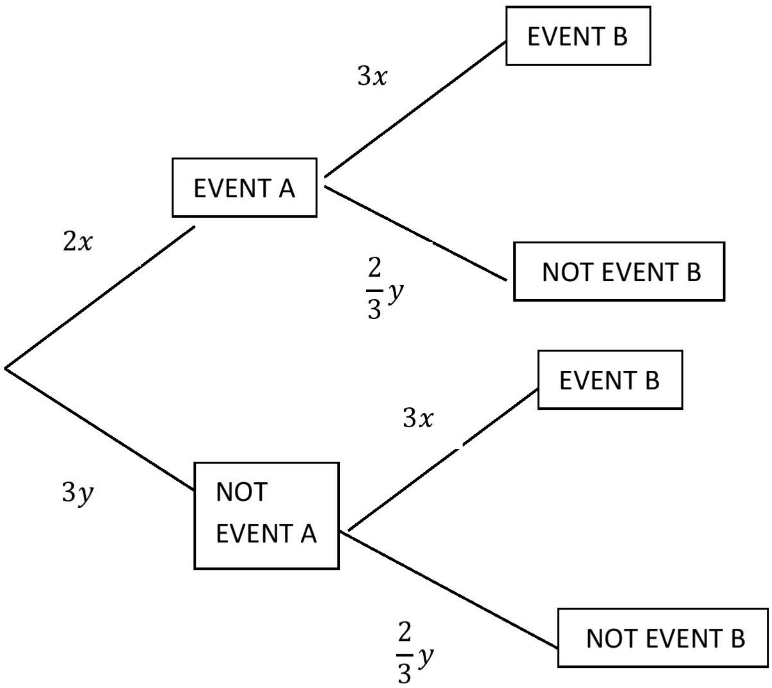

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$$x = \frac{7}{23}$$

(4 marks)

5) Extention1: Medium

2. Given that $x^a = \frac{1}{x^b}$, What is the value of $2a + 2b$?

$$x^a = x^{-b}$$

$$a = -b$$

$$a + b = 0$$

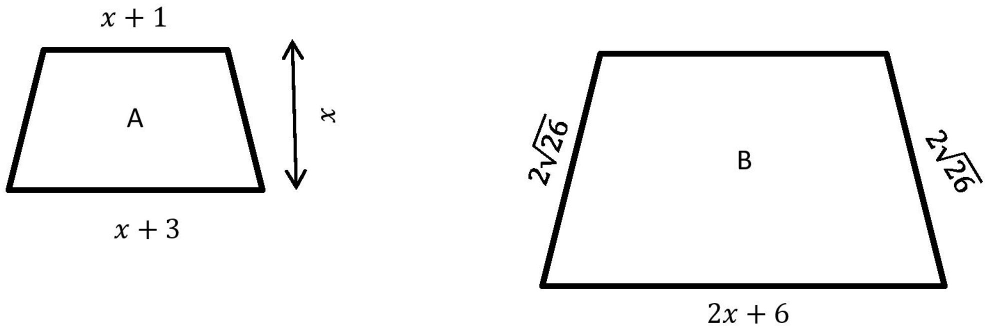
$$2(a + b) = 0$$

$$2a + 2b = 0$$

(3 marks)

5) Extention1: Harder

3. The two trapezia below are similar. The area of trapezium A is 35cm^2. Find the perimeter of trapezium B.



The area of trapezium A is given by $\frac{1}{2}(x+1+x+3)\times x$

$$\frac{1}{2}(2x+4)\times x = 35cm^2$$

$$x^2+2x = 35cm^2$$

$$x^2+2x-35=0$$

$$(x-5)(x+7)=0$$

$$x = 5cm, \qquad (as\ x>0)$$

The perimeter of Trapezium A is

$$2x+6+2x+2+4\sqrt{26}$$

When $x=5$ $\quad 4(5)+8+4\sqrt{26}$

$$= 18 + \ 4\sqrt{26}$$

(4 marks)

MACKENZIE Jed

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Pinpoint Topics

Topic 1: Expressions, identities and equations. MW: 7

Topic 2: Loci and Construction. Mathswatch Clip: 165

Topic 3: Direct and Inverse Proportion. Mathswatch Clip: 199

Topic 4: Counting Methods. Mathswatch Clip: NA

Topic 5: Proof. Mathswatch Clip: 193

PINPOINT

1) Expressions, identities and equations: Easier

1) Fill in the gaps with an appropriate word from the list
EQUATION, IDENTITY, EXPRESSION, TERMS

$$3x + 4 \; is \; an \; expression \; with \; two \; terms$$

$$2(x+4) \equiv 2x + 8 \; is \; an \; identity$$

$$2x + 3 = 11 \; is \; an \; equation$$

....

(2 Marks)

---

2) Circle the identity

A $5(x+3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x+3)$ D $x^2 + 2 = 27$

(1 Mark)

---

3) Circle the expression

A $5(x+3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x+3)$ D $x^2 + 2 = 27$

....

(1 Mark)

1) Expressions, identities and equations: Medium

4) Annemarie is asked to form an expression, given the following information.
There are a sweets in every packet. I have 3 packets of sweets. I put all the sweets in one container and eat 2 of them. Form an expression for the number of sweets I have left.

Annemarie writes

3a = -2

Write down one mistake Annemarie has made

She has written an equation, (with an equals) she wasn't told how many sweets there are left just that there are two less than 3 bags so she should have written 3a-2 which is an expression

(1 Mark)

---

5) Insert the correct symbol, = or ≡ in the boxes below

$$2x + 3 \quad \boxed{=} \quad 10$$

$$2a \times 3a^2 \quad \boxed{\equiv} \quad 6a^3$$

$$5(x-2) \quad \boxed{\equiv} \quad 5x - 10$$

Remember an equation is true for some values of the variable and an identity is true for all values of the variable

....

(3 Marks)

1) Expressions, identities and equations: Harder

6) Jim says that

$$(x + 4)^2 = x^2 + 16$$

is an identity. Paul says it is an equation and not an identity. Who is correct? You must explain your reasoning.

Paul is right, it is an equation, for the value $x = 0$ the equation is true as

$(0 + 4)^2 = 0^2 + 4^2$ as they are both equal to 16

It is not true for all values of x for example for $x = 1$

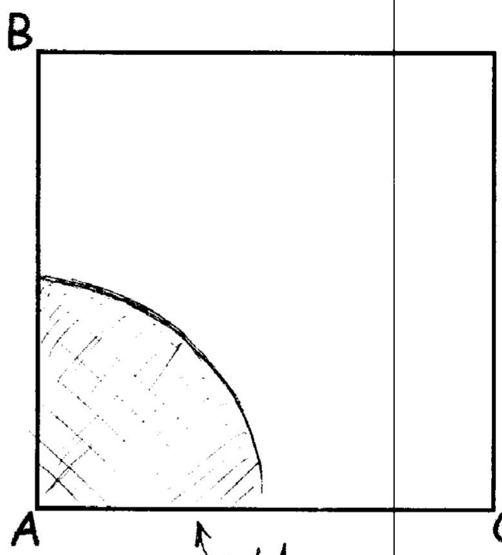
$(1 + 4)^2 = 25$ *and* $1^2 + 16 = 17$ so it does not hold for all values of x

$(x + 4)^2 = x^2 + 8x + 16$ is an identity

(1 Mark)

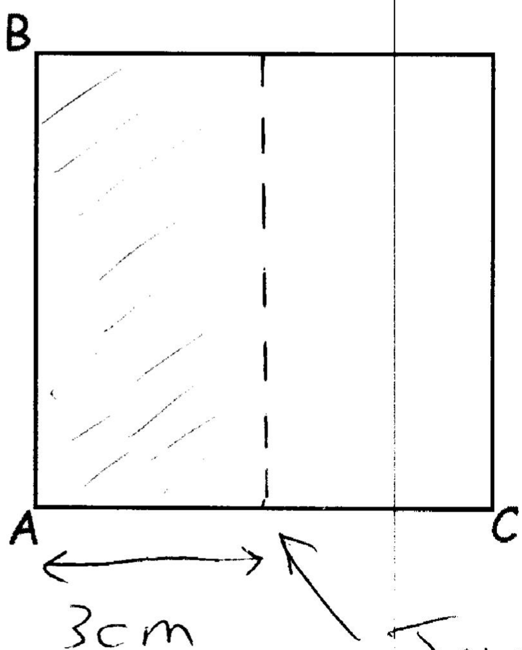
2) Loci and Construction: Easier

1) Shade the area closer than 3cm to point A within the square below:



Use compass at 3cm

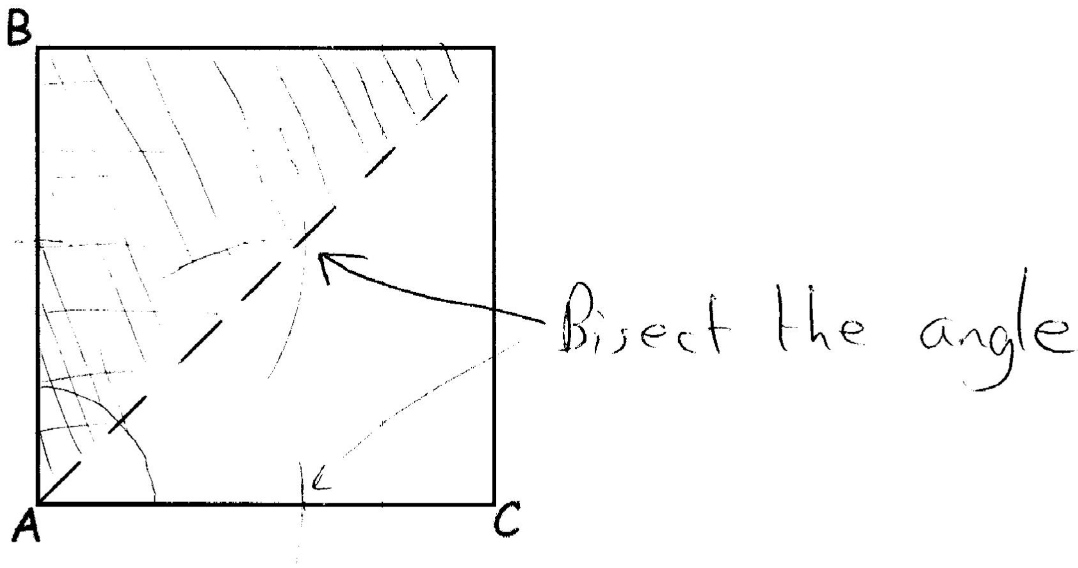
2) Shade the area closer than 3cm to the line AB within the square below:



Just measure 3cm with your ruler

2) Loci and Construction: Medium

3) Shade the area closer to the line AB than AC within the square below:

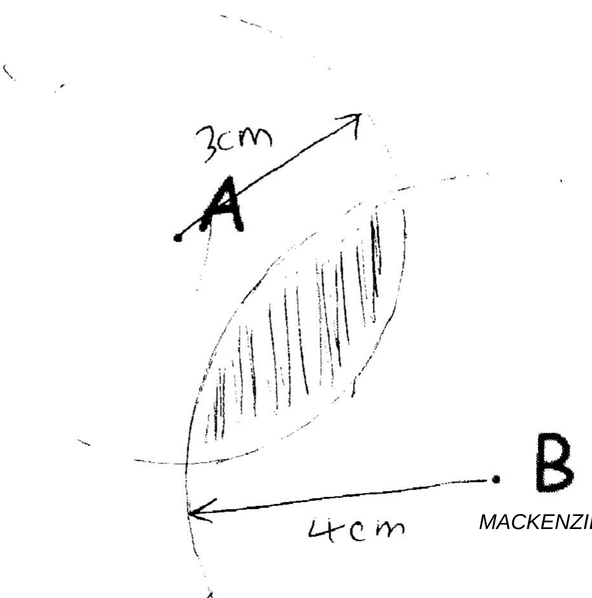


4) Two mobile phone stations transmit a signal.

Mobile phone station A transmits its signal ~~5~~ 3 miles.

Mobile phone station B transmits its signal 4 miles.

When you can receive both signals you experience interference on your phone. Shade below the area of interference.



Scale: 1 cm represents 1 mile

2) Loci and Construction: Harder

5) Mariam wants to plant a flower:

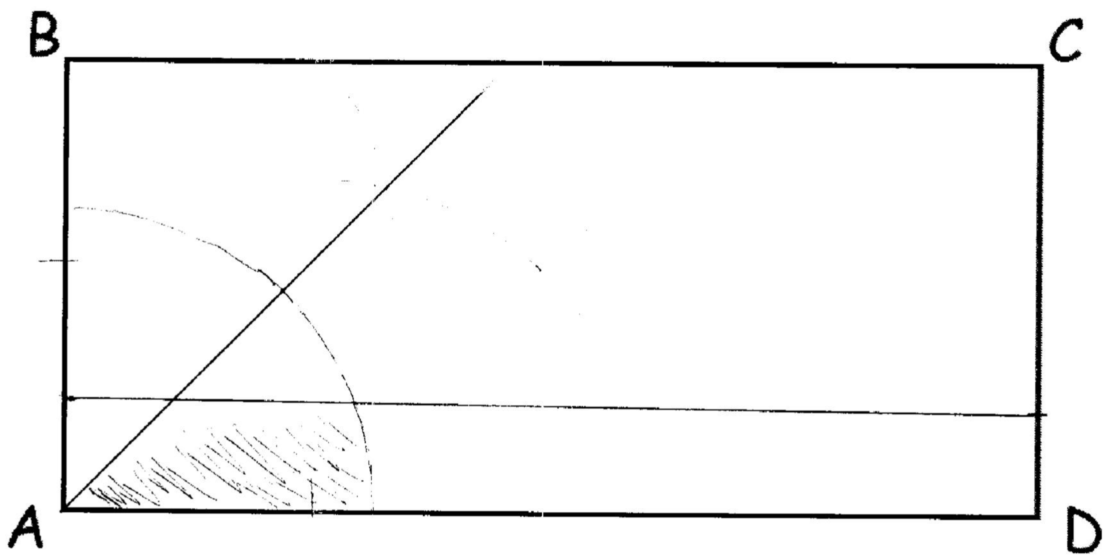
Within 4m of A

Closer to AD than AB

Less than 1.5m from AD.

Shade below the region where Mariam should plant her flower.

Show any construction lines your draw.



Scale: 1 cm represents 1 metre

3) Direct and Inverse Proportion: Easier

1. The weight of a piece of wire is directly proportional to its length.

A piece of wire is 25 cm long and has a weight of 6 grams.
Another piece of the same wire is 30 cm long.

Calculate the weight of the 30 cm piece of wire.

$W = kl$

$6 = 25k$

$k = 0.24$

$w = 0.24l$

$w = 0.24 \times 30$

$w = 7.2$

7.2 grams

(Total 2 marks)

2. A ball falls vertically after being dropped.
The ball falls a distance *d* metres in a time of *t* seconds.
d is directly proportional to the square of *t*.

$d = kt^2$

The ball falls 20 metres in a time of 2 seconds.

(a) Find a formula for *d* in terms of *t*.

$20 = k \times 2^2$

$20 = 4k$

$k = 5$

$d =$ $5t^2$

(3)

(b) Calculate the distance the ball falls in 3 seconds.

$d = 5 \times 3^2$

$d = 5 \times 9 = 45$

45 m

(1)

(c) Calculate the time the ball takes to fall 605 m.

$d = 5t^2$

$605 = 5t^2$

$t^2 = 121$

$t = \pm 11$

(ignore −11 as time can't be −ve)

11 seconds

(3)

(Total 7 marks)

3) Direct and Inverse Proportion: Medium

3. The time, T seconds, it takes a water heater to boil some water is directly proportional to the mass of water, m kg, in the water heater.

$T = km$

When $m = 250$, $T = 600$

(a) Find T when $m = 400$

$600 = 250k$

$k = \frac{600}{250} = 2.4$

$T = 2.4m$

$T = 2.4 \times 400$

$T = 960$

$T =$ 960

(3)

The time, T seconds, it takes a water heater to boil a constant mass of water is inversely proportional to the power, P watts, of the water heater.

$T = \frac{k}{P}$

When $P = 1400$, $T = 360$

(b) Find the value of T when $P = 900$

$T = \frac{504000}{900} = 560$

$360 = \frac{k}{1400}$

$k = 360 \times 1400$

$k = 504{,}000$

$\therefore T = \frac{504000}{P}$

$T =$ 560

(3)

(Total 6 marks)

4. D is proportional to S^2.

$D = kS^2$

$D = 900$ when $S = 20$

$900 = k \times 20^2$

Calculate the value of D when $S = 25$

$900 = 400k$

$k = \frac{900}{400} = 2.25$

$D = 2.25S^2$

$D = 2.25 \times 25^2$

$D =$ 1406.25

(Total 4 marks)

3) Direct and Inverse Proportion: Harder

1) A is inversely proportional to the square root of B. Jim says if B is very large A will be negative. Is he right?

Solution: $A \alpha \dfrac{1}{\sqrt{B}}$

$$A = \frac{k}{\sqrt{B}}$$

Jim is wrong. If B is very large $\sqrt{B}$ will be positive, therefore A will also be positive.

(As B becomes very large, A becomes very small)

____

(4 Marks)

---

2) If Sally drives to work 25% faster than she did yesterday. What would be her percentage decrease in the time taken to get to work?

Solution: $Time = \dfrac{Distance}{Speed}$

$$Time = \frac{D}{1.25}$$

$$Time = \frac{1}{1.25}$$

$$Time = \frac{4}{5}$$

$$\frac{4}{5} = 80\%$$

She will get there 20% faster.

____

(4Marks)

---

4) Counting Methods: Easier

1) Ryan has four shorts of different colours, blue, red, green and yellow.
He has three different T-shirts of different colours, black, white and orange.

Blue shorts and a black T-Shirt would be one possible outfit.
How many different outfits of Shorts and T-Shirts can Ryan wear?

4 shorts × 3 T-shirts = 12 possible outfits

____

(2 Marks)

2) There are 13 boys and 10 girls in a class.
Work out the total number of ways that 1 boy and 1 girl can be chosen from the class.

13 × 10 = 130 ways

____

(2 Marks)

3) There are 7 boys and 10 girls in a class.
Work out the total number of ways that 1 boys and 2 girls can be chosen from the class.

7 × 10 × 9 = 630 ways

____

(2 Marks)

4) Counting Methods: Medium

4) Mason's bank secret pin code is a four digit number and each digit can be the numbers 0, 1, 2, 3, 4, 5, 6 , 7, 8, or 9. For example one possible pin number could be 9021.

a) Mason's bank card is stolen. What is the probability with one guess only that someone correctly guesses Mason's pin number? Leave your answer as a fraction.

$10 \times 10 \times 10 \times 10 = 10000$ possibilities.

Probability of guessing first time = $\frac{1}{10000}$

____

(2 Marks)

Ishmael's bank does not allow any digit to be repeated in his secret pin number. For example 7762 would not be allowed, nor would 5075.

b) Ishmael's bank card is stolen. What is the probability with one guess only that someone correctly guesses Ishmael's pin number? Leave your answer as a fraction.

$10 \times 9 \times 8 \times 7 = 5040$ possibilities.

Probability of guessing first time = $\frac{1}{5040}$

____

(3 Marks)

4) Counting Methods: Harder

5) A restaurant menu has 6 starters, 10 mains and 6 desserts.
A customer can choose from the following meals

- a starter and a main,
- a main and a dessert,
- a starter, a main and a dessert.

Show that there are 480 different ways of choosing a meal at this restaurant.

$$(6 \times 10) + (10 \times 6) + (6 \times 10 \times 6)$$

$$= 60 + 60 + 360$$

$$= 480 \text{ ways}$$

____

(3 Marks)

6) A simple computer password only allows you to use two letters a and b.
"abaab" would be an example of one password which consists of 5 letters.
How many letters must your password contain such that the probability of someone randomly guessing it first time is less than 1 in a 1000?

Use Trial and Improvement:

2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 1024 ways with 10 letters.

Therefore a password of <u>10 letters</u> is needed as $\frac{1}{1024} < \frac{1}{1000}$

____

(3 Marks)

5) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As $2n$ is even $2n+1$ will be odd and so $2n+2$ is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

5) Proof: Medium

2. Prove that $(3n + 1)^2 - (3n - 1)^2$ is a multiple of 4, for all positive integer values of n.

$$(3n+1)^2 - (3n-1)^2$$

$$(3n+1)^2 = (3n+1)(3n+1)$$
$$= 9n^2 + 6n + 1$$

$$(3n-1)^2 = (3n-1)(3n-1)$$
$$= 9n^2 - 6n + 1$$

$$(3n+1)^2 - (3n+1)^2 = (9n^2 + 6n + 1) - (9n^2 - 6n + 1)$$
$$= 9n^2 + 6n + 1 - 9n^2 + 6n - 1$$
$$= 12n$$
$$= 4(3n)$$

which is a multiple of 4

(3 marks)

5) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$$n^2 + (n+1)^2$$

$$= n^2 + n^2 + 2n + 1$$

$$= 2n^2 + 2n + 1$$

$$= 2n(n+1) + 1$$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

$2n(n+1)$ is $2 \times$ an even number which has to be a multiple of 4

So $2n(n+1)+1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

MCLAUGHLIN Laura

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	16 from 20	1 from 1	9 from 10	2 from 5	3 from 3	1 from 1
A02 and 3	40 from 60	7 from 11	11 from 16	5 from 9	13 from 16	4 from 8
Total	56 from 80	8 from 12	20 from 26	7 from 14	16 from 19	5 from 9

Your Pinpoint Topics

Topic 1: Expressions, identities and equations. MW: 7

Topic 2: Proportionality. Mathswatch Clip: 199

Topic 3: Box plots. Mathswatch Clip: 187

Topic 4: Counting Methods. Mathswatch Clip: NA

Topic 5: Proof. Mathswatch Clip: 193

1) Expressions, identities and equations: Easier

1) Fill in the gaps with an appropriate word from the list
EQUATION, IDENTITY, EXPRESSION, TERMS

$$3x + 4 \text{ is an } expression \text{ with two } terms$$

$$2(x+4) \equiv 2x + 8 \text{ is an } identity$$

$$2x + 3 = 11 \text{ is an } equation$$

....

(2 Marks)

---

2) Circle the identity

A $5(x+3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x+3)$ D $x^2 + 2 = 27$

(1 Mark)

---

3) Circle the expression

A $5(x+3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x+3)$ D $x^2 + 2 = 27$

....

(1 Mark)

1) Expressions, identities and equations: Medium

4) Annemarie is asked to form an expression, given the following information.
There are a sweets in every packet. I have 3 packets of sweets. I put all the sweets in one container and eat 2 of them. Form an expression for the number of sweets I have left.

Annemarie writes

3a = -2

Write down one mistake Annemarie has made

She has written an equation, (with an equals) she wasn't told how many sweets there are left just that there are two less than 3 bags so she should have written 3a-2 which is an expression

(1 Mark)

5) Insert the correct symbol, = or ≡ in the boxes below

$$2x + 3 \quad \boxed{=} \quad 10$$

$$2a \times 3a^2 \quad \boxed{\equiv} \quad 6a^3$$

$$5(x - 2) \quad \boxed{\equiv} \quad 5x - 10$$

Remember an equation is true for some values of the variable and an identity is true for all values of the variable

....

(3 Marks)

1) Expressions, identities and equations: Harder

6) Jim says that

$$(x+4)^2 = x^2 + 16$$

is an identity. Paul says it is an equation and not an identity. Who is correct? You must explain your reasoning.

Paul is right, it is an equation, for the value $x = 0$ the equation is true as

$(0+4)^2 = 0^2 + 4^2$ as they are both equal to 16

It is not true for all values of x for example for $x = 1$

$(1+4)^2 = 25$ *and* $1^2 + 16 = 17$ so it does not hold for all values of x

$(x+4)^2 = x^2 + 8x + 16$ is an identity

(1 Mark)

PINPOINT

2) Proportionality: Easier

1) Here is a formula, where V is the volume of a pipe in m^3 and d is the diameter of the pipe in m.

$$V = 8d^2$$

(a) A pipe has volume $2m^3$.
Find the diameter of the pipe.

$2 = 8 \times d^2$
$2 \div 8 = d^2$
$d^2 = 0.25$
$d = \sqrt{0.25} = 0.5$m

(b) Which of these statements is true for the pipe?
Tick one box

☐ It has a volume of $4m^3$ with **exactly double** the diameter in part (a)

☒ It has a volume of $4m^3$ with **less than double** the diameter in part (a)

☐ It has a volume of $4m^3$ with **more than double** the diameter in part (a)

You **must** show working to support your answer

$4 = 8 \times d^2$
$d^2 = 0.5$
$d = \sqrt{0.5} = 0.7$m

(5 Marks)

---

2) Here is a formula, where E is the energy of a particle measured in Joules and v is the velocity of the particle measured in m/s.

$$E = 6v^2$$

(a) A moving particle has 54 Joules of energy.
Find the velocity of the particle.

$54 = 6 \times v^2$
$54 \div 6 = v^2$
$v^2 = 9$
$v = \sqrt{9} = 3$m/s

Which of these statements is true for the particle?

Tick one box

☐ It has 108J of energy when travelling at **exactly double** the velocity in (a)

☒ It has 108J of energy when travelling at **less than double** the velocity in (a)

☐ It has 108J of energy when travelling at **more than double** the velocity in (a)

You **must** show working to support your answer

$108 = 6 \times v^2$
$108 \div 6 = v^2$
$v^2 = 18$
$v = \sqrt{18} = 4.2$m/s

(5 Marks)

2) Proportionality: Medium

3) The table shows pairs of values x and y.

x	6	7
y	480	560

(a) Tick the correct statement

Trial and error:

Is $y \propto x$?

$480 \div 6 = 80$

$560 \div 7 = 80$

$y \propto x$ …Yes…..

$y \propto x^2$ …………..

$y \propto x^3$ …………..

(b) Write a formula for y in terms of x.

$y = \text{k}x$

$480 = 6\text{k}$

$\text{k} = 480 \div 6$

$\text{k} = 80$ => $y = 80x$

(3 Marks)

---

4) The table shows pairs of values x and y.

x	4	5
y	48	75

(i) Tick the correct statement

Trial and error:

Is $y \propto x$?

$48 \div 4 = 12$

$75 \div 5 = 15$

No

Is $y \propto x^2$?

$48 \div 4^2 = 3$

$75 \div 5^2 = 3$

Yes

$y \propto x$ …………..

$y \propto x^2$ … Yes …..

$y \propto x^3$ …………..

(ii) Write a formula for y in terms of x.

$y = \text{k}x^2$

$48 = 4^2\text{k}$

$\text{k} = 48 \div 16$

$\text{k} = 3$ => $y = 3x$

(3 Marks)

---

2) Proportionality: Harder

5) The table shows pairs of values *x* and *y*.

x	3	4
y	8	6

(i) Tick the correct statement

As *x* increases *y* decreases (no further reasoning necessary)

$y \propto x$ ....

$y \propto x^2$ ....

$y \propto \frac{1}{x}$ ...Yes.....

(ii) Write a formula for *y* in terms of *x*.

$y = \frac{k}{x}$

$8 = \frac{k}{3}$

k = 8 × 3

k = 24 => $y = \frac{24}{x}$

(3 Marks)

6) The table shows pairs of values *x* and *y*.

x	2	3
y	9	4

(i) Tick the correct statement

Trial and error:

Is $y \propto \frac{1}{x}$?

$9 \times 2 = 18$

$4 \times 3 = 12$

No

Is $y \propto \frac{1}{x^2}$?

$9 \times 2^2 = 36$

$4 \times 3^2 = 36$

Yes

$y \propto \frac{1}{x}$ ....

$y \propto \frac{1}{x^2}$ ...Yes.....

$y \propto \frac{1}{x^3}$ ....

(ii) Write a formula for *y* in terms of *x*.

$y = \frac{k}{x^2}$

$k = 4 \times 3^2 = 36$ => $y = \frac{36}{x^2}$

(3 Marks)

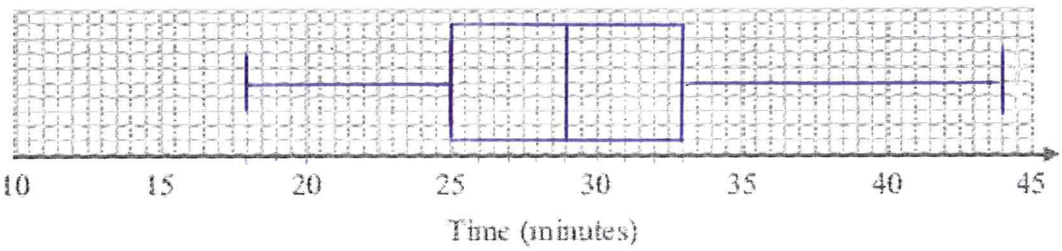
3) Box plots: Easier

2. Sameena recorded the times, in minutes, some girls took to do a jigsaw puzzle.

Sameena used her results to work out the information in this table.

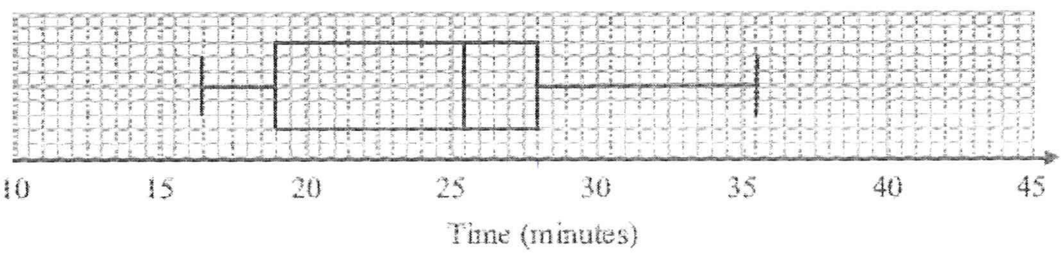
	Minutes
Shortest time	18
Lower quartile	25
Median	29
Upper quartile	33
Longest time	44

(a) On the grid, draw a box plot to show the information in the table.



(2)

The box plot below shows information about the times, in minutes, some boys took to do the same jigsaw puzzle.



(b) Compare the distributions of the girls' times and the boys' times.

The boys median time was less than that of the girls; Boys 25.5mins, Girls 29 mins.

The spread of data for the interquartile range is smaller for the girls (8 mins) than for the boys (9 mins)

(2)

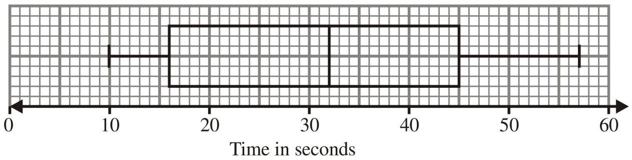
(4 marks)

3) Box plots: Medium

2. (a) 32 1

B1 for 32 (accept 31.5 to 33.5 inclusive)

(b) 3



B1 for ends of whiskers at 9 and 57 (with a box)
B1 for ends of box at 16 and 45/46 ($\pm$0.5)
B1for median marked at "32"or complete box and whisker diagram drawn with a median inside the box

(c) Median(B)>Median(G); on average boys take longer
IQR(B)>IQR(G); times for boys have a greater spread 2

B1 eg for comparison of medians (ft on diagrams)
B1 eg for comparison of (interquartile) ranges (ft on diagram)

[6]

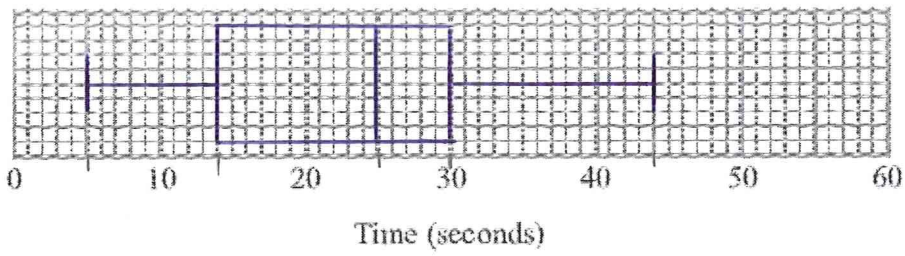
3) Box plots: Harder

7. Here are the times, in seconds, that 15 people waited to be served at Rose's garden centre.

5 9 11 $\boxed{14}$ 15 20 22 $\boxed{25}$ 27 27 28 $\boxed{30}$ 32 35 44

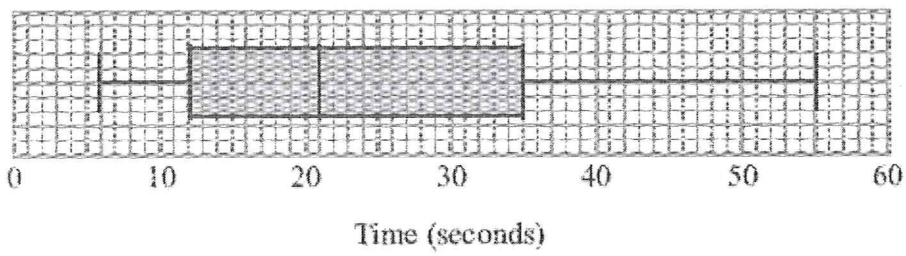
LQ Median UQ.

(a) On the grid, draw a box plot for this information.



(3)

The box plot below shows the distribution of the times that people waited to be served at Green's garden centre.



(b) Compare the distribution of the times that people waited at Rose's garden centre and the distribution of the times that people waited at Green's garden centre.

There was a greater spread of waiting times in the interquartile range for Green's Garden Centre than Rose's Garden centre

The median waiting time is shorter at ~~Rose's~~ Greens than Roses Garden centre.

(2)

(5 marks)

PINPOINT

4) Counting Methods: Easier

1) Ryan has four shorts of different colours, blue, red, green and yellow.
He has three different T-shirts of different colours, black, white and orange.

Blue shorts and a black T-Shirt would be one possible outfit.
How many different outfits of Shorts and T-Shirts can Ryan wear?

4 shorts × 3 T-shirts = 12 possible outfits

____

(2 Marks)

2) There are 13 boys and 10 girls in a class.
Work out the total number of ways that 1 boy and 1 girl can be chosen from the class.

$13 \times 10 = 130$ ways

____

(2 Marks)

3) There are 7 boys and 10 girls in a class.
Work out the total number of ways that 1 boys and 2 girls can be chosen from the class.

$7 \times 10 \times 9 = 630$ ways

____

(2 Marks)

4) Counting Methods: Medium

4) Mason's bank secret pin code is a four digit number and each digit can be the numbers 0, 1, 2, 3, 4, 5, 6 , 7, 8, or 9. For example one possible pin number could be 9021.

a) Mason's bank card is stolen. What is the probability with one guess only that someone correctly guesses Mason's pin number? Leave your answer as a fraction.

$10 \times 10 \times 10 \times 10 = 10000$ possibilities.

Probability of guessing first time = $\frac{1}{10000}$

____

(2 Marks)

Ishmael's bank does not allow any digit to be repeated in his secret pin number. For example 7762 would not be allowed, nor would 5075.

b) Ishmael's bank card is stolen. What is the probability with one guess only that someone correctly guesses Ishmael's pin number? Leave your answer as a fraction.

$10 \times 9 \times 8 \times 7 = 5040$ possibilities.

Probability of guessing first time = $\frac{1}{5040}$

____

(3 Marks)

4) Counting Methods: Harder

5) A restaurant menu has 6 starters, 10 mains and 6 desserts.
A customer can choose from the following meals

- a starter and a main,
- a main and a dessert,
- a starter, a main and a dessert.

Show that there are 480 different ways of choosing a meal at this restaurant.

$$(6 \times 10) + (10 \times 6) + (6 \times 10 \times 6)$$

$$= 60 + 60 + 360$$

$$= 480 \text{ ways}$$

____

(3 Marks)

6) A simple computer password only allows you to use two letters a and b.
"abaab" would be an example of one password which consists of 5 letters.
How many letters must your password contain such that the probability of someone randomly guessing it first time is less than 1 in a 1000?

Use Trial and Improvement:

2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 1024 ways with 10 letters.

Therefore a password of <u>10 letters</u> is needed as $\frac{1}{1024} < \frac{1}{1000}$

____

(3 Marks)

5) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As $2n$ is even $2n+1$ will be odd and so $2n+2$ is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

5) Proof: Medium

8. Prove that

$(n+1)^2 - (n-1)^2 + 1$ is always odd for all positive integer values of n.

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$$
$$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$$
$$= 4n + 1$$

4n is a multiple of 4 so it must be even which means 4n+1 is odd.

(3 marks)

5) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$n^2 + (n+1)^2$

$= n^2 + n^2 + 2n + 1$

$= 2n^2 + 2n + 1$

$= 2n(n+1) + 1$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

$2n(n+1)$ is 2 x an even number which has to be a multiple of 4

So $2n(n+1) + 1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

PINPOINT

MELLISH Aaron

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	15 from 20	1 from 1	5 from 10	5 from 5	3 from 3	1 from 1
A02 and 3	48 from 60	10 from 11	14 from 16	7 from 9	9 from 16	8 from 8
Total	63 from 80	11 from 12	19 from 26	12 from 14	12 from 19	9 from 9

Your Pinpoint Topics

Topic 1: Expressions, identities and equations. MW: 7

Topic 2: Loci and Construction. Mathswatch Clip: 165

Topic 3: Distance Time Graphs. Mathswatch Clip: 143

Topic 4: Counting Methods. Mathswatch Clip: NA

Topic 5: Proof. Mathswatch Clip: 193

PINPOINT

1) Expressions, identities and equations: Easier

1) Fill in the gaps with an appropriate word from the list
EQUATION, IDENTITY, EXPRESSION, TERMS

$$3x + 4 \textit{ is an expression with two terms}$$

$$2(x + 4) \equiv 2x + 8 \textit{ is an identity}$$

$$2x + 3 = 11 \textit{ is an equation}$$

....

(2 Marks)

---

2) Circle the identity

A $5(x + 3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x + 3)$ D $x^2 + 2 = 27$

(1 Mark)

---

3) Circle the expression

A $5(x + 3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x + 3)$ D $x^2 + 2 = 27$

....

(1 Mark)

1) Expressions, identities and equations: Medium

4) Annemarie is asked to form an expression, given the following information.
There are a sweets in every packet. I have 3 packets of sweets. I put all the sweets in one container and eat 2 of them. Form an expression for the number of sweets I have left.

Annemarie writes

3a = -2

Write down one mistake Annemarie has made

She has written an equation, (with an equals) she wasn't told how many sweets there are left just that there are two less than 3 bags so she should have written 3a-2 which is an expression

(1 Mark)

---

5) Insert the correct symbol, = or ≡ in the boxes below

$$2x + 3 \quad \boxed{=} \quad 10$$

$$2a \times 3a^2 \quad \boxed{\equiv} \quad 6a^3$$

$$5(x-2) \quad \boxed{\equiv} \quad 5x - 10$$

Remember an equation is true for some values of the variable and an identity is true for all values of the variable

....

(3 Marks)

1) Expressions, identities and equations: Harder

6) Jim says that

$$(x+4)^2 = x^2 + 16$$

is an identity. Paul says it is an equation and not an identity. Who is correct? You must explain your reasoning.

Paul is right, it is an equation, for the value $x = 0$ the equation is true as

$(0+4)^2 = 0^2 + 4^2$ as they are both equal to 16

It is not true for all values of x for example for $x = 1$

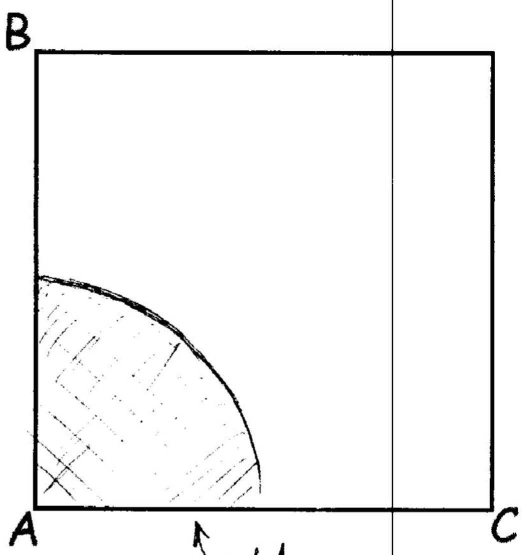
$(1+4)^2 = 25$ *and* $1^2 + 16 = 17$ so it does not hold for all values of x

$(x+4)^2 = x^2 + 8x + 16$ is an identity

(1 Mark)

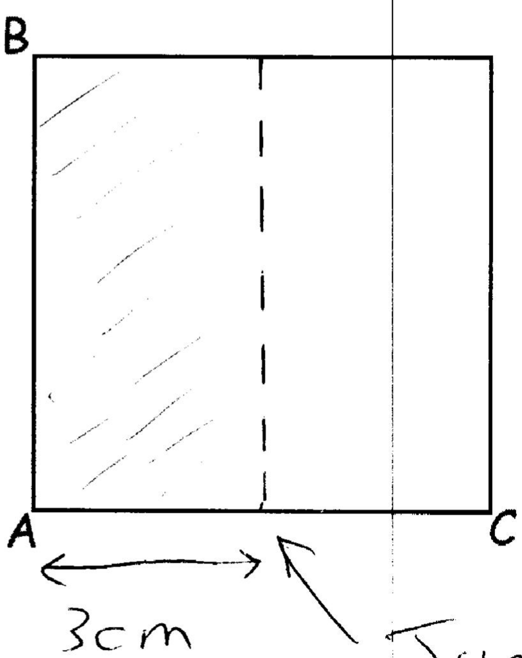
2) Loci and Construction: Easier

1) Shade the area closer than 3cm to point A within the square below:



↖ Use compass at 3cm

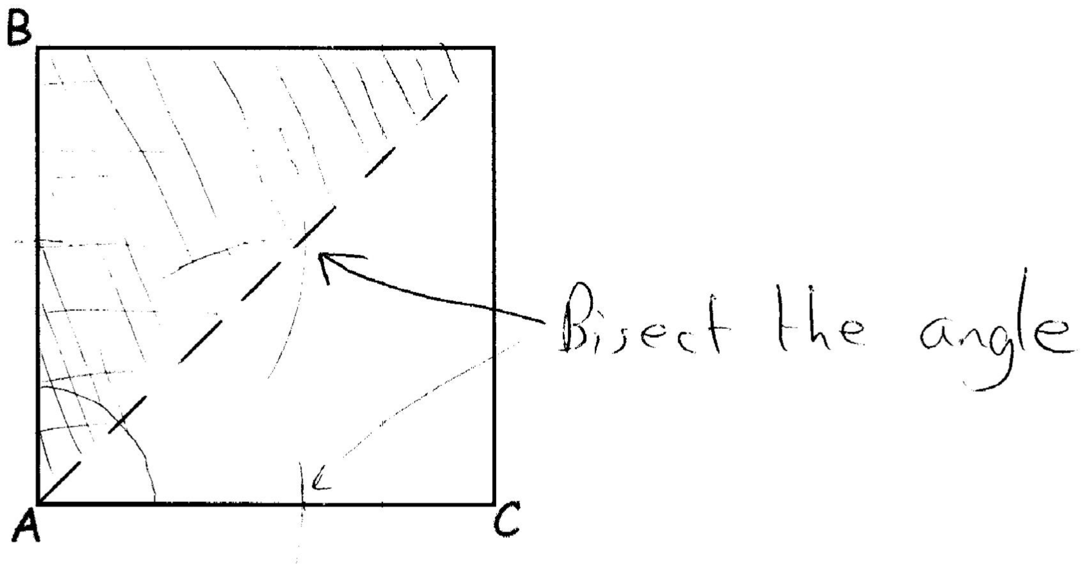
2) Shade the area closer than 3cm to the line AB within the square below:



Just measure 3cm with your ruler

2) Loci and Construction: Medium

3) Shade the area closer to the line AB than AC within the square below:

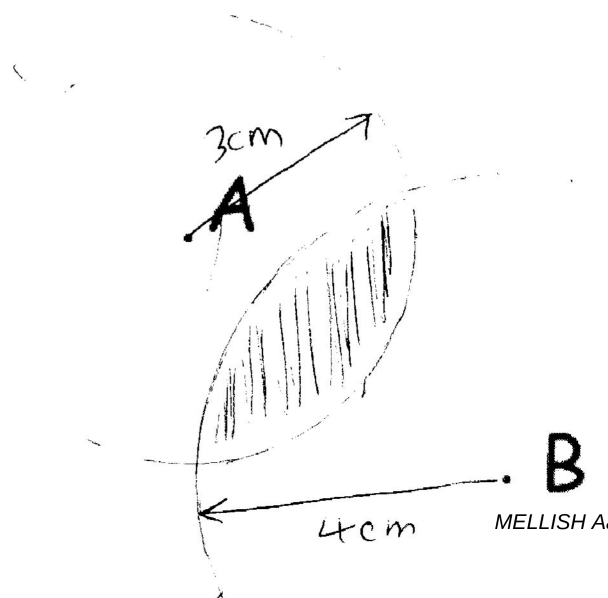


4) Two mobile phone stations transmit a signal.

Mobile phone station A transmits its signal ~~5~~ 3 miles.

Mobile phone station B transmits its signal 4 miles.

When you can receive both signals you experience interference on your phone. Shade below the area of interference.



Scale: 1 cm represents 1 mile

2) Loci and Construction: Harder

5) Mariam wants to plant a flower:

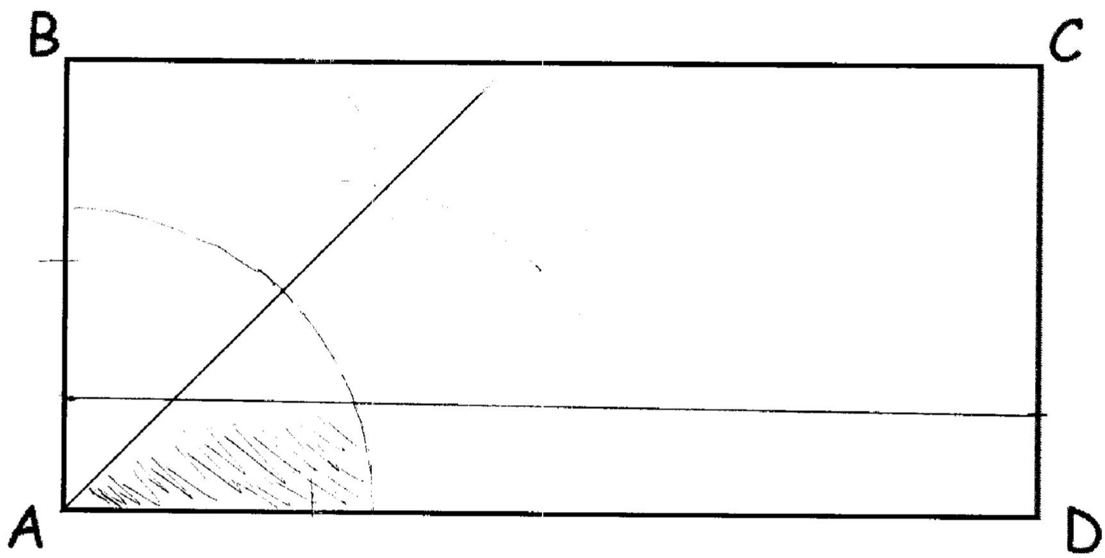
Within 4m of A

Closer to AD than AB

Less than 1.5m from AD.

Shade below the region where Mariam should plant her flower.

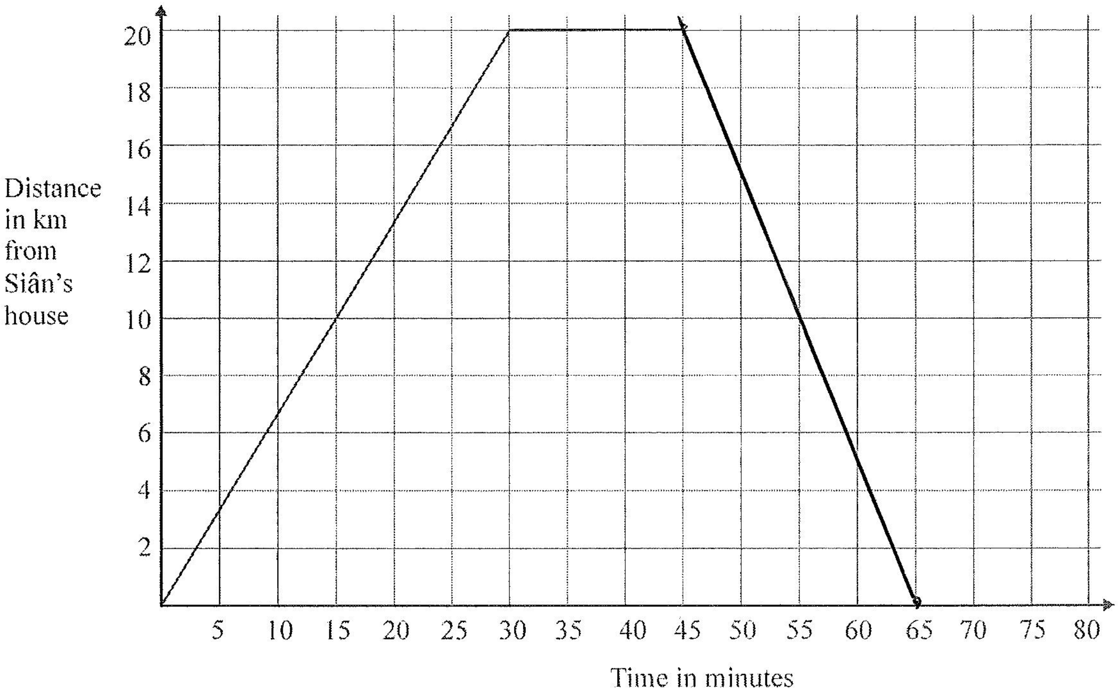
Show any construction lines your draw.



Scale: 1 cm represents 1 metre

3) Distance Time Graphs: Easier

1. Here is part of a travel graph of Siân's journey from her house to the shops and back.



(a) Work out Siân's speed for the first 30 minutes of her journey.
Give your answer in km/h.

distance ÷ time 30 minutes = 0.5 hours.

20 ÷ 0.5 = 40

40 km/h

(2)

Siân spends 15 minutes at the shops.
She then travels back to her house at 60 km/h.

(b) Complete the travel graph.

20km at 60 km/h

20 in 20minutes

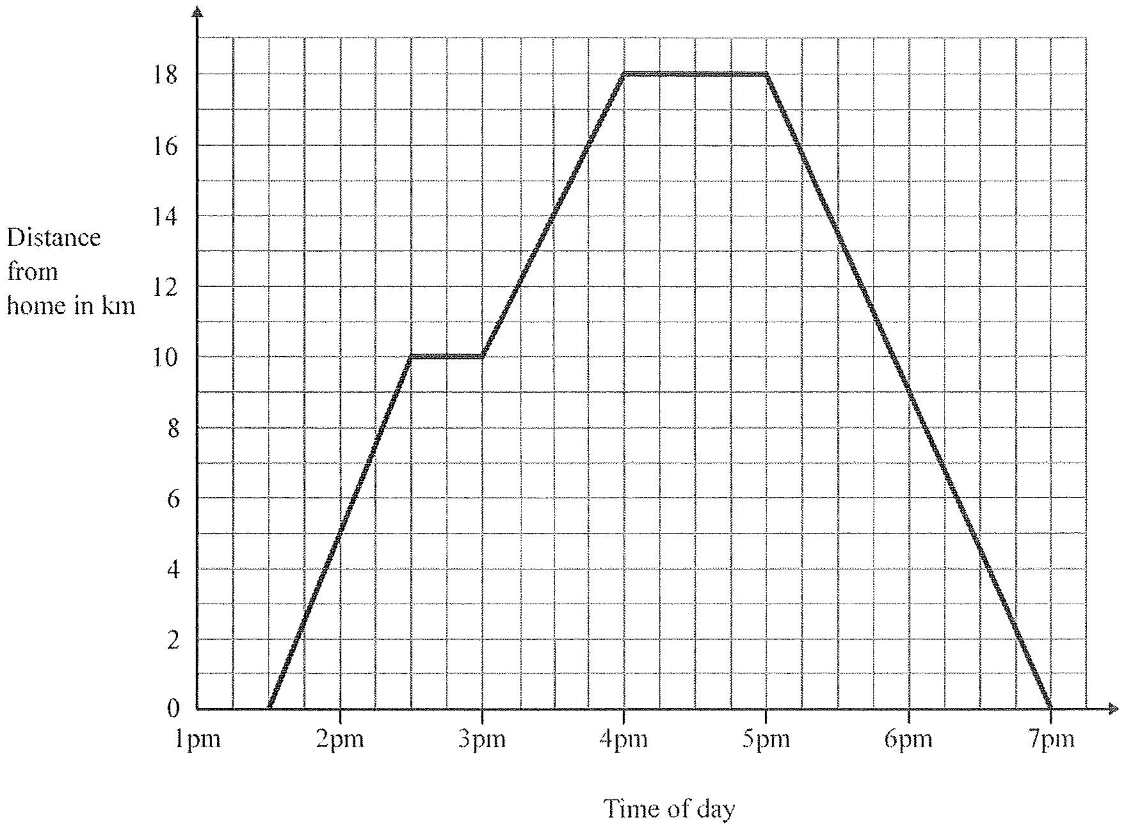
(2)

(Total 4 marks)

PINPOINT

3) Distance Time Graphs: Medium

10. Pete visited his friend and then returned home.
The travel graph shows some information about Pete's journey.



(a) Write down the time that Pete started his journey.

1.30pm

(1)

At 2.30 pm Pete stopped for a rest.

(b) (i) Find his distance from home when he stopped for this rest.

10 km

(ii) How many minutes was this rest?

30 minutes

(2)

Pete stayed with his friend for one hour.
He then returned home.

(c) Work out the total distance travelled by Pete on this journey.

$18 \times 2 = 36$

36 km

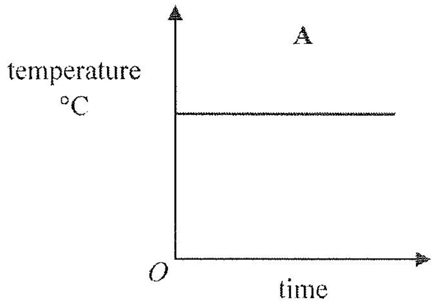
(2)

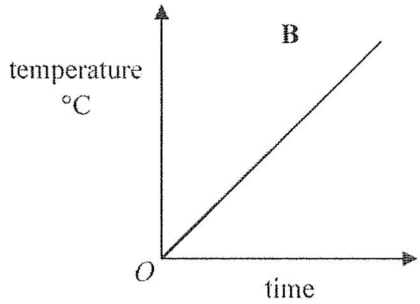
(Total 5 marks)

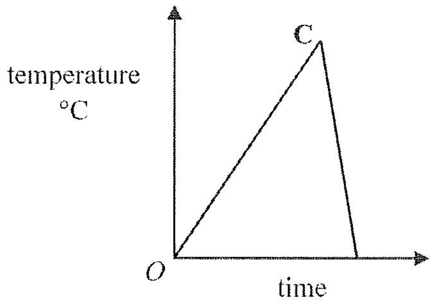
PINPOINT

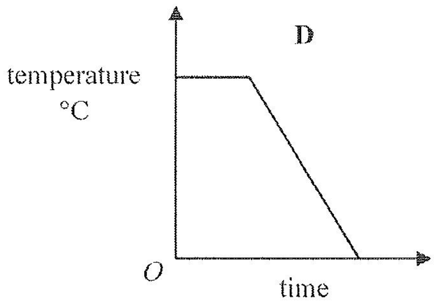
3) Distance Time Graphs: Harder

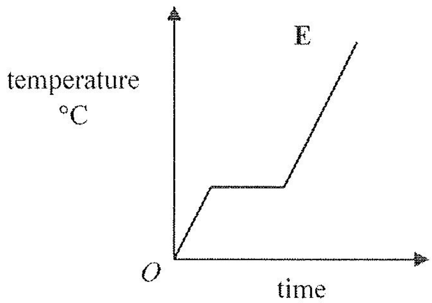
11. Here are six temperature/time graphs.

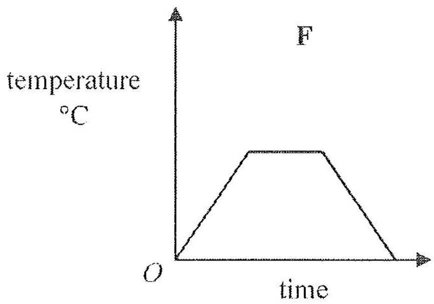












Each sentence in the table describes one of the graphs.
Write the letter of the correct graph next to each sentence.

The first one has been done for you.

The temperature starts at 0°C and keeps rising.	**B**
The temperature stays the same for a time and then falls.	D
The temperature rises and then falls quickly.	C
The temperature is always the same.	A
The temperature rises, stays the same for a time and then falls.	F
The temperature rises, stays the same for a time and then rises again.	E

(Total 3 marks)

4) Counting Methods: Easier

1) Ryan has four shorts of different colours, blue, red, green and yellow.
He has three different T-shirts of different colours, black, white and orange.

Blue shorts and a black T-Shirt would be one possible outfit.
How many different outfits of Shorts and T-Shirts can Ryan wear?

4 shorts × 3 T-shirts = 12 possible outfits

____

(2 Marks)

---

2) There are 13 boys and 10 girls in a class.
Work out the total number of ways that 1 boy and 1 girl can be chosen from the class.

$13 \times 10 = 130$ ways

____

(2 Marks)

---

3) There are 7 boys and 10 girls in a class.
Work out the total number of ways that 1 boys and 2 girls can be chosen from the class.

$7 \times 10 \times 9 = 630$ ways

____

(2 Marks)

4) Counting Methods: Medium

4) Mason's bank secret pin code is a four digit number and each digit can be the numbers 0, 1, 2, 3, 4, 5, 6 , 7, 8, or 9. For example one possible pin number could be 9021.

a) Mason's bank card is stolen. What is the probability with one guess only that someone correctly guesses Mason's pin number? Leave your answer as a fraction.

$10 \times 10 \times 10 \times 10 = 10000$ possibilities.

Probability of guessing first time = $\frac{1}{10000}$

____

(2 Marks)

Ishmael's bank does not allow any digit to be repeated in his secret pin number. For example 7762 would not be allowed, nor would 5075.

b) Ishmael's bank card is stolen. What is the probability with one guess only that someone correctly guesses Ishmael's pin number? Leave your answer as a fraction.

$10 \times 9 \times 8 \times 7 = 5040$ possibilities.

Probability of guessing first time = $\frac{1}{5040}$

____

(3 Marks)

4) Counting Methods: Harder

5) A restaurant menu has 6 starters, 10 mains and 6 desserts.
A customer can choose from the following meals

- a starter and a main,
- a main and a dessert,
- a starter, a main and a dessert.

Show that there are 480 different ways of choosing a meal at this restaurant.

$$(6 \times 10) + (10 \times 6) + (6 \times 10 \times 6)$$

$$= 60 + 60 + 360$$

$$= 480 \text{ ways}$$

____

(3 Marks)

---

6) A simple computer password only allows you to use two letters a and b.
"abaab" would be an example of one password which consists of 5 letters.
How many letters must your password contain such that the probability of someone randomly guessing it first time is less than 1 in a 1000?

Use Trial and Improvement:

2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 1024 ways with 10 letters.

Therefore a password of <u>10 letters</u> is needed as $\frac{1}{1024} < \frac{1}{1000}$

____

(3 Marks)

---

5) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As 2n is even 2n+1 will be odd and so 2n+2 is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

5) Proof: Medium

8. Prove that

$(n+1)^2 - (n-1)^2 + 1$ is always odd for all positive integer values of n.

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$

$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$

$= 4n + 1$

4n is a multiple of 4 so it must be even which means 4n+1 is odd.

(3 marks)

5) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$n^2 + (n+1)^2$

$= n^2 + n^2 + 2n + 1$

$= 2n^2 + 2n + 1$

$= 2n(n+1) + 1$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

$2n(n+1)$ is $2 \times$ an even number which has to be a multiple of 4

So $2n(n+1) + 1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

PINPOINT

PAVEY Samuel

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
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A02 and 3	39 from 60	5 from 11	12 from 16	6 from 9	13 from 16	3 from 8
Total	55 from 80	6 from 12	18 from 26	11 from 14	16 from 19	4 from 9

Your Pinpoint Topics

Topic 1: Expressions, identities and equations. MW: 7

Topic 2: Proportionality. Mathswatch Clip: 199

Topic 3: Box plots. Mathswatch Clip: 187

Topic 4: Counting Methods. Mathswatch Clip: NA

Topic 5: Proof. Mathswatch Clip: 193

PINPOINT

1) Expressions, identities and equations: Easier

1) Fill in the gaps with an appropriate word from the list
EQUATION, IDENTITY, EXPRESSION, TERMS

$$3x + 4 \; is \; an \; expression \; with \; two \; terms$$

$$2(x+4) \equiv 2x + 8 \; is \; an \; identity$$

$$2x + 3 = 11 \; is \; an \; equation$$

....

(2 Marks)

---

2) Circle the identity

A $5(x+3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x+3)$ D $x^2 + 2 = 27$

(1 Mark)

---

3) Circle the expression

A $5(x+3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x+3)$ D $x^2 + 2 = 27$

....

(1 Mark)

1) Expressions, identities and equations: Medium

4) Annemarie is asked to form an expression, given the following information. There are a sweets in every packet. I have 3 packets of sweets. I put all the sweets in one container and eat 2 of them. Form an expression for the number of sweets I have left.

Annemarie writes

3a = -2

Write down one mistake Annemarie has made

She has written an equation, (with an equals) she wasn't told how many sweets there are left just that there are two less than 3 bags so she should have written 3a-2 which is an expression

(1 Mark)

5) Insert the correct symbol, = or ≡ in the boxes below

$$2x + 3 \quad \boxed{=} \quad 10$$

$$2a \times 3a^2 \quad \boxed{\equiv} \quad 6a^3$$

$$5(x - 2) \quad \boxed{\equiv} \quad 5x - 10$$

Remember an equation is true for some values of the variable and an identity is true for all values of the variable

....

(3 Marks)

1) Expressions, identities and equations: Harder

6) Jim says that

$$(x + 4)^2 = x^2 + 16$$

is an identity. Paul says it is an equation and not an identity. Who is correct? You must explain your reasoning.

Paul is right, it is an equation, for the value $x = 0$ the equation is true as

$(0 + 4)^2 = 0^2 + 4^2$ as they are both equal to 16

It is not true for all values of x for example for $x = 1$

$(1 + 4)^2 = 25$ and $1^2 + 16 = 17$ so it does not hold for all values of x

$(x + 4)^2 = x^2 + 8x + 16$ is an identity

(1 Mark)

2) Proportionality: Easier

1) Here is a formula, where V is the volume of a pipe in m^3 and d is the diameter of the pipe in m.

$$V = 8d^2$$

(a) A pipe has volume $2m^3$.
Find the diameter of the pipe.

$2 = 8 \times d^2$
$2 \div 8 = d^2$
$d^2 = 0.25$
$d = \sqrt{0.25} = 0.5$m

(b) Which of these statements is true for the pipe?
Tick one box

- [ ] It has a volume of $4m^3$ with **exactly double** the diameter in part (a)
- [x] It has a volume of $4m^3$ with **less than double** the diameter in part (a)
- [ ] It has a volume of $4m^3$ with **more than double** the diameter in part (a)

You **must** show working to support your answer

$4 = 8 \times d^2$
$d^2 = 0.5$
$d = \sqrt{0.5} = 0.7$m

(5 Marks)

---

2) Here is a formula, where E is the energy of a particle measured in Joules and v is the velocity of the particle measured in m/s.

$$E = 6v^2$$

(a) A moving particle has 54 Joules of energy.
Find the velocity of the particle.

$54 = 6 \times v^2$
$54 \div 6 = v^2$
$v^2 = 9$
$v = \sqrt{9} = 3$m/s

Which of these statements is true for the particle?

Tick one box

- [ ] It has 108J of energy when travelling at **exactly double** the velocity in (a)
- [x] It has 108J of energy when travelling at **less than double** the velocity in (a)
- [ ] It has 108J of energy when travelling at **more than double** the velocity in (a)

You **must** show working to support your answer

$108 = 6 \times v^2$
$108 \div 6 = v^2$
$v^2 = 18$
$v = \sqrt{18} = 4.2$m/s

(5 Marks)

---

2) Proportionality: Medium

3) The table shows pairs of values x and y.

x	6	7
y	480	560

(a) Tick the correct statement

Trial and error:

Is $y \propto x$?

$480 \div 6 = 80$

$560 \div 7 = 80$

$y \propto x$ …Yes…..

$y \propto x^2$ …………..

$y \propto x^3$ …………..

(b) Write a formula for y in terms of x.

$y = kx$

$480 = 6k$

$k = 480 \div 6$

$k = 80$ => $y = 80x$

(3 Marks)

4) The table shows pairs of values x and y.

x	4	5
y	48	75

(i) Tick the correct statement

Trial and error:

Is $y \propto x$?

$48 \div 4 = 12$

$75 \div 5 = 15$

No

Is $y \propto x^2$?

$48 \div 4^2 = 3$

$75 \div 5^2 = 3$

Yes

$y \propto x$ …………..

$y \propto x^2$ … Yes …..

$y \propto x^3$ …………..

(ii) Write a formula for y in terms of x.

$y = kx^2$

$48 = 4^2k$

$k = 48 \div 16$

$k = 3$ => $y = 3x$

(3 Marks)

2) Proportionality: Harder

5) The table shows pairs of values *x* and *y*.

x	3	4
y	8	6

(i) Tick the correct statement

As *x* increases *y* decreases (no further reasoning necessary)

$y \propto x$ …………..

$y \propto x^2$ …………..

$y \propto \frac{1}{x}$ …Yes…..

(ii) Write a formula for *y* in terms of *x*.

$y = \frac{k}{x}$

$8 = \frac{k}{3}$

$k = 8 \times 3$

$k = 24$ => $y = \frac{24}{x}$

(3 Marks)

6) The table shows pairs of values *x* and *y*.

x	2	3
y	9	4

(i) Tick the correct statement

Trial and error:

Is $y \propto \frac{1}{x}$?

$9 \times 2 = 18$

$4 \times 3 = 12$

No

Is $y \propto \frac{1}{x^2}$?

$9 \times 2^2 = 36$

$4 \times 3^2 = 36$

Yes

$y \propto \frac{1}{x}$ …………..

$y \propto \frac{1}{x^2}$ …Yes…..

$y \propto \frac{1}{x^3}$ …………..

(ii) Write a formula for *y* in terms of *x*.

$y = \frac{k}{x^2}$

$k = 4 \times 3^2 = 36$ => $y = \frac{36}{x^2}$

(3 Marks)

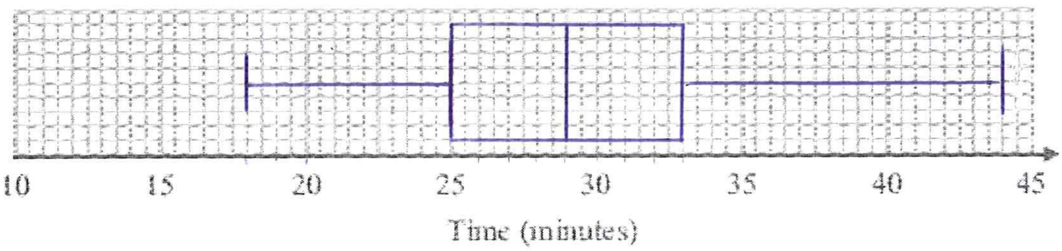
3) Box plots: Easier

2. Sameena recorded the times, in minutes, some girls took to do a jigsaw puzzle.

Sameena used her results to work out the information in this table.

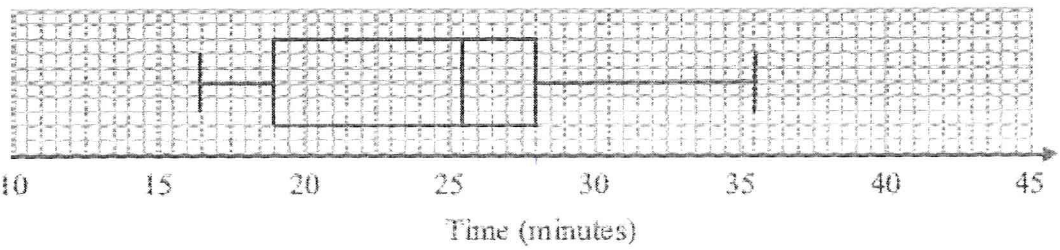
	Minutes
Shortest time	18
Lower quartile	25
Median	29
Upper quartile	33
Longest time	44

(a) On the grid, draw a box plot to show the information in the table.



(2)

The box plot below shows information about the times, in minutes, some boys took to do the same jigsaw puzzle.



(b) Compare the distributions of the girls' times and the boys' times.

The boys median time was less than that of the girls; Boys 25.5mins, Girls 29 mins.

The spread of data for the interquartile range is smaller for the girls (8 mins) than for the boys (9 mins).

(2)

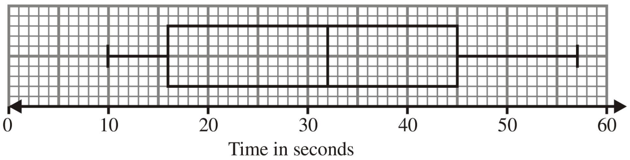
(4 marks)

3) Box plots: Medium

2. (a) 32 — 1

B1 for 32 (accept 31.5 to 33.5 inclusive)

(b) — 3



B1 for ends of whiskers at 9 and 57 (with a box)
B1 for ends of box at 16 and 45/46 (±0.5)
B1for median marked at "32"or complete box and whisker diagram drawn with a median inside the box

(c) Median(B)>Median(G); on average boys take longer
IQR(B)>IQR(G); times for boys have a greater spread — 2

B1 eg for comparison of medians (ft on diagrams)
B1 eg for comparison of (interquartile) ranges (ft on diagram)

[6]

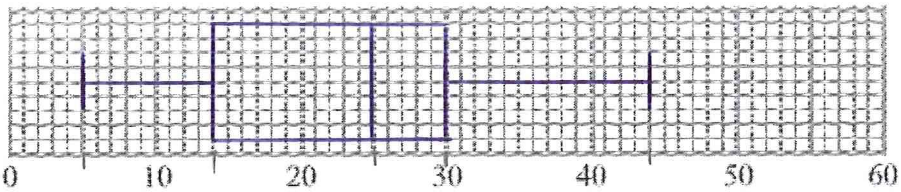
3) Box plots: Harder

7. Here are the times, in seconds, that 15 people waited to be served at Rose's garden centre.

5 9 11 $\boxed{14}$ 15 20 22 $\boxed{25}$ 27 27 28 $\boxed{30}$ 32 35 44

LQ (14), Median (25), UQ (30).

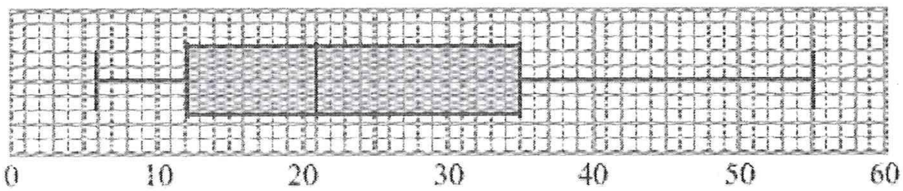
(a) On the grid, draw a box plot for this information.



Time (seconds)

(3)

The box plot below shows the distribution of the times that people waited to be served at Green's garden centre.



Time (seconds)

(b) Compare the distribution of the times that people waited at Rose's garden centre and the distribution of the times that people waited at Green's garden centre.

There was a greater spread of waiting times in the interquartile range for Green's Garden Centre than Rose's Garden centre

The median waiting time is shorter at ~~Roses's~~ Greens than Roses Garden centre.

(2)

(5 marks)

4) Counting Methods: Easier

1) Ryan has four shorts of different colours, blue, red, green and yellow.
He has three different T-shirts of different colours, black, white and orange.

Blue shorts and a black T-Shirt would be one possible outfit.
How many different outfits of Shorts and T-Shirts can Ryan wear?

4 shorts × 3 T-shirts = 12 possible outfits

____

(2 Marks)

2) There are 13 boys and 10 girls in a class.
Work out the total number of ways that 1 boy and 1 girl can be chosen from the class.

$13 \times 10 = 130$ ways

____

(2 Marks)

3) There are 7 boys and 10 girls in a class.
Work out the total number of ways that 1 boys and 2 girls can be chosen from the class.

$7 \times 10 \times 9 = 630$ ways

____

(2 Marks)

4) Counting Methods: Medium

4) Mason's bank secret pin code is a four digit number and each digit can be the numbers 0, 1, 2, 3, 4, 5, 6 , 7, 8, or 9. For example one possible pin number could be 9021.

a) Mason's bank card is stolen. What is the probability with one guess only that someone correctly guesses Mason's pin number? Leave your answer as a fraction.

$10 \times 10 \times 10 \times 10 = 10000$ possibilities.

Probability of guessing first time = $\frac{1}{10000}$

____

(2 Marks)

Ishmael's bank does not allow any digit to be repeated in his secret pin number. For example 7762 would not be allowed, nor would 5075.

b) Ishmael's bank card is stolen. What is the probability with one guess only that someone correctly guesses Ishmael's pin number? Leave your answer as a fraction.

$10 \times 9 \times 8 \times 7 = 5040$ possibilities.

Probability of guessing first time = $\frac{1}{5040}$

____

(3 Marks)

4) Counting Methods: Harder

5) A restaurant menu has 6 starters, 10 mains and 6 desserts.
A customer can choose from the following meals

- a starter and a main,
- a main and a dessert,
- a starter, a main and a dessert.

Show that there are 480 different ways of choosing a meal at this restaurant.

$$(6 \times 10) + (10 \times 6) + (6 \times 10 \times 6)$$

$$= 60 + 60 + 360$$

$$= 480 \text{ ways}$$

____

(3 Marks)

6) A simple computer password only allows you to use two letters a and b.
"abaab" would be an example of one password which consists of 5 letters.
How many letters must your password contain such that the probability of someone randomly guessing it first time is less than 1 in a 1000?

Use Trial and Improvement:

2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 1024 ways with 10 letters.

Therefore a password of <u>10 letters</u> is needed as $\frac{1}{1024} < \frac{1}{1000}$

____

(3 Marks)

5) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As $2n$ is even $2n+1$ will be odd and so $2n+2$ is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

5) Proof: Medium

8. Prove that

$(n + 1)^2 - (n - 1)^2 + 1$ is always odd for all positive integer values of n.

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$

$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$

$= 4n + 1$

4n is a multiple of 4 so it must be even which means 4n+1 is odd.

(3 marks)

5) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$$n^2 + (n+1)^2$$

$$= n^2 + n^2 + 2n + 1$$

$$= 2n^2 + 2n + 1$$

$$= 2n(n+1) + 1$$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

$2n(n+1)$ is $2 \times$ an even number which has to be a multiple of 4

So $2n(n+1) + 1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

RYAN Natalie

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	16 from 20	1 from 1	6 from 10	5 from 5	3 from 3	1 from 1
A02 and 3	31 from 60	3 from 11	11 from 16	4 from 9	8 from 16	5 from 8
Total	47 from 80	4 from 12	17 from 26	9 from 14	11 from 19	6 from 9

Your Pinpoint Topics

Topic 1: Expressions, identities and equations. MW: 7

Topic 2: Recognising cubic and quadratic graphs. MW: 99

Topic 3: Probability from tables. Mathswatch Clip: NA

Topic 4: Loci and Construction. Mathswatch Clip: 165

Topic 5: Distance Time Graphs. Mathswatch Clip: 143

1) Expressions, identities and equations: Easier

1) Fill in the gaps with an appropriate word from the list
EQUATION, IDENTITY, EXPRESSION, TERMS

$$3x + 4 \ is \ an \ expression \ with \ two \ terms$$

$$2(x + 4) \equiv 2x + 8 \ is \ an \ identity$$

$$2x + 3 = 11 \ is \ an \ equation$$

....

(2 Marks)

2) Circle the identity

A $5(x + 3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x + 3)$ D $x^2 + 2 = 27$

(1 Mark)

3) Circle the expression

A $5(x + 3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x + 3)$ D $x^2 + 2 = 27$

....

(1 Mark)

1) Expressions, identities and equations: Medium

4) Annemarie is asked to form an expression, given the following information.
There are a sweets in every packet. I have 3 packets of sweets. I put all the sweets in one container and eat 2 of them. Form an expression for the number of sweets I have left.

Annemarie writes

3a = -2

Write down one mistake Annemarie has made

She has written an equation, (with an equals) she wasn't told how many sweets there are left just that there are two less than 3 bags so she should have written 3a-2 which is an expression

(1 Mark)

---

5) Insert the correct symbol, = or ≡ in the boxes below

$$2x + 3 \quad \boxed{=} \quad 10$$

$$2a \times 3a^2 \quad \boxed{\equiv} \quad 6a^3$$

$$5(x - 2) \quad \boxed{\equiv} \quad 5x - 10$$

Remember an equation is true for some values of the variable and an identity is true for all values of the variable

…………………………

(3 Marks)

1) Expressions, identities and equations: Harder

6) Jim says that

$$(x+4)^2 = x^2 + 16$$

is an identity. Paul says it is an equation and not an identity. Who is correct? You must explain your reasoning.

Paul is right, it is an equation, for the value $x = 0$ the equation is true as

$(0+4)^2 = 0^2 + 4^2$ as they are both equal to 16

It is not true for all values of x for example for $x = 1$

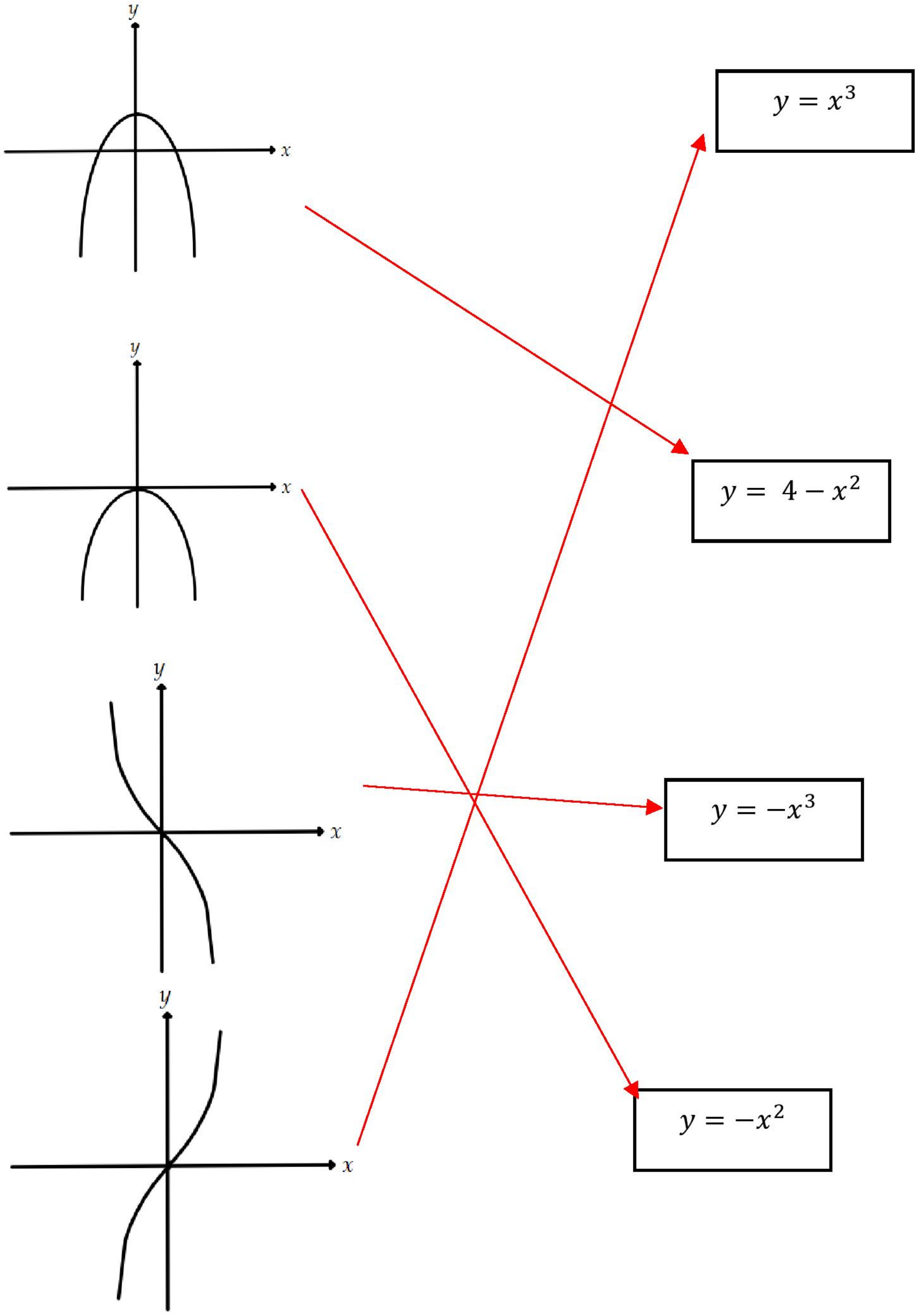
$(1+4)^2 = 25$ *and* $1^2 + 16 = 17$ so it does not hold for all values of x

$(x+4)^2 = x^2 + 8x + 16$ is an identity

(1 Mark)

2) Recognising cubic and quadratic graphs: Easier

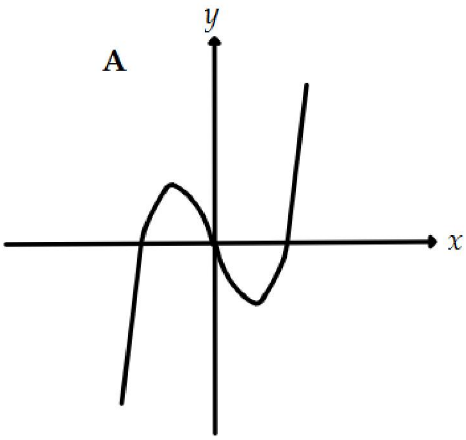
1) Karen has sketched quadratic and cubic graphs. Match each graph with its possible equation, the first one is done for you



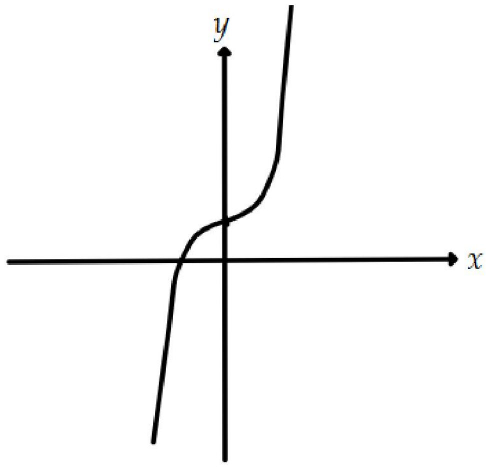
2) Recognising cubic and quadratic graphs: Medium

2) Harry has sketched some cubic graphs,

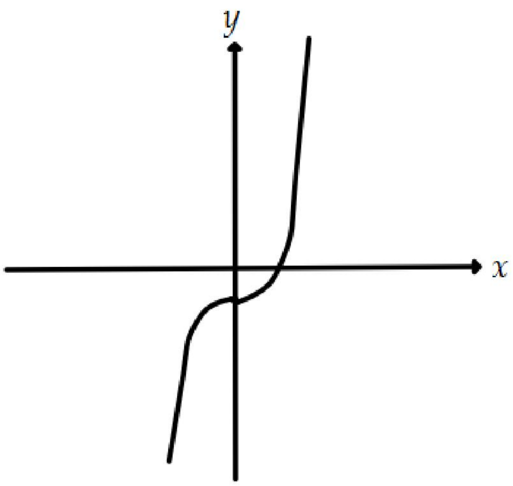
A



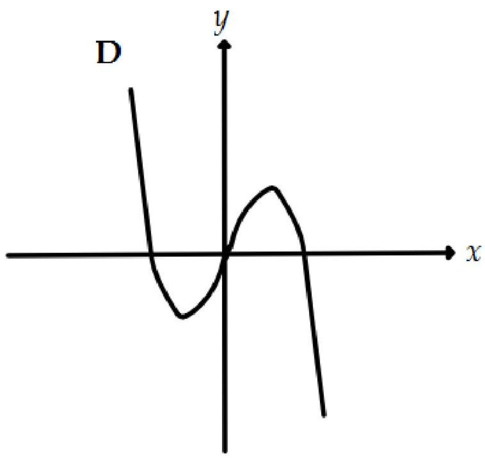
B



C



D



a) Write down the letter of the graph that could have the equation $y = x^3 - 3$

C

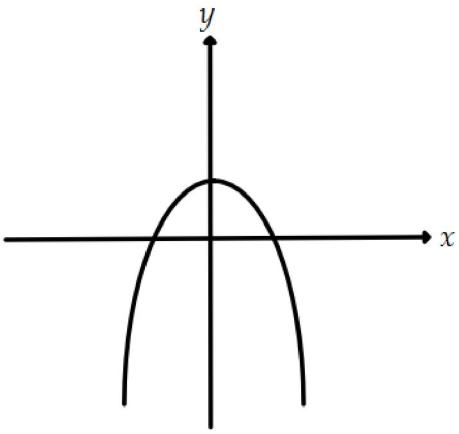
____

(1 Mark)

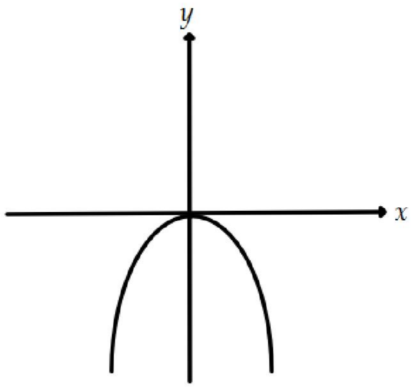
2) Recognising cubic and quadratic graphs: Harder

3) Harry has sketched some quadratic graphs,

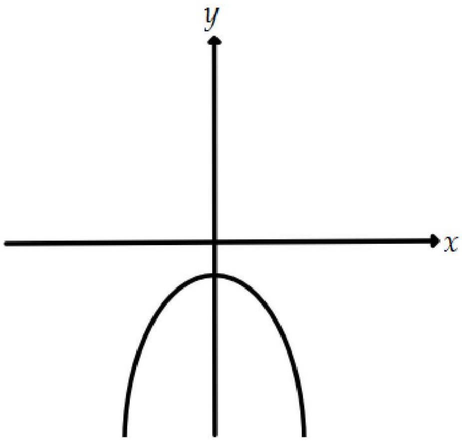
A



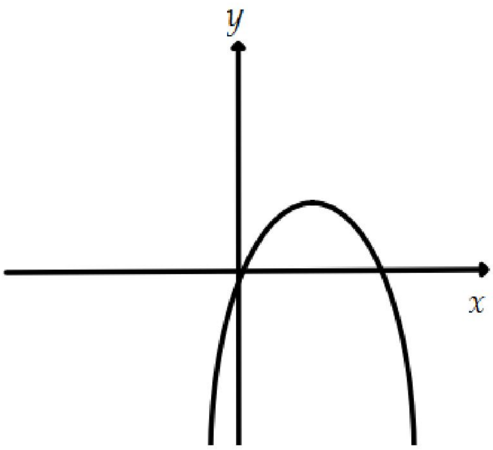
B



C



D



a) Write down the letter of the graph that could have the equation $y = x^2 - 4$

C

____

(1 Mark)

b) Write down the letter of the graph that could have the equation $y = x^2 - 4x$

D

____

(1 Mark)

3) Probability from tables: Easier

1) A spinner has 5 sections of different sizes and colours. When the spinner is spun, the probability of it landing on each of the colours is given in the table below.

   Show that P(red) = 0.3

Colour	Green	Red	Yellow	Orange	Black
Probability	0.2		0.1	0.05	0.35

$0.2 + 0.1 + 0.05 + 0.35 = 0.7$

$1 - 0.7 = 0.3$

(1 Mark)

2) A biased dice is rolled. The probability of it landing on each number is given in the table below. It has equal chance of landing on all the even numbers.

   What is the probability that is lands on a 6?

Number	1	2	3	4	5	6
Probability	0.05	0.2	0.1	0.2	0.25	0.2

$0.05 + 0.1 + 0.25 = 0.4$
$1 - 0.4 = 0.6$
$0.6 \div 3 = 0.2$

(2 Marks)

3) Probability from tables: Medium

3) There are only red, green, blue and yellow counters in a bag.

Colour	Red	Green	Blue	Yellow
Probability	0.45	0.1	0.15	0.3

The table shows the probability that each colour is chosen when one counter is taken at random from a bag. There are 3 times as many red counters as blue counters in the bag. Fill the table.

$0.1 + 0.3 = 0.4$
$1 - 0.4 = 0.6$
$4x = 0.6$
$x = 0.15$
$3 \times 0.15 = 0.45$

(3 Marks)

4) In a bag the ratio of green to blue to red counters in 9:5:6. These are no other colours. Fill in the probability table.

Colour	Green	Blue	Red
Probability	0.45	0.25	0.3

$9 + 5 + 6 = 20$
Green $= \frac{9}{20} = 0.45$
Blue $= \frac{5}{20} = 0.25$
Red $= \frac{6}{20} = 0.3$

(3 Marks)

3) Probability from tables: Harder

5) The probabilities of landing on each number on a biased dice are shown in the table below.
Find P(3)

Score	1	2	3	4	5	6
Probability	$2x$	0.31	$4x$	x	$3x + 0.1$	0.005

$2x + 4x + x + 3x + 0.31 + 0.1 + 0.005$
$10x + 0.415 = 1$
$10x = 0.585$
$x = 0.0585$
$P(3) = 4(0.0585) = 0.234$

(3 Marks)

6) There are only red, yellow, green, and purple counters in a bag. The number of each colour of counters is shown in the table

Colour	Green	Red	Yellow	Purple
Number	12	$2x - 1$	$4x$	$7x - 9$

Given that the probability of getting a green counter is $\frac{3}{50}$

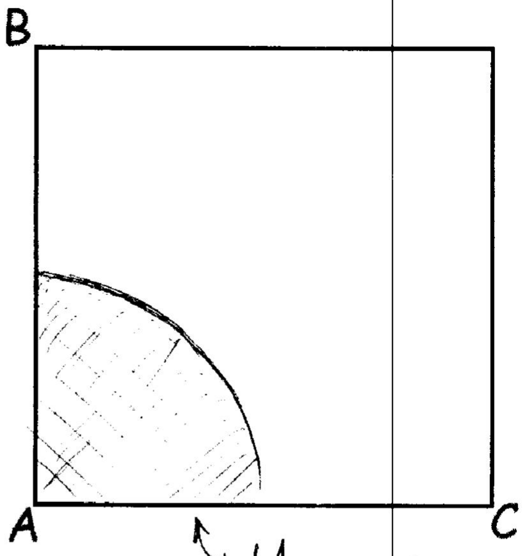
Find the probability of getting a purple counter

$12 \div \frac{3}{50} = 200$ (Total number of counters)
$13x + 2 = 200$
$x = \frac{198}{13}$
Probability of purple $= \frac{7\left(\frac{198}{13}\right)-9}{200} = \frac{1269}{2600}$

(4 Marks)

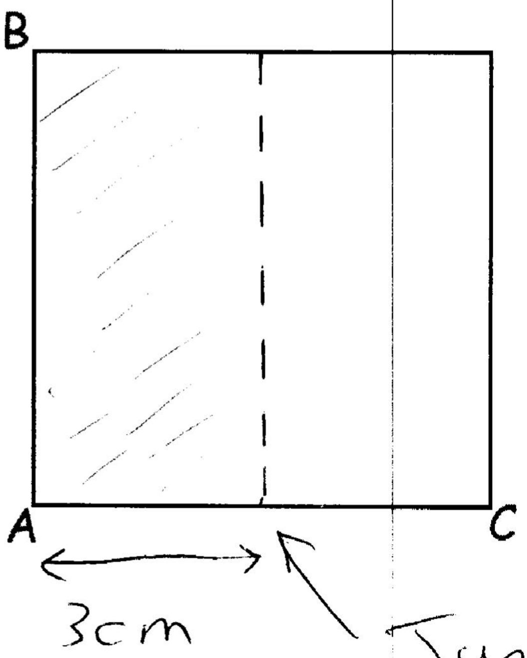
4) Loci and Construction: Easier

1) Shade the area closer than 3cm to point A within the square below:



Use compass at 3cm

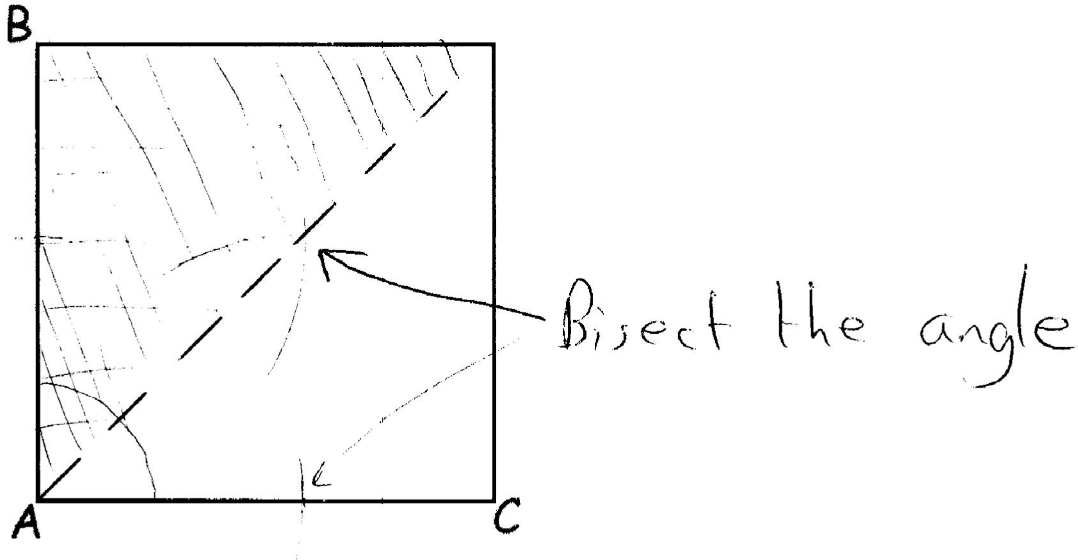
2) Shade the area closer than 3cm to the line AB within the square below:



Just measure 3cm with your ruler

4) Loci and Construction: Medium

3) Shade the area closer to the line AB than AC within the square below:

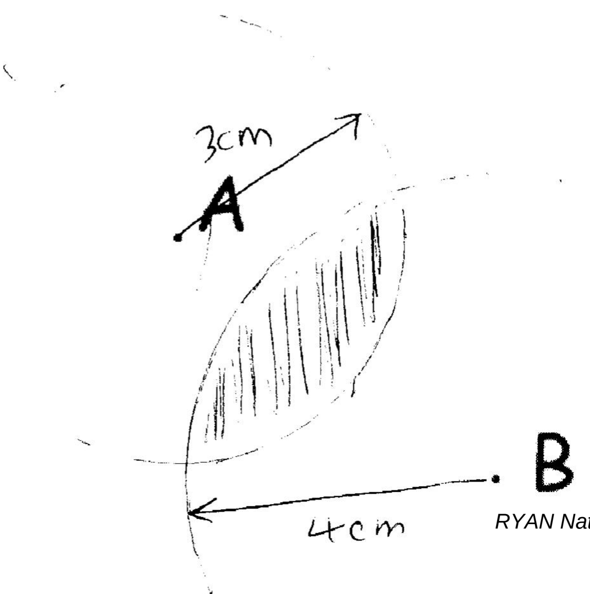


4) Two mobile phone stations transmit a signal.

Mobile phone station A transmits its signal ~~5~~ 3 miles.

Mobile phone station B transmits its signal 4 miles.

When you can receive both signals you experience interference on your phone. Shade below the area of interference.



Scale: 1 cm represents 1 mile

4) Loci and Construction: Harder

5) Mariam wants to plant a flower:

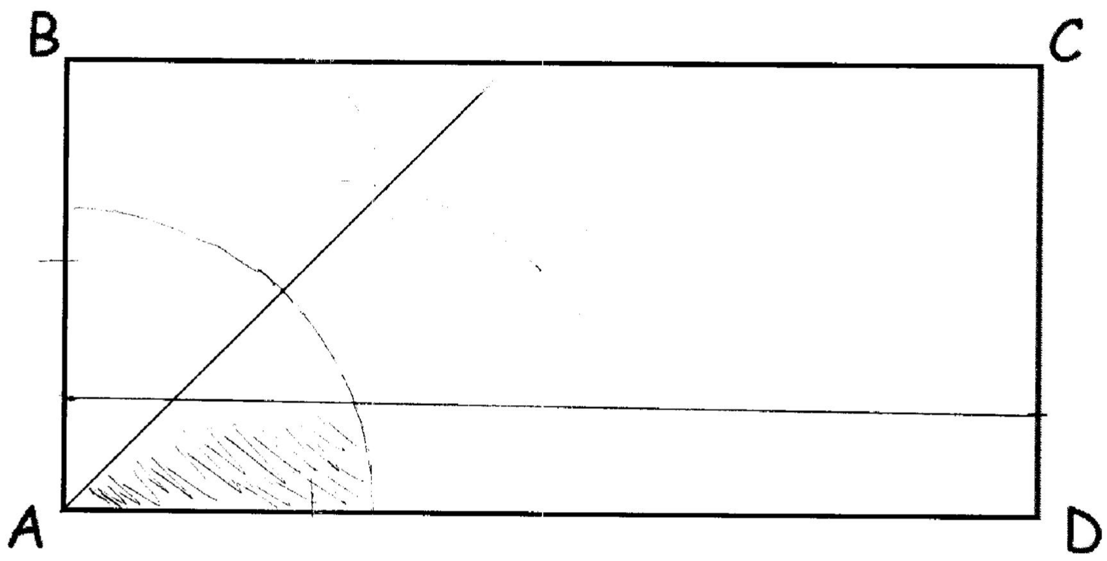
Within 4m of A

Closer to AD than AB

Less than 1.5m from AD.

Shade below the region where Mariam should plant her flower.

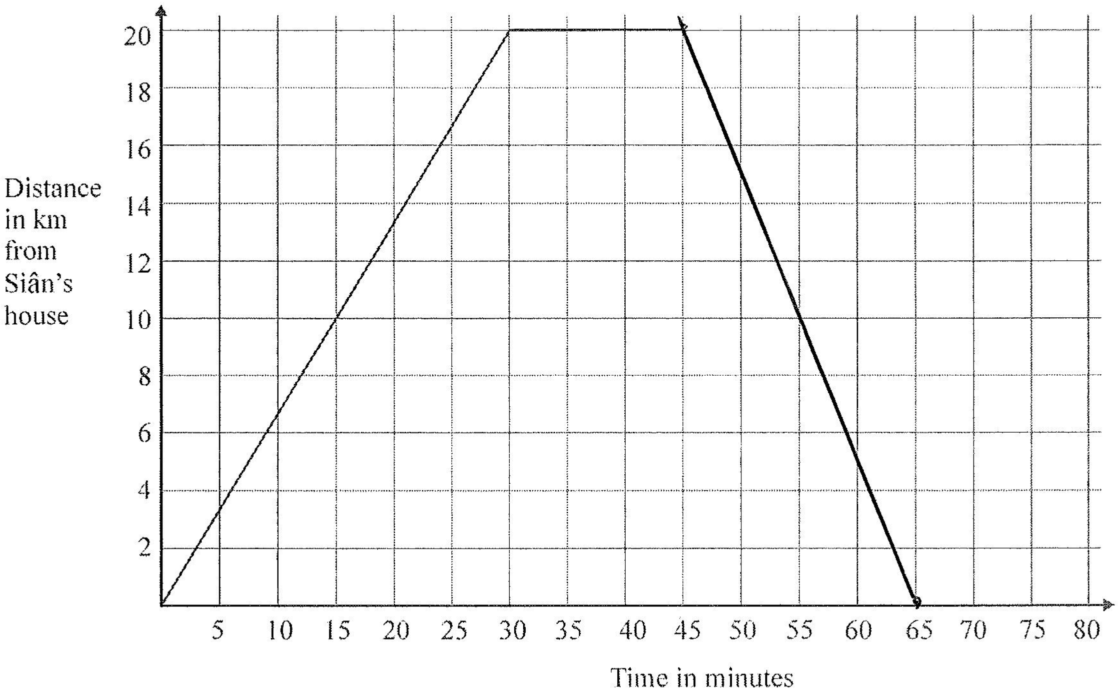
Show any construction lines your draw.



Scale: 1 cm represents 1 metre

5) Distance Time Graphs: Easier

1. Here is part of a travel graph of Siân's journey from her house to the shops and back.



(a) Work out Siân's speed for the first 30 minutes of her journey.
Give your answer in km/h.

distance ÷ time   30 minutes = 0.5 hours.

20 ÷ 0.5 = 40

40 .... km/h

(2)

Siân spends 15 minutes at the shops.
She then travels back to her house at 60 km/h.

(b) Complete the travel graph.

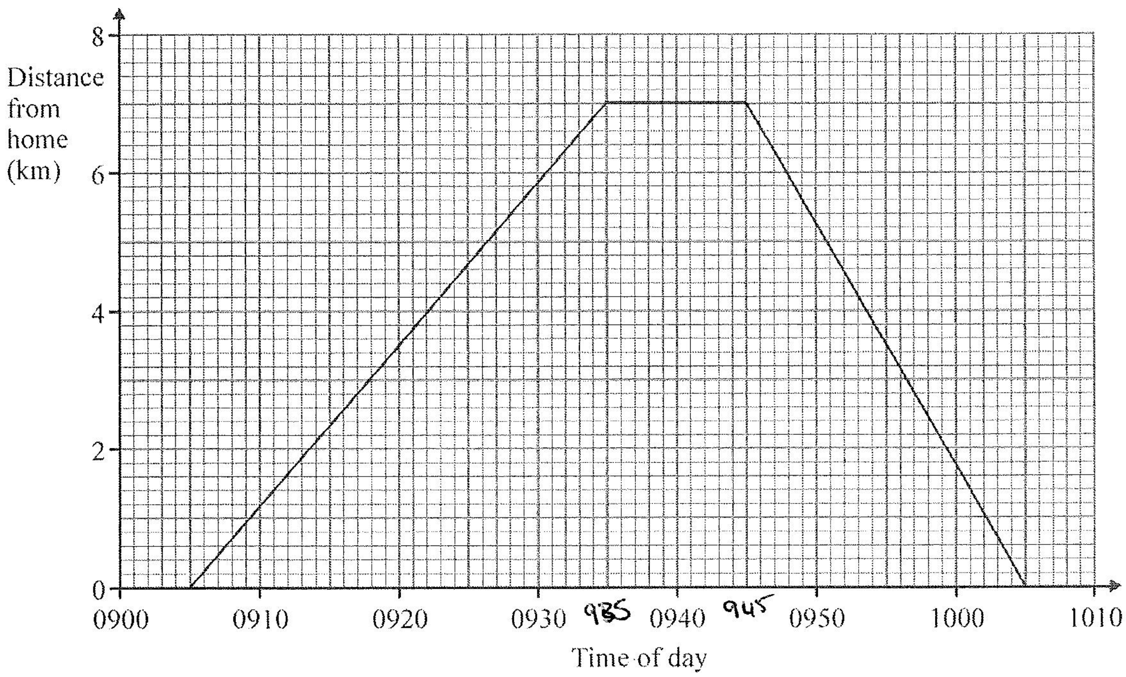
20km at 60 km/h

20 in 20minutes

(2)
(Total 4 marks)

5) Distance Time Graphs: Medium

2. Anil cycled from his home to the park.
Anil waited in the park.
Then he cycled back home.
Here is a distance-time graph for Anil's complete journey.



(a) At what time did Anil leave home?

0905

(1)

(b) What is the distance from Anil's home to the park?

7.5 km

(1)

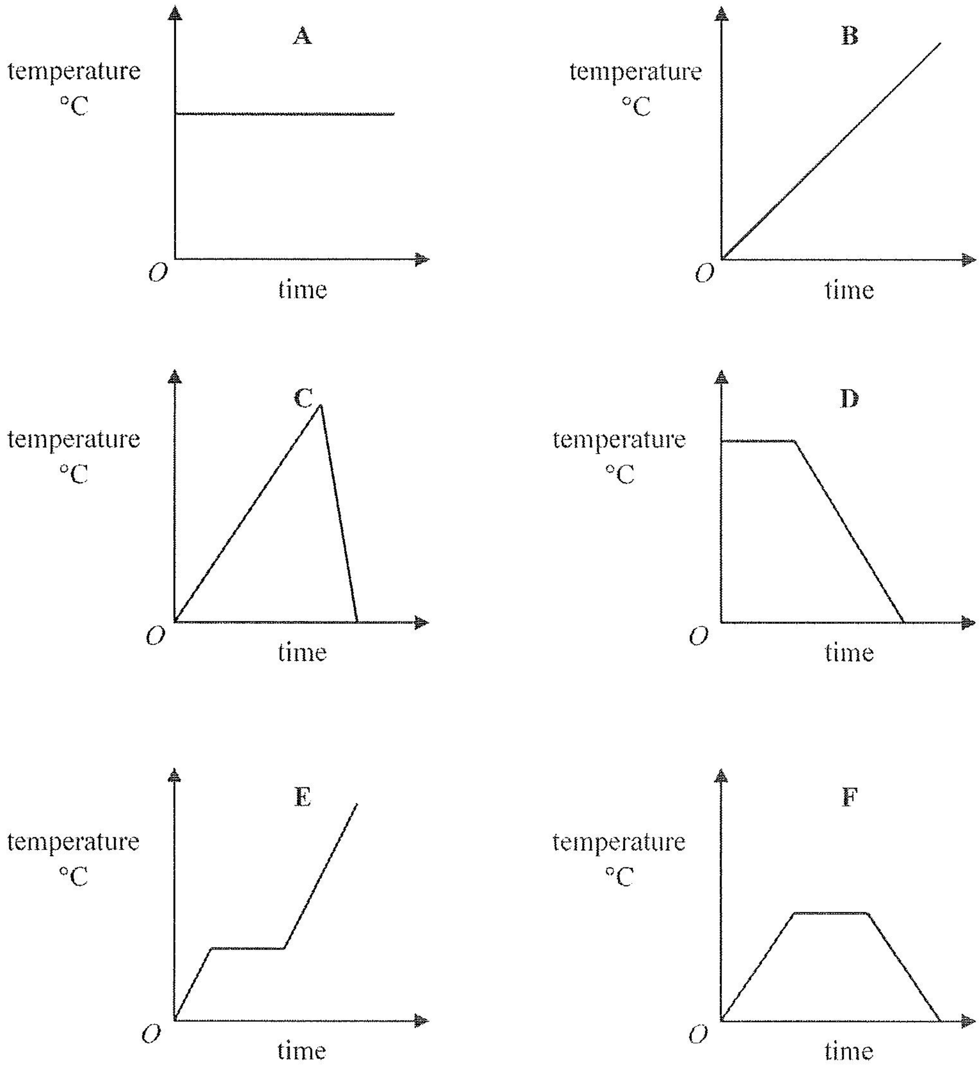
(c) How many minutes did Anil wait in the park?

10minutes

(1)
(Total 3 marks)

5) Distance Time Graphs: Harder

11. Here are six temperature/time graphs.



Each sentence in the table describes one of the graphs.
Write the letter of the correct graph next to each sentence.

The first one has been done for you.

The temperature starts at 0°C and keeps rising.	**B**
The temperature stays the same for a time and then falls.	D
The temperature rises and then falls quickly.	C
The temperature is always the same.	A
The temperature rises, stays the same for a time and then falls.	F
The temperature rises, stays the same for a time and then rises again.	E

(Total 3 marks)

STREET Tom

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
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A02 and 3	41 from 60	3 from 11	14 from 16	9 from 9	7 from 16	8 from 8
Total	59 from 80	4 from 12	22 from 26	14 from 14	10 from 19	9 from 9

Your Pinpoint Topics

Topic 1: Loci and Construction. Mathswatch Clip: 165

Topic 2: Distance Time Graphs. Mathswatch Clip: 143

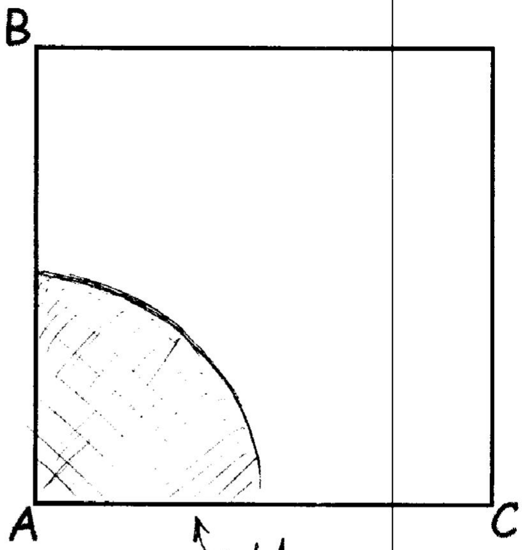
Topic 3: Proof. Mathswatch Clip: 193

Topic 4: Applied Trig Problems. Mathswatch Clip: 168

Topic 5: Upper and Lower Bounds. Mathswatch Clip: 206

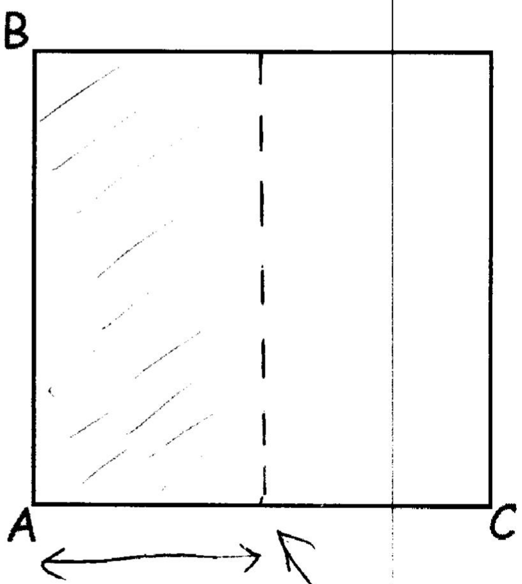
1) Loci and Construction: Easier

1) Shade the area closer than 3cm to point A within the square below:



Use compass at 3cm

2) Shade the area closer than 3cm to the line AB within the square below:

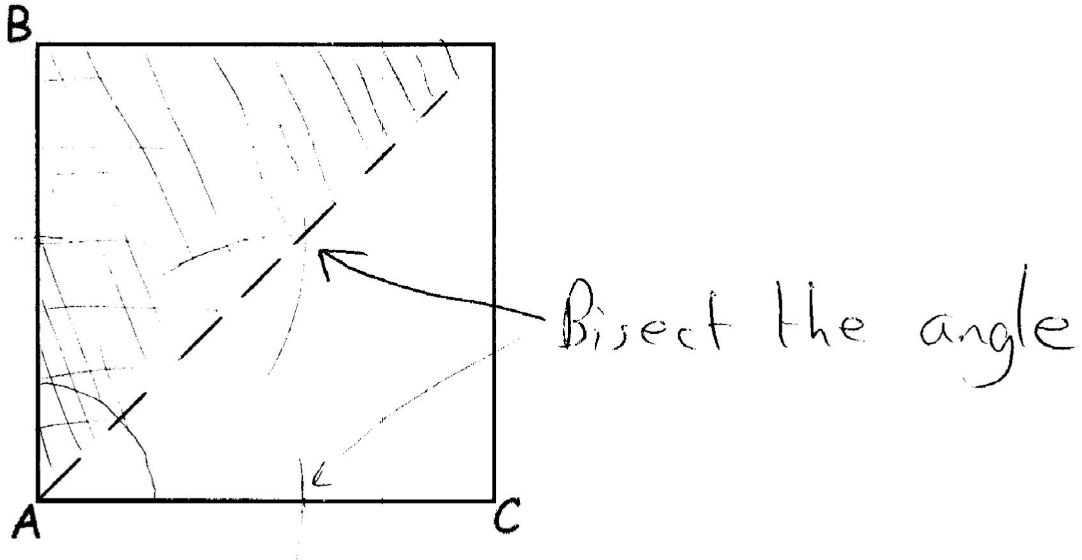


3cm

Just measure 3cm with your ruler

1) Loci and Construction: Medium

3) Shade the area closer to the line AB than AC within the square below:



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Mobile phone station A transmits its signal ~~5~~ 3 miles.

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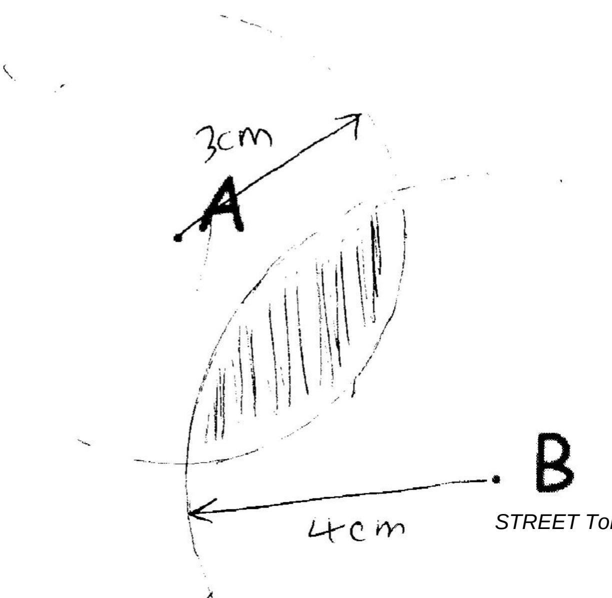


Scale: 1 cm represents 1 mile

1) Loci and Construction: Harder

5) Mariam wants to plant a flower:

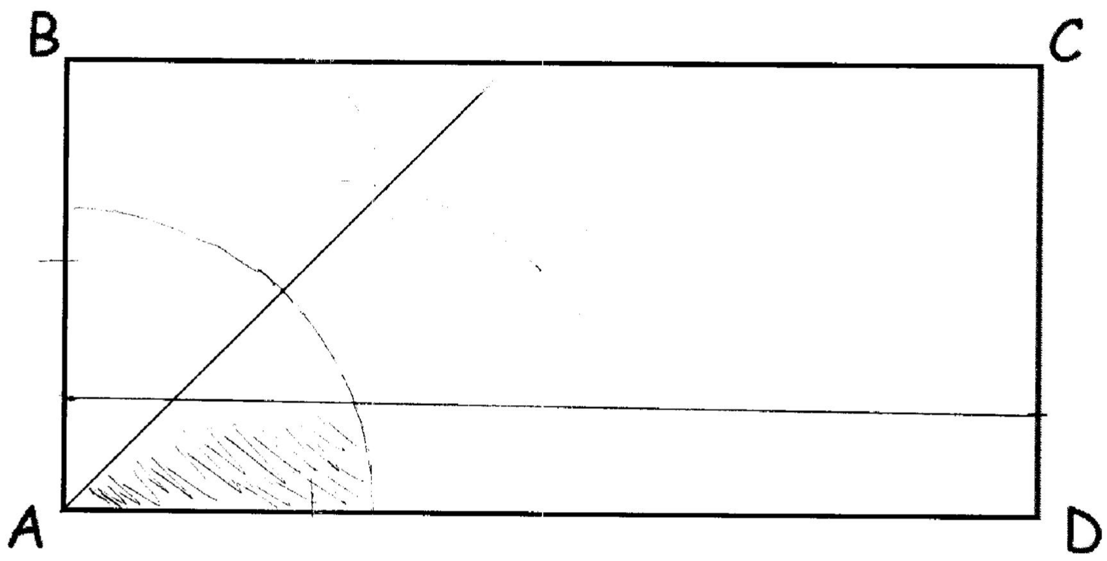
Within 4m of A

Closer to AD than AB

Less than 1.5m from AD.

Shade below the region where Mariam should plant her flower.

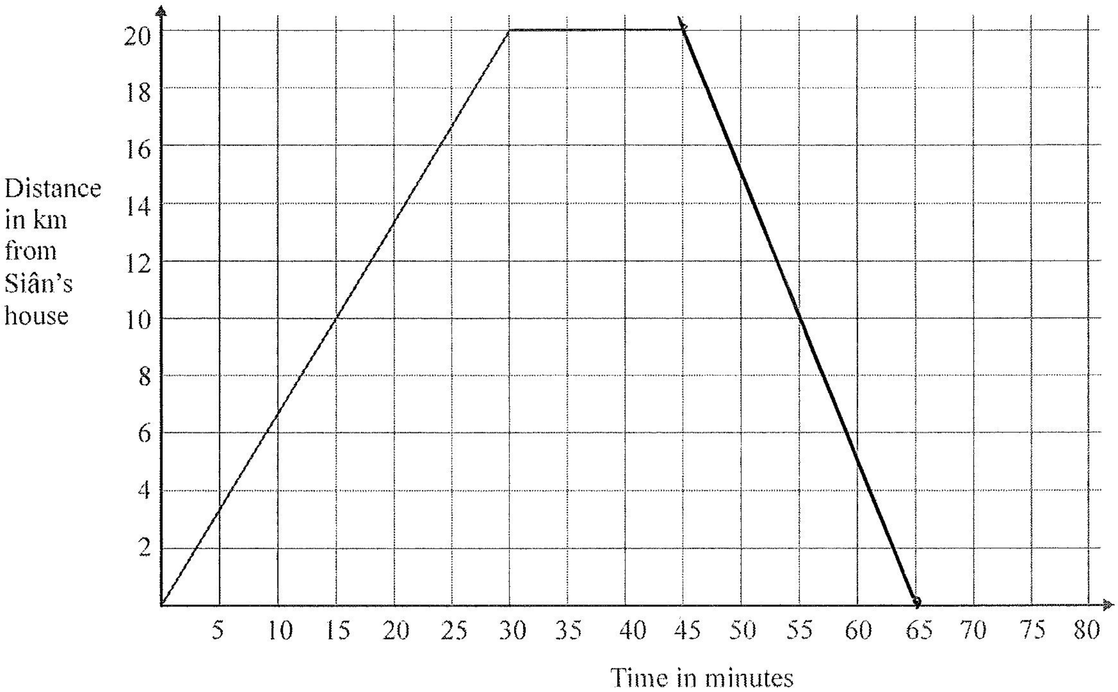
Show any construction lines your draw.



Scale: 1 cm represents 1 metre

2) Distance Time Graphs: Easier

1. Here is part of a travel graph of Siân's journey from her house to the shops and back.



(a) Work out Siân's speed for the first 30 minutes of her journey.
Give your answer in km/h.

distance ÷ time 30 minutes = 0.5 hours.

$20 \div 0.5 = 40$

40 km/h

(2)

Siân spends 15 minutes at the shops.
She then travels back to her house at 60 km/h.

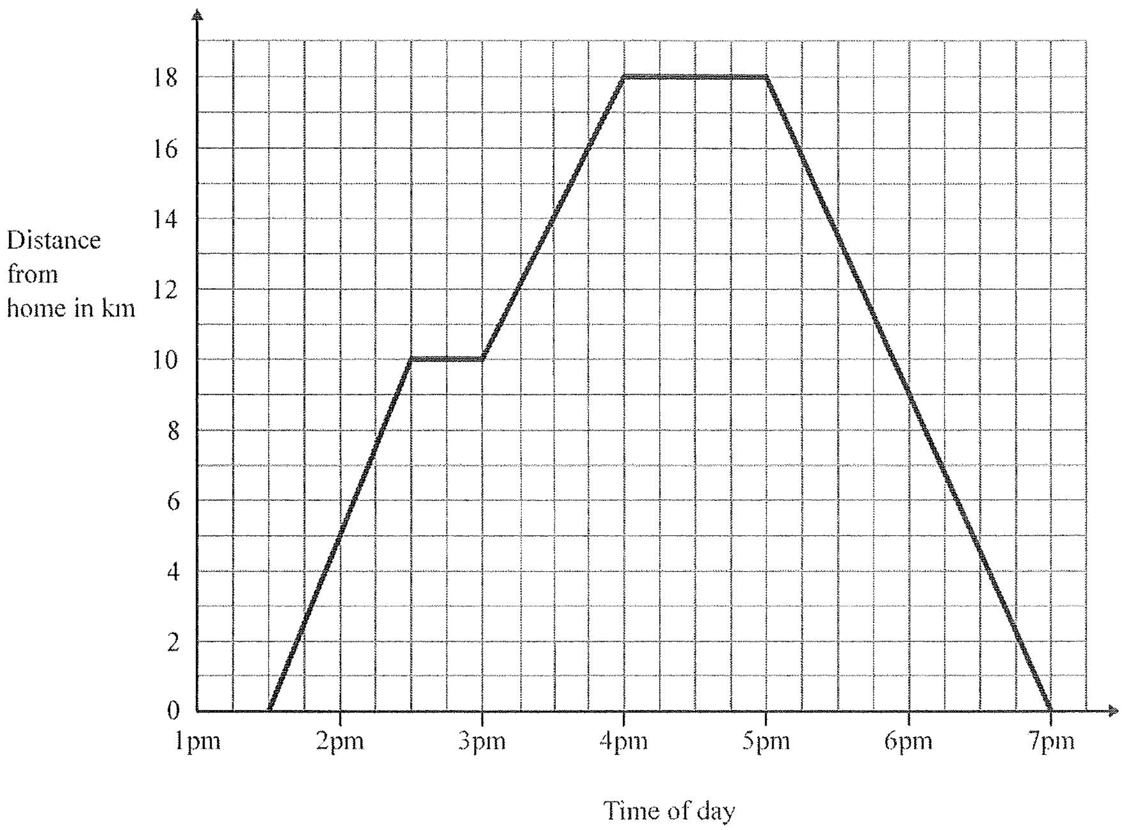
(b) Complete the travel graph.

20km at 60 km/h
20 in 20minutes

(2)
(Total 4 marks)

2) Distance Time Graphs: Medium

10. Pete visited his friend and then returned home.
The travel graph shows some information about Pete's journey.



(a) Write down the time that Pete started his journey.

1.30pm

(1)

At 2.30 pm Pete stopped for a rest.

(b) (i) Find his distance from home when he stopped for this rest.

10 km

(ii) How many minutes was this rest?

30 minutes

(2)

Pete stayed with his friend for one hour.
He then returned home.

(c) Work out the total distance travelled by Pete on this journey.

$18 \times 2 = 36$

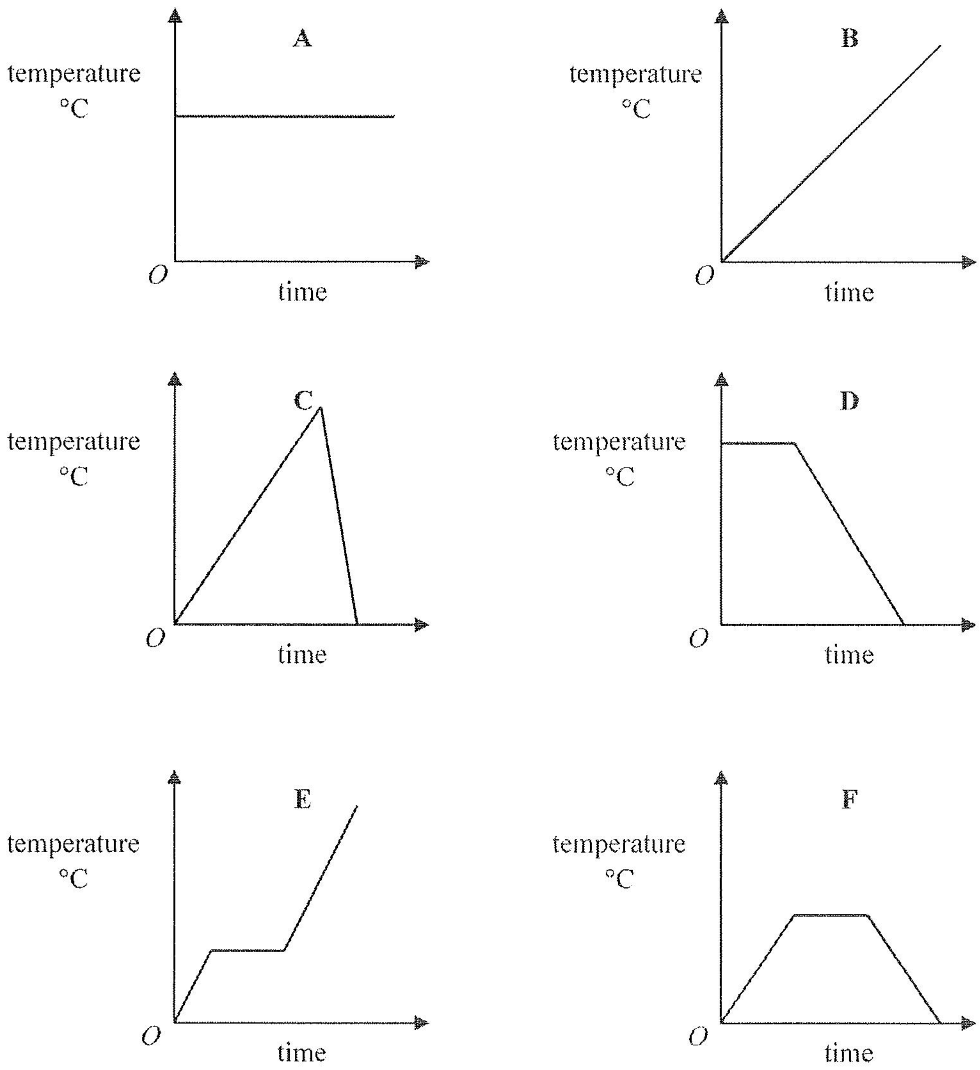
36 km

(2)

(Total 5 marks)

2) Distance Time Graphs: Harder

11. Here are six temperature/time graphs.



Each sentence in the table describes one of the graphs.
Write the letter of the correct graph next to each sentence.

The first one has been done for you.

The temperature starts at 0°C and keeps rising.	**B**
The temperature stays the same for a time and then falls.	D
The temperature rises and then falls quickly.	C
The temperature is always the same.	A
The temperature rises, stays the same for a time and then falls.	F
The temperature rises, stays the same for a time and then rises again.	E

(Total 3 marks)

3) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As $2n$ is even

$2n+1$ will be odd and so $2n+2$ is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

3) Proof: Medium

8. Prove that

$(n+1)^2 - (n-1)^2 + 1$ is always odd for all positive integer values of n.

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$$
$$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$$
$$= 4n + 1$$

$4n$ is a multiple of 4 so it must be even which means $4n+1$ is odd.

(3 marks)

3) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$n^2 + (n+1)^2$

$= n^2 + n^2 + 2n + 1$

$= 2n^2 + 2n + 1$

$= 2n(n+1) + 1$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

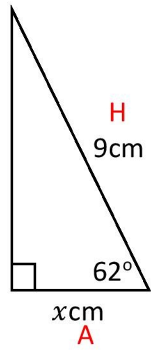
$2n(n+1)$ is $2 \times$ an even number which has to be a multiple of 4

So $2n(n+1)+1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

4) Applied Trig Problems: Easier

1) (a) Find the missing length x to two decimal places.



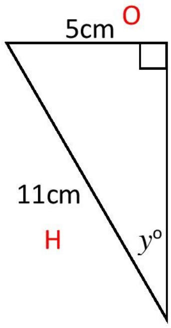
$\cos 62 = \frac{x}{9}$

$9 \cos 62 = x$

$x = 4.22524...$

$x = 4.23$ cm

(b) Find the missing angle y to two decimal places.



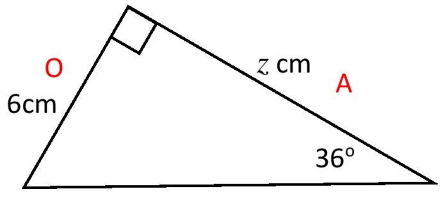
$\sin y = \frac{5}{11}$

$y = \sin^{-1}(\frac{5}{11})$

$y = 27.03569$

$y = 27.04°$

(c) Find the missing length z



$\tan 36 = \frac{6}{z}$

$z \tan 36 = 6$

$z = \frac{6}{\tan 36}$

$z = 8.25829$

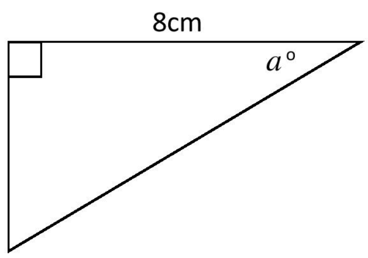
$z = 8.26cm$

(6 Marks)

4) Applied Trig Problems: Medium

2) The area of this triangle is $24cm^2$

Calculate the size of angle *a* to three significant figures.



Calculating the missing height:

$$Area = \frac{1}{2} \times base \times height$$

$$24 = \frac{1}{2} \times 8 \times height$$

$$24 = 4 \times height$$

$$height = 6cm$$

Calculating the missing angle using trig:

$$\tan a = \frac{6}{8}$$

$$a = \tan^{-1}(\frac{6}{8})$$

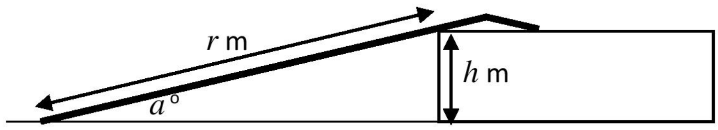
$$a = 36.8698976458$$

$$a = 36.8°$$

(4 Marks)

4) Applied Trig Problems: Harder

3) A wheelchair ramp is placed over a step, as shown.



The step is h meters high, and the ramp is r meters long to where it touches the step.

The angle between the ground and the ramp is a°.

In order to function safely, then ramp has to be 6 times as long, as the height of the step it is covering

(a) Work out the value of a when $r = 6h$, to the nearest degree.

$$\sin a = \frac{h}{r}$$

$$\sin a = \frac{h}{6h}$$

$$\sin a = \frac{1}{6}$$

$$a = \sin^{-1}(\frac{1}{6})$$

$$a = 9.59406822686$$

$$a = 10^\circ$$

(b) New safety regulations replace the initial ones, saying that the angle between the ramp and the ground cannot be more than 8°. How does this affect the height of step that the ramp can be used with?

Tick one box

- [ ] It can now be used with higher steps.
- [ ] There is no change to the step height with which the ramp can be used.
- [x] It can now only be used with lower steps.

(4 Marks)

5) Upper and Lower Bounds: Easier

1. The weight of a plasma TV is 12kg to the nearest kg.

a) What is the smallest possible weight of the TV?

11.5Kg

………………. **(1)**

b) What is the largest possible weight of the TV?

12.5Kg

………………. **(1)**

2. The height of a wardrobe is given as 253 cm to the nearest cm. What is the maximum height the wardrobe could be?

253.5cm

………………. **(1)**

3. The number of people that attended a football fixture is given as 3200 to two significant figures. What is the minimum number of people that could have attended?

3250

………………. **(1)**

PINPOINT

5) Upper and Lower Bounds: Medium

6. On sports day a girl runs 100m, to the nearest metre. She wins and finishes in 11.3 seconds, correct to the nearest tenth of a second.

What is the fastest possible speed she could have run?

$$Speed = \frac{distance}{time}$$

$$UB(Speed) = \frac{UB(distance)}{LB(time)}$$

$$UB(Speed) = \frac{100.5}{11.25}$$

=8.99m/s

…..………….. **(4)**

7. The maximum load for a crane is 5400kg, measured to the nearest 100 kg. Each crate weighs 20kg, measured to the nearest 10kg.

What is the maximum number of crates the crane can safely take?

$$Max\ number\ of\ cranes = \frac{LB(Max\ load)}{UB(weight\ of\ crate)}$$

$$= \frac{5350}{25}$$

=214 Crates

…..………….. **(4)**

5) Upper and Lower Bounds: Harder

8. The formula for density is

$$D = \frac{M}{V}$$

V is the volume of the object, M is the mass and D the density.

The Volume of a liquid is given as 500ml to the nearest 10ml and the Mass of the liquid is 600g to nearest gram

By considering bounds, give the Density of the drink to a suitable degree of accuracy. You must show all of your working and give a reason for your answer

$$UB(D) = \frac{UB(M)}{LB(V)}$$

$$UB(D) = \frac{505}{599.5} = 0.842369$$

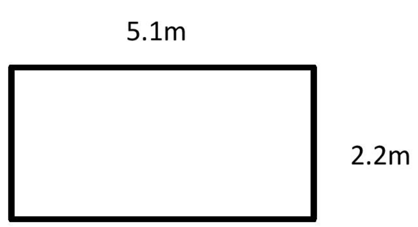
$$LB(D) = \frac{LB(M)}{UB(V)}$$

$$LB(D) = \frac{495}{600.5} = 0.824313$$

The lower bound and the upper bound are the same to one significant figure so 0.8

0.8g/ml
……..………..g/ml **(4)**

*9. Sabrina is decorating and is painting a feature wall. The measurements of the wall are shown below to the nearest 0.1m. A pot of paint covers 12m^2 of wall to the nearest 1m^2. By considering bounds, does Sabrina definitely have enough paint to cover the wall with one pot?



UB (area of wall)= 5.15 x 2.25=11.5875m^2

LB(area paint covers) = 11.5m^2
No she does not definitely have enough as she could only have enough for 11.5m^2 but she could need enough for 11.5875m^2

PINPOINT

TALMAGE Rheanna

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	15 from 20	1 from 1	5 from 10	5 from 5	3 from 3	1 from 1
A02 and 3	42 from 60	7 from 11	9 from 16	7 from 9	12 from 16	7 from 8
Total	57 from 80	8 from 12	14 from 26	12 from 14	15 from 19	8 from 9

Your Pinpoint Topics

Topic 1: Expressions, identities and equations. MW: 7

Topic 2: Loci and Construction. Mathswatch Clip: 165

Topic 3: Simultaneous Equations. Mathswatch Clip: 162

Topic 4: Box plots. Mathswatch Clip: 187

Topic 5: Proof. Mathswatch Clip: 193

1) Expressions, identities and equations: Easier

1) Fill in the gaps with an appropriate word from the list
EQUATION, IDENTITY, EXPRESSION, TERMS

$$3x + 4 \text{ is an expression with two terms}$$

$$2(x + 4) \equiv 2x + 8 \text{ is an identity}$$

$$2x + 3 = 11 \text{ is an equation}$$

....

(2 Marks)

---

2) Circle the identity

A $5(x+3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x+3)$ D $x^2 + 2 = 27$

(1 Mark)

---

3) Circle the expression

A $5(x+3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x+3)$ D $x^2 + 2 = 27$

....

(1 Mark)

1) Expressions, identities and equations: Medium

4) Annemarie is asked to form an expression, given the following information.
There are a sweets in every packet. I have 3 packets of sweets. I put all the sweets in one container and eat 2 of them. Form an expression for the number of sweets I have left.

Annemarie writes

3a = -2

Write down one mistake Annemarie has made

She has written an equation, (with an equals) she wasn't told how many sweets there are left just that there are two less than 3 bags so she should have written 3a-2 which is an expression

(1 Mark)

---

5) Insert the correct symbol, = or ≡ in the boxes below

$$2x + 3 \quad \boxed{=} \quad 10$$

$$2a \times 3a^2 \quad \boxed{\equiv} \quad 6a^3$$

$$5(x-2) \quad \boxed{\equiv} \quad 5x - 10$$

Remember an equation is true for some values of the variable and an identity is true for all values of the variable

....

(3 Marks)

1) Expressions, identities and equations: Harder

6) Jim says that

$$(x+4)^2 = x^2 + 16$$

is an identity. Paul says it is an equation and not an identity. Who is correct? You must explain your reasoning.

Paul is right, it is an equation, for the value $x = 0$ the equation is true as

$(0+4)^2 = 0^2 + 4^2$ as they are both equal to 16

It is not true for all values of x for example for $x = 1$

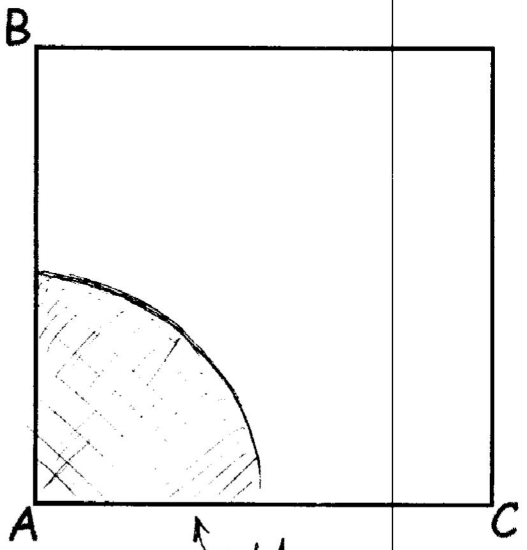
$(1+4)^2 = 25$ *and* $1^2 + 16 = 17$ so it does not hold for all values of x

$(x+4)^2 = x^2 + 8x + 16$ is an identity

(1 Mark)

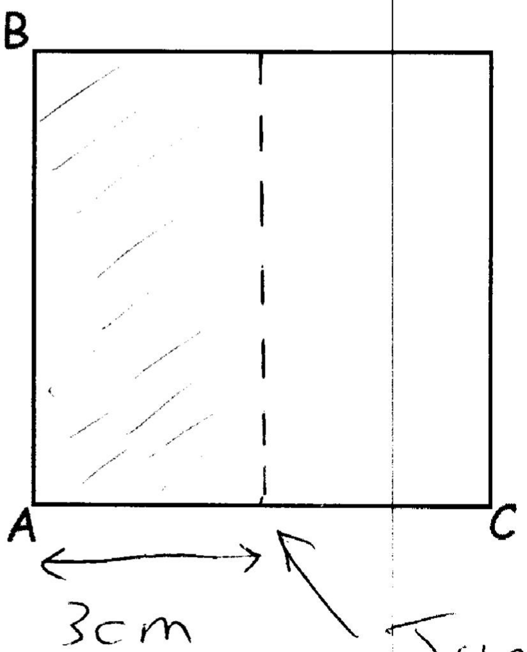
2) Loci and Construction: Easier

1) Shade the area closer than 3cm to point A within the square below:



Use compass at 3cm

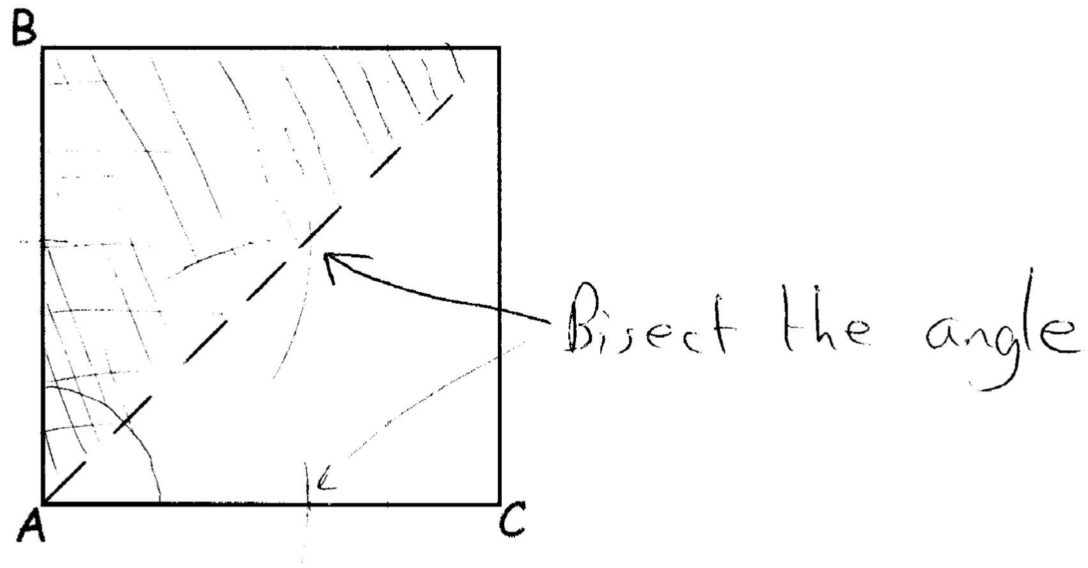
2) Shade the area closer than 3cm to the line AB within the square below:



Just measure 3cm with your ruler

2) Loci and Construction: Medium

3) Shade the area closer to the line AB than AC within the square below:

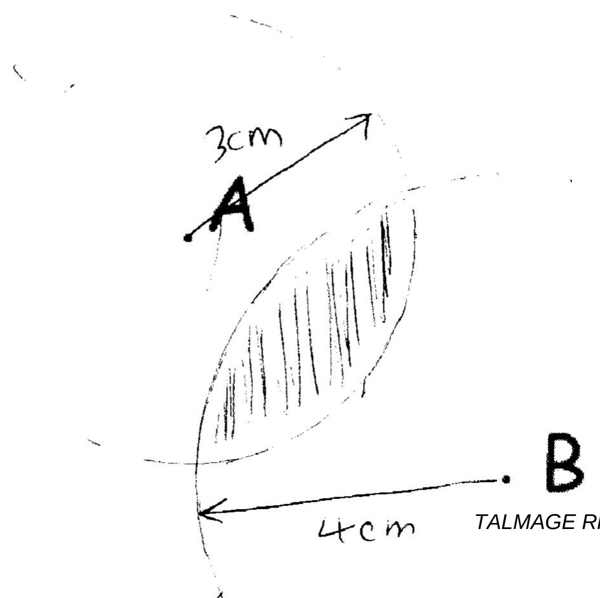


4) Two mobile phone stations transmit a signal.

Mobile phone station A transmits its signal ~~5~~ 3 miles.

Mobile phone station B transmits its signal 4 miles.

When you can receive both signals you experience interference on your phone. Shade below the area of interference.



Scale: 1 cm represents 1 mile

2) Loci and Construction: Harder

5) Mariam wants to plant a flower:

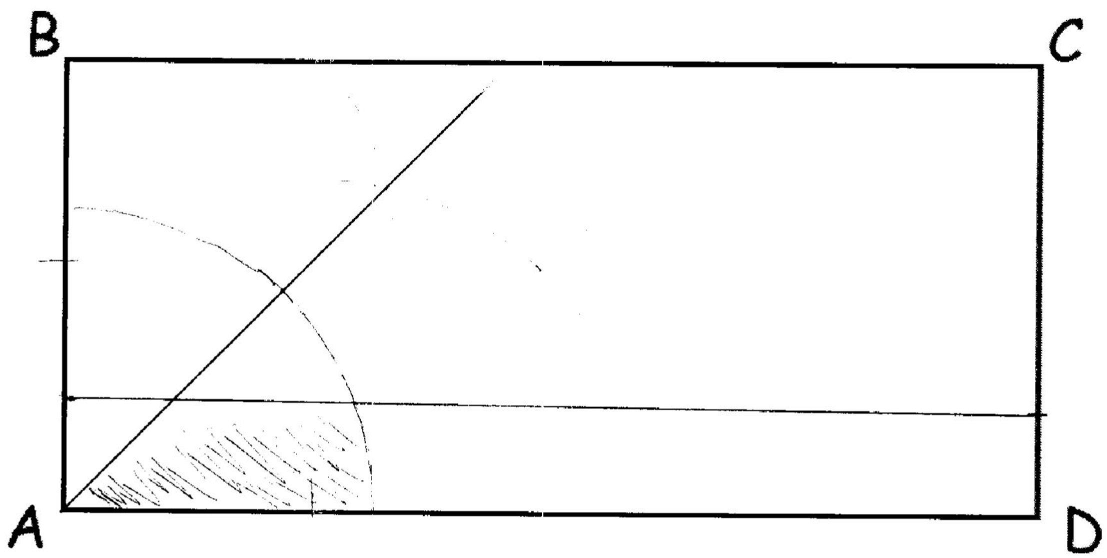
Within 4m of A

Closer to AD than AB

Less than 1.5m from AD.

Shade below the region where Mariam should plant her flower.

Show any construction lines your draw.



Scale: 1 cm represents 1 metre

3) Simultaneous Equations: Easier

1) Solve the simultaneous equations.

① $2x + 3y = 9$

② $5x + 3y = 18$

② − ①

$5x + 3y = 18$

$2x + 3y = 9$ −

$\frac{3x}{3} = \frac{9}{3}$

$x = 3$

Sub $x = 3$ into ①

$2x + 3y = 9$

$6 + 3y = 9$

$3y = 3$

$y = 1$

x = 3

y = 1

(3 Marks)

2) Solve the simultaneous equations.

① $4x + 2y = 9$ ×2

② $8x + 8y = 20$

③ $8x + 4y = 18$

② − ③

$8x + 8y = 20$

$8x + 4y = 18$ −

$\frac{4y}{4} = \frac{2}{4}$

$y = 0.5$

Sub $y = 0.5$ into ①

$4x + 1 = 9$

−1 −1

$\frac{4x}{4} = \frac{8}{4}$

$x = 2$

x = 2

y = 0.5

(4 Marks)

3) Simultaneous Equations: Medium

7) Solve the simultaneous equations.

$① \quad 6x + 3y = 15 \quad \times 3$

$② \quad 4x - 9y = -34$

$③ \quad 18x + 9y = 45$

$② + ③$

$4x - 9y = -34$

$18x + 9y = 45 \quad +$

$\frac{22x}{22} = \frac{11}{22}$

$x = 0.5$

Sub $x = 0.5$ into $①$

$3 + 3y = 15$

$-3 \qquad -3$

$\frac{3y}{3} = \frac{12}{3}$

$y = 4$

x = 0.5

y = 4

(4 Marks)

8) Solve the simultaneous equations.

$① \quad 5x + 2y = 29 \quad \times 3$

$② \quad 8x - 6y = 51$

$③ \quad 15x + 6y = 87$

$② + ③$

$8x - 6y = 51$

$15x + 6y = 87 \quad +$

$\frac{23x}{23} = \frac{138}{23}$

$x = 6$

Sub $x = 6$ into $①$

$30 + 2y = 29$

$-30 \qquad -30$

$\frac{2y}{2} = \frac{-1}{2}$

$y = -0.5$

x = 6

y = -0.5

(4 Marks)

3) Simultaneous Equations: Harder

9) Bill goes into a chip shop and buys **3 fish** and **2 portions of chips,** it cost him £5.20

Jenny also goes into the same chip shop. She buys **5 fish** and **6 portions of chips,** it cost her £10.80

What is the cost of a portion of fish and chips?

① $3f + 2p = 5.20$ $\times 3$

② $5f + 6p = 10.80$

③ $9f + 6p = 15.60$

③ − ②

$9f + 6p = 15.60$

$5f + 6p = 10.80$

$4f = 4.8$

$\frac{4f}{4} = \frac{4.80}{4}$

$f = 1.20$

Sub into ①

$3.60 + 2p = 5.20$

$-3.60 \quad -3.60$

$2p = 1.60$

$p = 0.80$

$p + f = £2$

(5 Marks)

10) There are some ducks and some sheep on a farm. Altogether they have 35 heads and 94 feet.
How many ducks and sheep are there?

① $d + s = 35$ (heads) $\times 2$

② $2d + 4s = 94$ (feet)

③ $2d + 2s = 70$

② − ③

$2d + 4s = 94$

$2d + 2s = 70$ −

$2s = 24$

Sub $s = 12$ into ①

$d + 12 = 35$

$-12 \quad -12$

$d = 23$

Ducks = 23

Sheep = 12

(5 Marks)

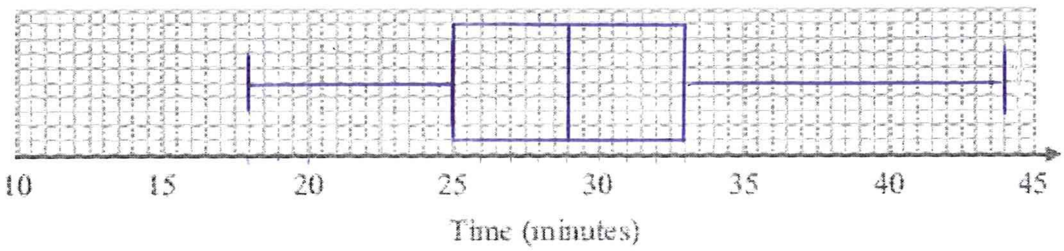
4) Box plots: Easier

2. Sameena recorded the times, in minutes, some girls took to do a jigsaw puzzle.

Sameena used her results to work out the information in this table.

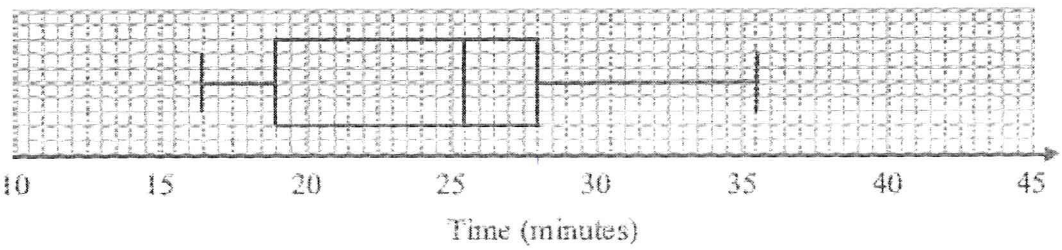
	Minutes
Shortest time	18
Lower quartile	25
Median	29
Upper quartile	33
Longest time	44

(a) On the grid, draw a box plot to show the information in the table.



(2)

The box plot below shows information about the times, in minutes, some boys took to do the same jigsaw puzzle.



(b) Compare the distributions of the girls' times and the boys' times.

The boys median time was less than that of the girls; Boys 25.5mins, Girls 29mins.

The spread of data for the interquartile range is smaller for the girls (8 mins) than for the boys (9 mins).

(2)

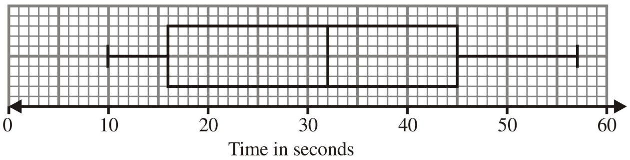
(4 marks)

4) Box plots: Medium

2. (a) 32 1

B1 for 32 (accept 31.5 to 33.5 inclusive)

(b) 3



B1 for ends of whiskers at 9 and 57 (with a box)
B1 for ends of box at 16 and 45/46 (±0.5)
B1for median marked at "32"or complete box and whisker diagram drawn with a median inside the box

(c) Median(B)>Median(G); on average boys take longer
IQR(B)>IQR(G); times for boys have a greater spread 2

B1 eg for comparison of medians (ft on diagrams)
B1 eg for comparison of (interquartile) ranges (ft on diagram)

[6]

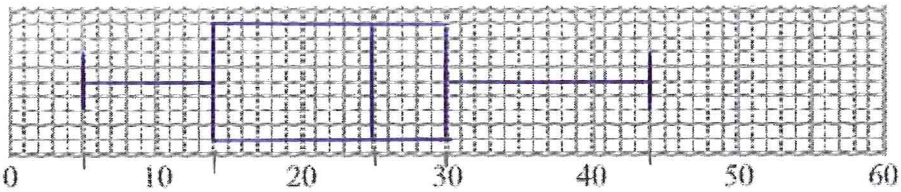
4) Box plots: Harder

7. Here are the times, in seconds, that 15 people waited to be served at Rose's garden centre.

5 9 11 $\boxed{14}$ 15 20 22 $\boxed{25}$ 27 27 28 $\boxed{30}$ 32 35 44

LQ Median UQ.

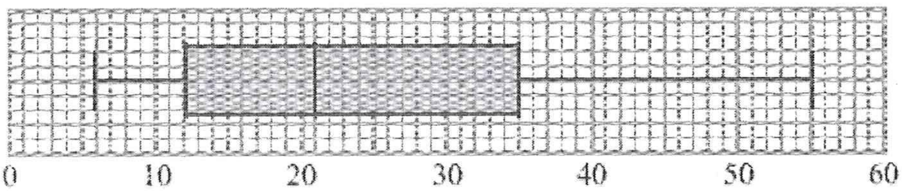
(a) On the grid, draw a box plot for this information.



Time (seconds)

(3)

The box plot below shows the distribution of the times that people waited to be served at Green's garden centre.



Time (seconds)

(b) Compare the distribution of the times that people waited at Rose's garden centre and the distribution of the times that people waited at Green's garden centre.

There was a greater spread of waiting times in the interquartile range for Green's Garden Centre than Rose's Garden centre

The median waiting time is shorter at ~~Rose's~~ Greens than Roses Garden centre.

(2)

(5 marks)

5) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As $2n$ is even $2n+1$ will be odd and so $2n+2$ is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

5) Proof: Medium

8. Prove that

$(n+1)^2 - (n-1)^2 + 1$ is always odd for all positive integer values of n.

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$

$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$

$= 4n + 1$

$4n$ is a multiple of 4 so it must be even which means $4n+1$ is odd.

(3 marks)

5) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$n^2 + (n+1)^2$

$= n^2 + n^2 + 2n + 1$

$= 2n^2 + 2n + 1$

$= 2n(n+1) + 1$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

$2n(n+1)$ is $2 \times$ an even number which has to be a multiple of 4

So $2n(n+1) + 1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

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THOMPSON Angus

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	18 from 20	1 from 1	8 from 10	5 from 5	3 from 3	1 from 1
A02 and 3	42 from 60	7 from 11	12 from 16	4 from 9	12 from 16	7 from 8
Total	60 from 80	8 from 12	20 from 26	9 from 14	15 from 19	8 from 9

Your Pinpoint Topics

Topic 1: Expressions, identities and equations. MW: 7

Topic 2: Loci and Construction. Mathswatch Clip: 165

Topic 3: Box plots. Mathswatch Clip: 187

Topic 4: Counting Methods. Mathswatch Clip: NA

Topic 5: Proof. Mathswatch Clip: 193

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1) Expressions, identities and equations: Easier

1) Fill in the gaps with an appropriate word from the list
EQUATION, IDENTITY, EXPRESSION, TERMS

$$3x + 4 \textit{ is an expression with two terms}$$

$$2(x+4) \equiv 2x + 8 \textit{ is an identity}$$

$$2x + 3 = 11 \textit{ is an equation}$$

....

(2 Marks)

---

2) Circle the identity

A $5(x+3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x+3)$ D $x^2 + 2 = 27$

(1 Mark)

---

3) Circle the expression

A $5(x+3) \equiv 5x + 15$ B $3x + 5 < 7$

C $6(x+3)$ D $x^2 + 2 = 27$

....

(1 Mark)

1) Expressions, identities and equations: Medium

4) Annemarie is asked to form an expression, given the following information.
There are a sweets in every packet. I have 3 packets of sweets. I put all the sweets in one container and eat 2 of them. Form an expression for the number of sweets I have left.

Annemarie writes

3a = -2

Write down one mistake Annemarie has made

She has written an equation, (with an equals) she wasn't told how many sweets there are left just that there are two less than 3 bags so she should have written 3a-2 which is an expression

(1 Mark)

---

5) Insert the correct symbol, = or ≡ in the boxes below

$$2x + 3 \quad \boxed{=} \quad 10$$

$$2a \times 3a^2 \quad \boxed{\equiv} \quad 6a^3$$

$$5(x-2) \quad \boxed{\equiv} \quad 5x - 10$$

Remember an equation is true for some values of the variable and an identity is true for all values of the variable

....

(3 Marks)

1) Expressions, identities and equations: Harder

6) Jim says that

$$(x+4)^2 = x^2 + 16$$

is an identity. Paul says it is an equation and not an identity. Who is correct? You must explain your reasoning.

Paul is right, it is an equation, for the value $x = 0$ the equation is true as

$(0+4)^2 = 0^2 + 4^2$ as they are both equal to 16

It is not true for all values of x for example for $x = 1$

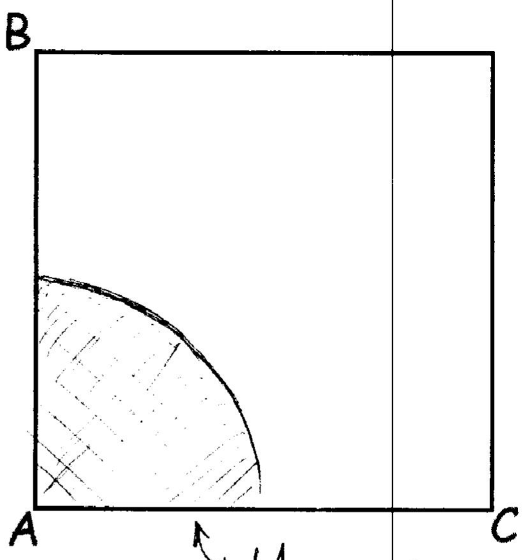
$(1+4)^2 = 25 \textit{ and } 1^2 + 16 = 17$ so it does not hold for all values of x

$(x+4)^2 = x^2 + 8x + 16$ is an identity

(1 Mark)

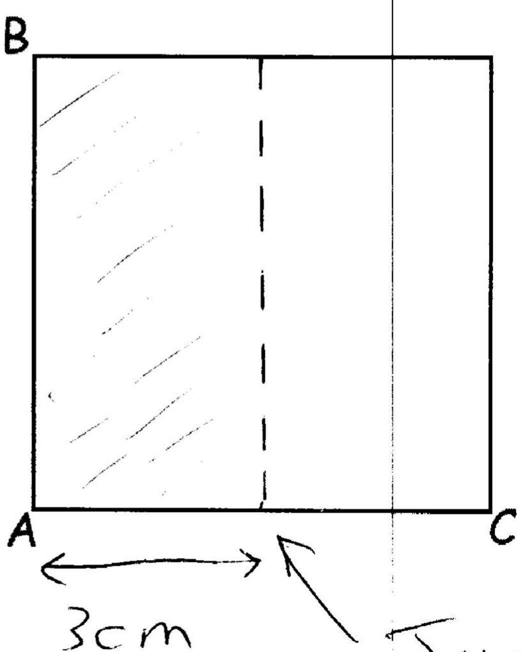
2) Loci and Construction: Easier

1) Shade the area closer than 3cm to point A within the square below:



Use compass at 3cm

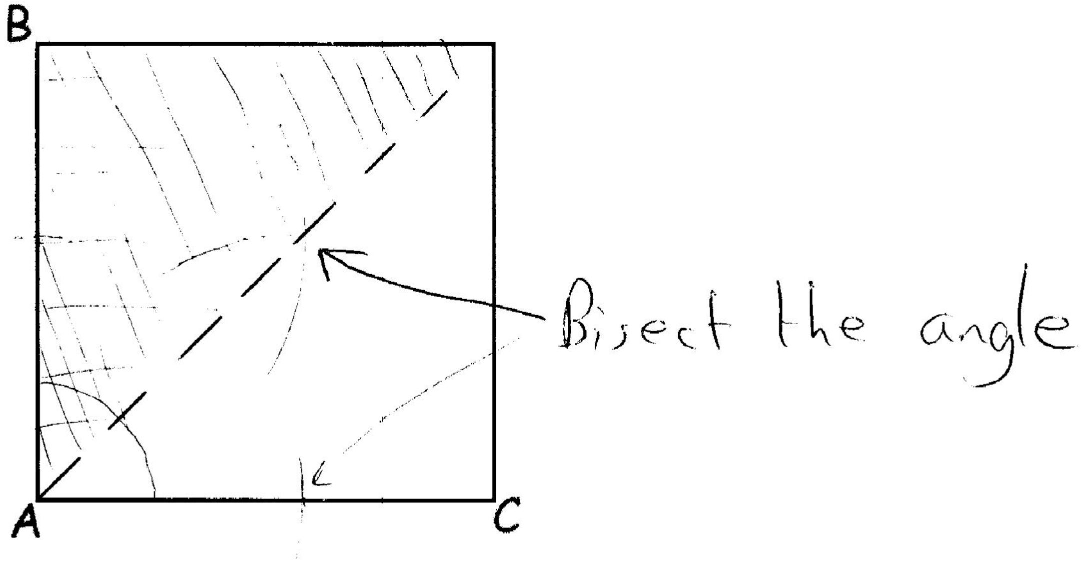
2) Shade the area closer than 3cm to the line AB within the square below:



Just measure 3cm with your ruler

2) Loci and Construction: Medium

3) Shade the area closer to the line AB than AC within the square below:

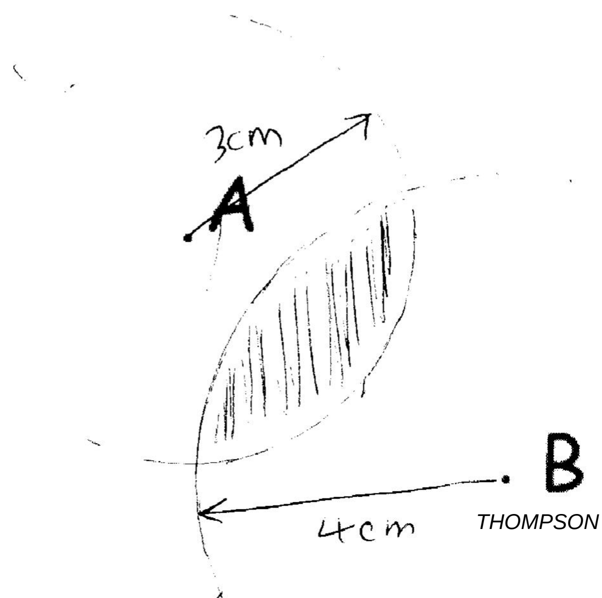


4) Two mobile phone stations transmit a signal.

Mobile phone station A transmits its signal ~~5~~ 3 miles.

Mobile phone station B transmits its signal 4 miles.

When you can receive both signals you experience interference on your phone. Shade below the area of interference.



Scale: 1 cm represents 1 mile

2) Loci and Construction: Harder

5) Mariam wants to plant a flower:

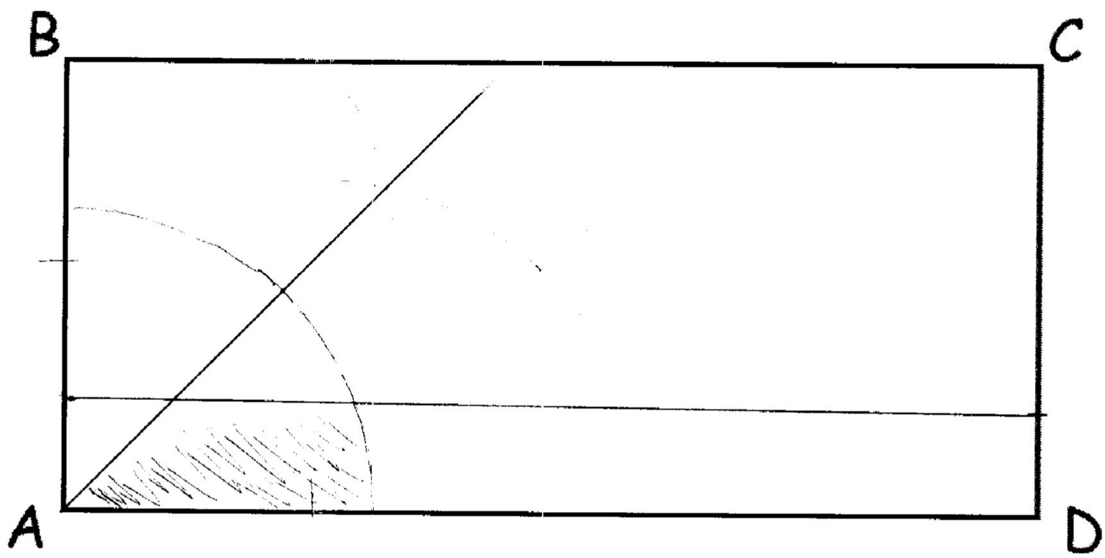
Within 4m of A

Closer to AD than AB

Less than 1.5m from AD.

Shade below the region where Mariam should plant her flower.

Show any construction lines your draw.



Scale: 1 cm represents 1 metre

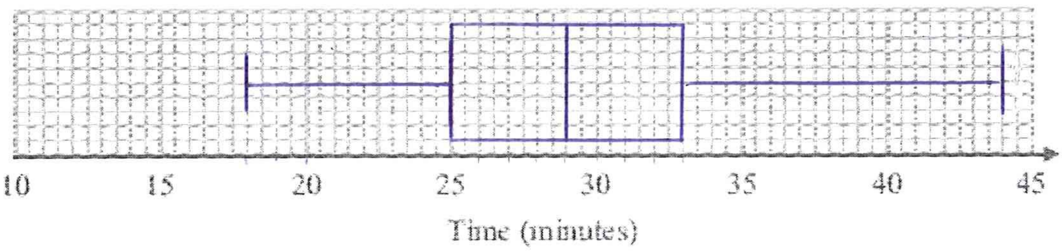
3) Box plots: Easier

2. Sameena recorded the times, in minutes, some girls took to do a jigsaw puzzle.

Sameena used her results to work out the information in this table.

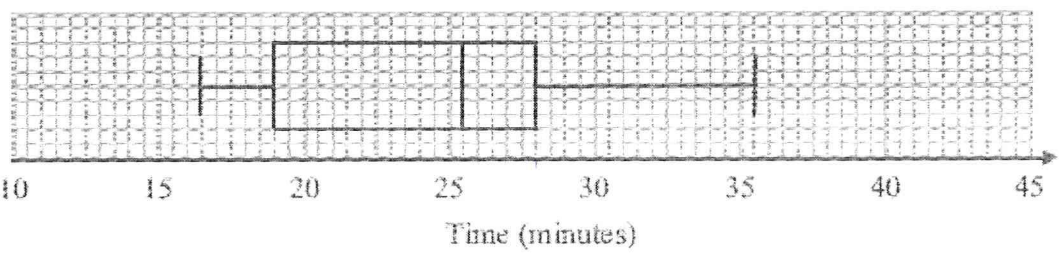
	Minutes
Shortest time	18
Lower quartile	25
Median	29
Upper quartile	33
Longest time	44

(a) On the grid, draw a box plot to show the information in the table.



(2)

The box plot below shows information about the times, in minutes, some boys took to do the same jigsaw puzzle.



(b) Compare the distributions of the girls' times and the boys' times.

The boys median time was less than that of the girls: Boys 25.5mins, Girls 29 mins.

The spread of data for the interquartile range is smaller for the girls (8 mins) than for the boys (9 mins)

(2)

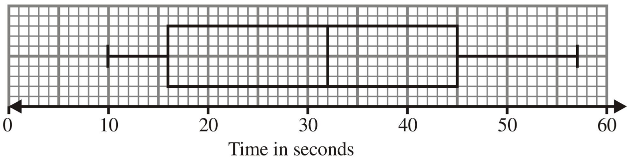
(4 marks)

3) Box plots: Medium

2. (a) 32 — 1

B1 for 32 (accept 31.5 to 33.5 inclusive)

(b)



3

B1 for ends of whiskers at 9 and 57 (with a box)
B1 for ends of box at 16 and 45/46 (± 0.5)
B1for median marked at "32" or complete box and whisker diagram drawn with a median inside the box

(c) Median(B)>Median(G); on average boys take longer
IQR(B)>IQR(G); times for boys have a greater spread — 2

B1 eg for comparison of medians (ft on diagrams)
B1 eg for comparison of (interquartile) ranges (ft on diagram)

[6]

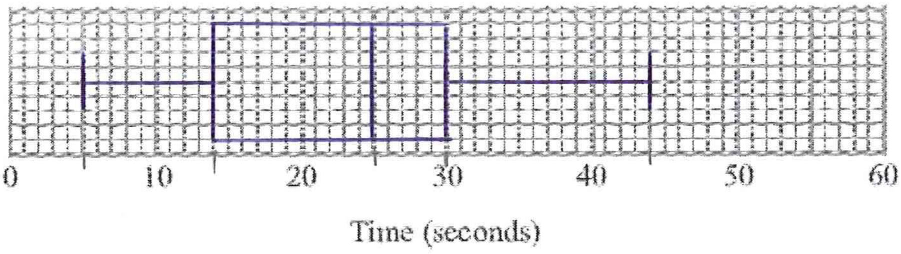
3) Box plots: Harder

7. Here are the times, in seconds, that 15 people waited to be served at Rose's garden centre.

5 9 11 $\boxed{14}$ 15 20 22 $\boxed{25}$ 27 27 28 $\boxed{30}$ 32 35 44

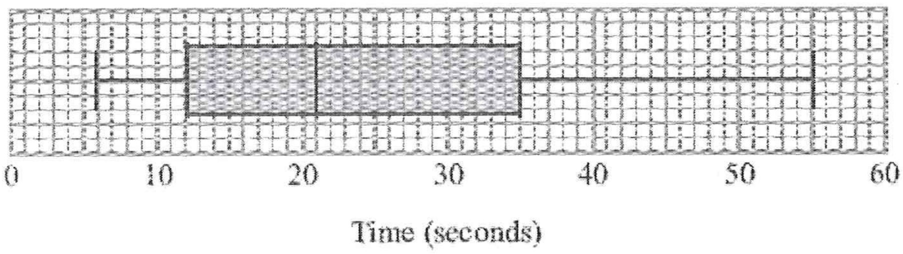
LQ Median UQ.

(a) On the grid, draw a box plot for this information.



(3)

The box plot below shows the distribution of the times that people waited to be served at Green's garden centre.



(b) Compare the distribution of the times that people waited at Rose's garden centre and the distribution of the times that people waited at Green's garden centre.

There was a greater spread of waiting times in the interquartile range for Green's Garden Centre than Rose's Garden centre

The median waiting time is shorter at ~~Rose's~~ Greens than Roses Garden centre.

(2)

(5 marks)

4) Counting Methods: Easier

1) Ryan has four shorts of different colours, blue, red, green and yellow.
He has three different T-shirts of different colours, black, white and orange.

Blue shorts and a black T-Shirt would be one possible outfit.
How many different outfits of Shorts and T-Shirts can Ryan wear?

4 shorts × 3 T-shirts = 12 possible outfits

____

(2 Marks)

---

2) There are 13 boys and 10 girls in a class.
Work out the total number of ways that 1 boy and 1 girl can be chosen from the class.

$13 \times 10 = 130$ ways

____

(2 Marks)

---

3) There are 7 boys and 10 girls in a class.
Work out the total number of ways that 1 boys and 2 girls can be chosen from the class.

$7 \times 10 \times 9 = 630$ ways

____

(2 Marks)

4) Counting Methods: Medium

4) Mason's bank secret pin code is a four digit number and each digit can be the numbers 0, 1, 2, 3, 4, 5, 6 , 7, 8, or 9. For example one possible pin number could be 9021.

a) Mason's bank card is stolen. What is the probability with one guess only that someone correctly guesses Mason's pin number? Leave your answer as a fraction.

$10 \times 10 \times 10 \times 10 = 10000$ possibilities.

Probability of guessing first time = $\frac{1}{10000}$

____

(2 Marks)

Ishmael's bank does not allow any digit to be repeated in his secret pin number. For example 7762 would not be allowed, nor would 5075.

b) Ishmael's bank card is stolen. What is the probability with one guess only that someone correctly guesses Ishmael's pin number? Leave your answer as a fraction.

$10 \times 9 \times 8 \times 7 = 5040$ possibilities.

Probability of guessing first time = $\frac{1}{5040}$

____

(3 Marks)

PINPOINT

4) Counting Methods: Harder

5) A restaurant menu has 6 starters, 10 mains and 6 desserts.
A customer can choose from the following meals

• a starter and a main,
• a main and a dessert,
• a starter, a main and a dessert.

Show that there are 480 different ways of choosing a meal at this restaurant.

$(6 \times 10) + (10 \times 6) + (6 \times 10 \times 6)$

$= 60 + 60 + 360$

$= 480$ ways

____

(3 Marks)

---

6) A simple computer password only allows you to use two letters a and b.
"abaab" would be an example of one password which consists of 5 letters.
How many letters must your password contain such that the probability of someone randomly guessing it first time is less than 1 in a 1000?

Use Trial and Improvement:

2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 1024 ways with 10 letters.

Therefore a password of <u>10 letters</u> is needed as $\frac{1}{1024} < \frac{1}{1000}$

____

(3 Marks)

5) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As 2n is even 2n+1 will be odd and so 2n+2 is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

5) Proof: Medium

8. Prove that

$(n+1)^2 - (n-1)^2 + 1$ is always odd for all positive integer values of n.

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$

$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$

$= 4n + 1$

4n is a multiple of 4 so it must be even which means 4n+1 is odd.

(3 marks)

5) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$n^2 + (n+1)^2$

$= n^2 + n^2 + 2n + 1$

$= 2n^2 + 2n + 1$

$= 2n(n+1) + 1$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

$2n(n+1)$ is $2 \times$ an even number which has to be a multiple of 4

So $2n(n+1) + 1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

PINPOINT

THOMPSON Daniel

9to1_AQA_PracticeSet3_3H_Whole_Qns

Login to www.pinpointlearning.co.uk

Username: TH91905, Password: PPL

Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	18 from 20	1 from 1	8 from 10	5 from 5	3 from 3	1 from 1
A02 and 3	52 from 60	8 from 11	14 from 16	6 from 9	16 from 16	8 from 8
Total	70 from 80	9 from 12	22 from 26	11 from 14	19 from 19	9 from 9

Your Pinpoint Topics

Topic 1: Box plots. Mathswatch Clip: 187

Topic 2: Counting Methods. Mathswatch Clip: NA

Topic 3: Proof. Mathswatch Clip: 193

Topic 4: Upper and Lower Bounds. Mathswatch Clip: 206

Topic 5: Extention1. Mathswatch Clip:

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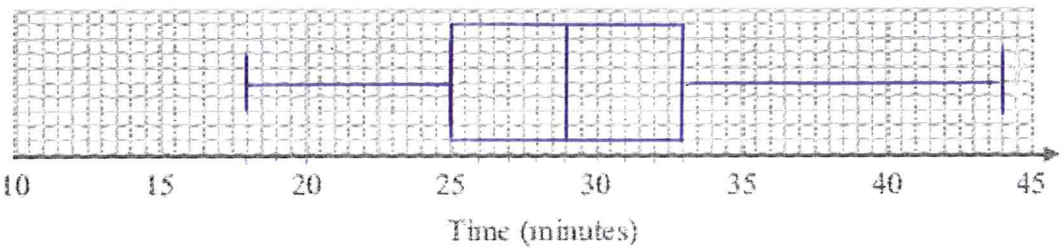

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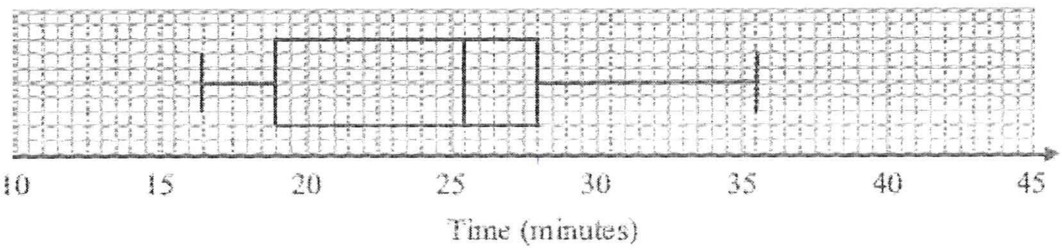

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(2)

(4 marks)

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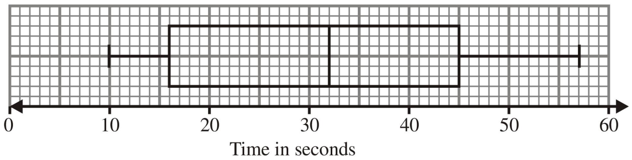

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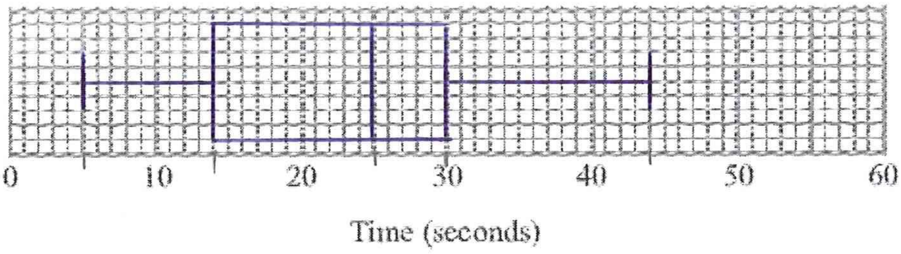

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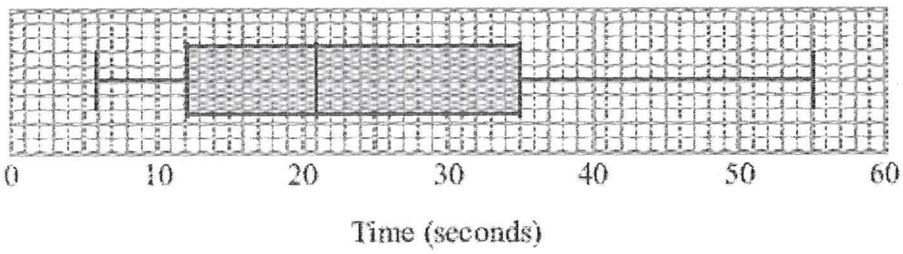

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(2)

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____

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____

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• a main and a dessert,
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$$= 60 + 60 + 360$$

$$= 480 \text{ ways}$$

____

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Therefore a password of <u>10 letters</u> is needed as $\frac{1}{1024} < \frac{1}{1000}$

____

(3 Marks)

PINPOINT

3) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As $2n$ is even $2n+1$ will be odd and so $2n+2$ is even.

(1)

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$2n + 2 + 2 = 2n + 4$

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$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

PINPOINT

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$(n+1)^2 - (n-1)^2 + 1$ is always odd for all positive integer values of n.

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$

$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$

$= 4n + 1$

$4n$ is a multiple of 4 so it must be even which means $4n+1$ is odd.

(3 marks)

3) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and n+1

$n^2 + (n+1)^2$

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$2n(n+1)$ is 2 x an even number which has to be a multiple of 4

So $2n(n+1) + 1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

4) Upper and Lower Bounds: Easier

1. The weight of a plasma TV is 12kg to the nearest kg.

a) What is the smallest possible weight of the TV?

11.5Kg

……………….. **(1)**

b) What is the largest possible weight of the TV?

12.5Kg

……………….. **(1)**

2. The height of a wardrobe is given as 253 cm to the nearest cm. What is the maximum height the wardrobe could be?

253.5cm

……………….. **(1)**

3. The number of people that attended a football fixture is given as 3200 to two significant figures. What is the minimum number of people that could have attended?

3250

……………….. **(1)**

4) Upper and Lower Bounds: Medium

6. On sports day a girl runs 100m, to the nearest metre. She wins and finishes in 11.3 seconds, correct to the nearest tenth of a second.

What is the fastest possible speed she could have run?

$$Speed = \frac{distance}{time}$$

$$UB(Speed) = \frac{UB(distance)}{LB(time)}$$

$$UB(Speed) = \frac{100.5}{11.25}$$

=8.99m/s

…..………….. **(4)**

7. The maximum load for a crane is 5400kg, measured to the nearest 100 kg. Each crate weighs 20kg, measured to the nearest 10kg.

What is the maximum number of crates the crane can safely take?

$$Max\ number\ of\ cranes = \frac{LB(Max\ load)}{UB(weight\ of\ crate)}$$

$$= \frac{5350}{25}$$

=214 Crates

…..………….. **(4)**

4) Upper and Lower Bounds: Harder

8. The formula for density is

$$D = \frac{M}{V}$$

V is the volume of the object, M is the mass and D the density.

The Volume of a liquid is given as 500ml to the nearest 10ml and the Mass of the liquid is 600g to nearest gram

By considering bounds, give the Density of the drink to a suitable degree of accuracy. You must show all of your working and give a reason for your answer

$$UB(D) = \frac{UB(M)}{LB(V)}$$

$$UB(D) = \frac{505}{599.5} = 0.842369$$

$$LB(D) = \frac{LB(M)}{UB(V)}$$

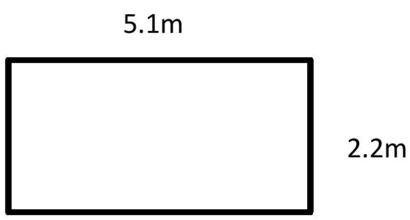
$$LB(D) = \frac{495}{600.5} = 0.824313$$

The lower bound and the upper bound are the same to one significant figure so 0.8

0.8g/ml

…….……….g/ml **(4)**

*9. Sabrina is decorating and is painting a feature wall. The measurements of the wall are shown below to the nearest 0.1m. A pot of paint covers 12m^2 of wall to the nearest 1m^2. By considering bounds, does Sabrina definitely have enough paint to cover the wall with one pot?



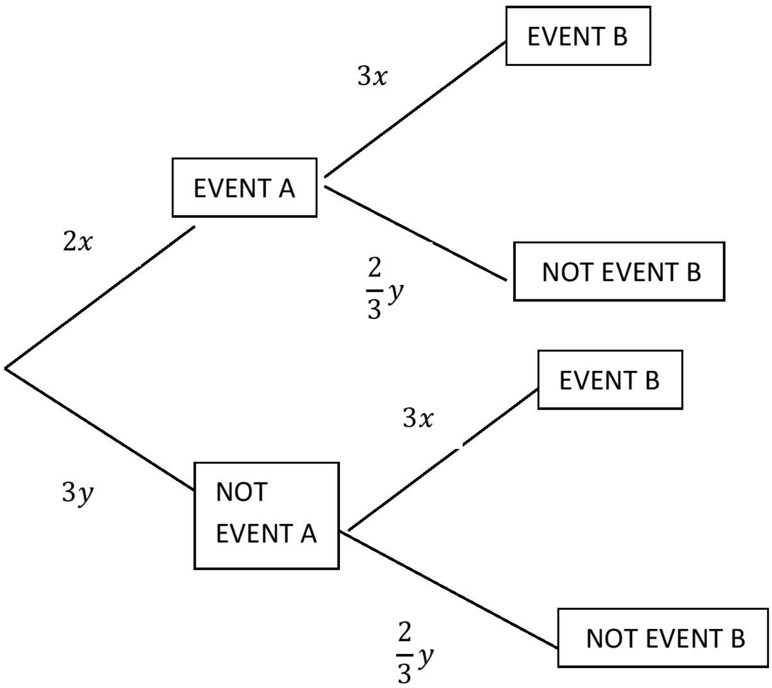
UB (area of wall)= 5.15 x 2.25=11.5875m^2

LB(area paint covers) = 11.5m^2

No she does not definitely have enough as she could only have enough for 11.5m^2 but she could need enough for 11.5875m^2

5) Extention1: Easier

1. The figure below shows a probability tree diagram for two events. What is the value of x and y?



From tree diagram (branches sum to one)

$$2x + 3y = 1$$

$$3x + \frac{2}{3}y = 1$$

Multiplying equations to eliminate x

$$6x + 9y = 3$$

$$6x + \frac{4}{3}y = 2$$

$$\frac{23}{3}y = 1$$

$$y = \frac{3}{23}$$

$$2x + \frac{9}{23} = 1$$

$$x = \frac{7}{23}$$

(4 marks)

5) Extention1: Medium

2. Given that $x^a = \frac{1}{x^b}$, What is the value of $2a + 2b$?

$$x^a = x^{-b}$$

$$a = -b$$

$$a + b = 0$$

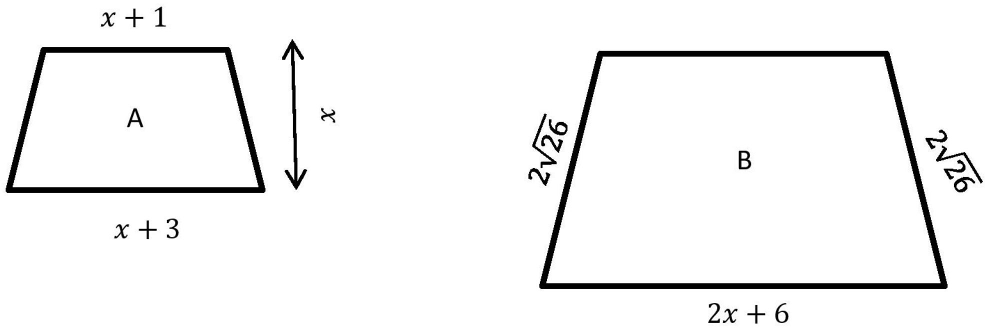
$$2(a + b) = 0$$

$$2a + 2b = 0$$

(3 marks)

5) Extention1: Harder

3. The two trapezia below are similar. The area of trapezium A is 35cm^2. Find the perimeter of trapezium B.



The area of trapezium A is given by $\frac{1}{2}(x+1+x+3)\times x$

$$\frac{1}{2}(2x+4)\times x = 35cm^2$$

$$x^2+2x = 35cm^2$$

$$x^2+2x-35=0$$

$$(x-5)(x+7)=0$$

$$x = 5cm, \qquad (as\ x>0)$$

The perimeter of Trapezium A is

$$2x+6+2x+2+4\sqrt{26}$$

When $x=5$ $\quad 4(5)+8+4\sqrt{26}$

$$=18+\ 4\sqrt{26}$$

(4 marks)

WATERS Tom

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	19 from 20	1 from 1	9 from 10	5 from 5	3 from 3	1 from 1
A02 and 3	49 from 60	9 from 11	13 from 16	9 from 9	10 from 16	8 from 8
Total	68 from 80	10 from 12	22 from 26	14 from 14	13 from 19	9 from 9

Your Pinpoint Topics

Topic 1: Loci and Construction. Mathswatch Clip: 165

Topic 2: Proof. Mathswatch Clip: 193

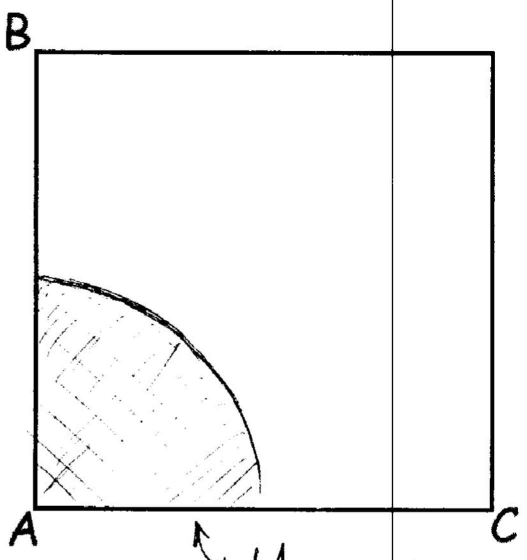
Topic 3: Completing the Square. Mathswatch Clip: 209

Topic 4: Upper and Lower Bounds. Mathswatch Clip: 206

Topic 5: Extention1. Mathswatch Clip:

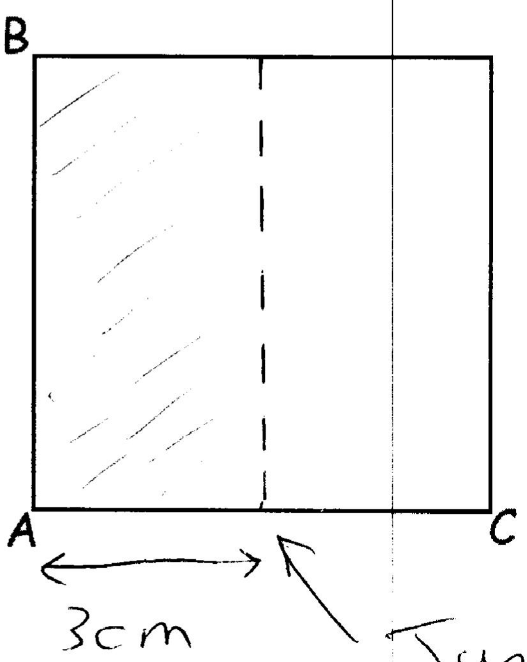
1) Loci and Construction: Easier

1) Shade the area closer than 3cm to point A within the square below:



Use compass at 3cm

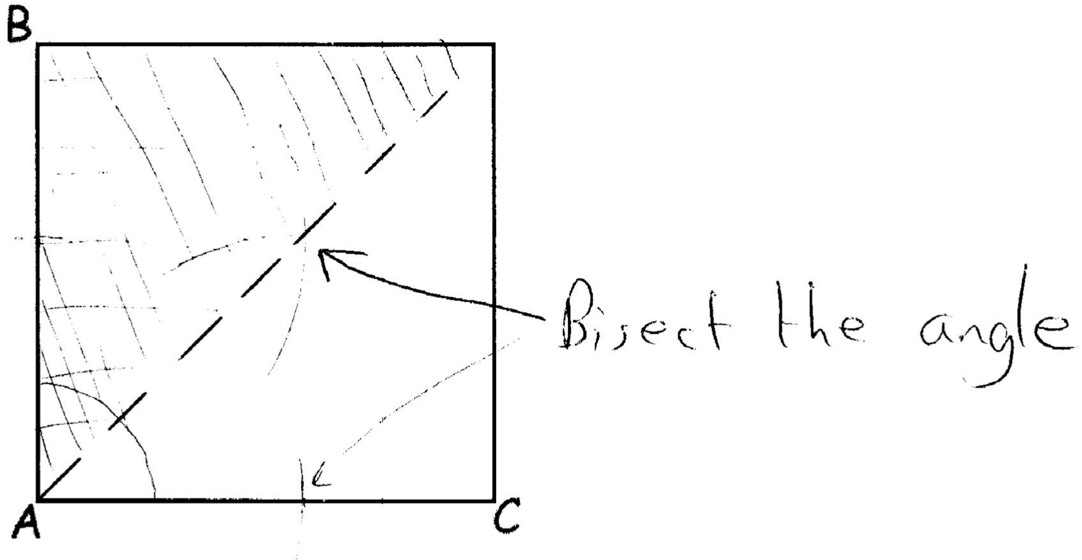
2) Shade the area closer than 3cm to the line AB within the square below:



Just measure 3cm with your ruler

1) Loci and Construction: Medium

3) Shade the area closer to the line AB than AC within the square below:

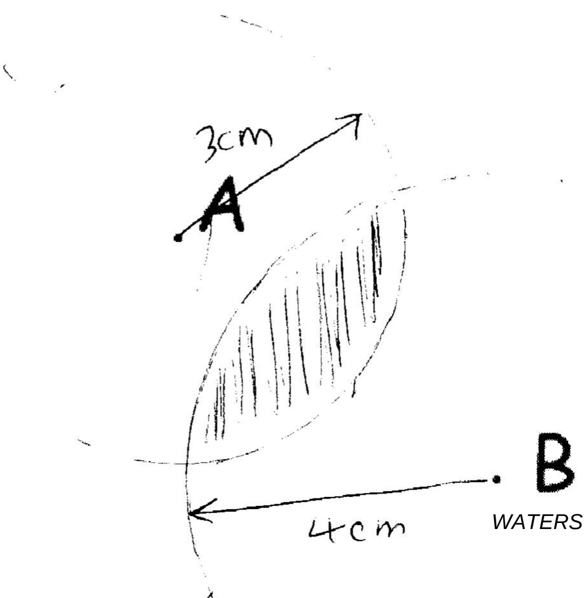


4) Two mobile phone stations transmit a signal.

Mobile phone station A transmits its signal ~~5~~ 3 miles.

Mobile phone station B transmits its signal 4 miles.

When you can receive both signals you experience interference on your phone. Shade below the area of interference.



Scale: 1 cm represents 1 mile

1) Loci and Construction: Harder

5) Mariam wants to plant a flower:

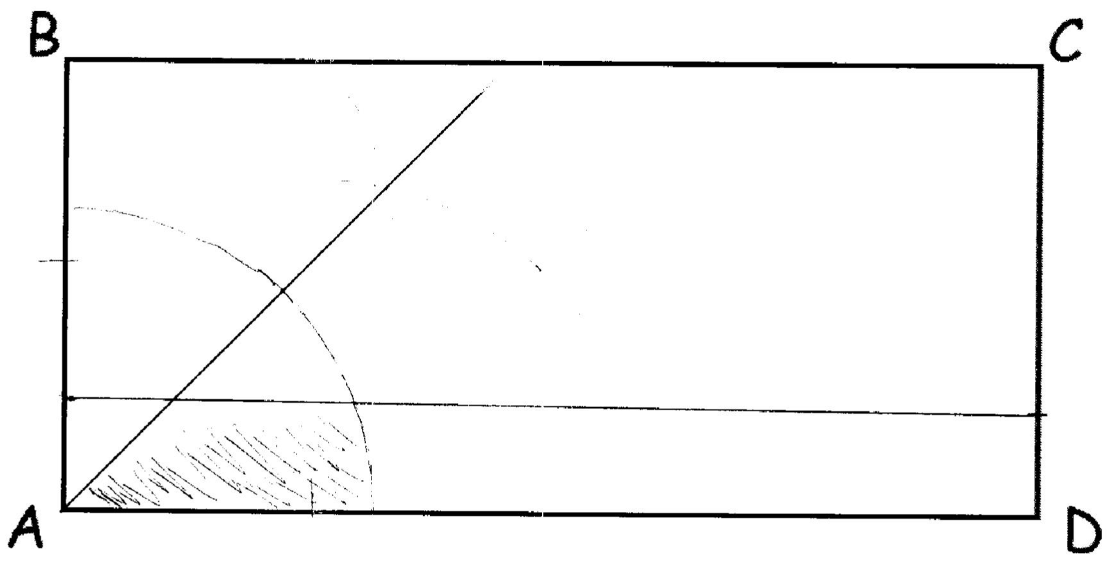
Within 4m of A

Closer to AD than AB

Less than 1.5m from AD.

Shade below the region where Mariam should plant her flower.

Show any construction lines your draw.



Scale: 1 cm represents 1 metre

2) Proof: Easier

1. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

Every alternate integer is even. As $2n$ is even $2n+1$ will be odd and so $2n+2$ is even.

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

$2n + 2 + 2 = 2n + 4$

$2n + 4$

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

$2n + 2n+2 + 2n+4$

$= 6n + 6$

$= 6(n+1)$

↑ a multiple of 6.

(3)

(5 marks)

2) Proof: Medium

8. Prove that

$$(n+1)^2 - (n-1)^2 + 1 \text{ is always odd for all positive integer values of } n.$$

$(n+1)^2 = n^2 + 2n + 1$

$(n-1)^2 = n^2 - 2n + 1$

$$(n+1)^2 - (n-1)^2 + 1 = (n^2 + 2n + 1) - (n^2 - 2n + 1) + 1$$
$$= n^2 + 2n + 1 - n^2 + 2n - 1 + 1$$
$$= 4n + 1$$

$4n$ is a multiple of 4 so it must be even which means $4n+1$ is odd.

(3 marks)

2) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$$n^2 + (n+1)^2$$

$$= n^2 + n^2 + 2n + 1$$

$$= 2n^2 + 2n + 1$$

$$= 2n(n+1) + 1$$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

$2n(n+1)$ is $2 \times$ an even number which has to be a multiple of 4

So $2n(n+1) + 1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)

PINPOINT

3) Completing the Square: Easier

1) Express $x^2 + 6x + 10$ in the form $(x + p)^2 + q$

$$(x+3)^2 - 3^2 + 10$$

$$= (x+3)^2 - 9 + 10$$

$$= (x+3)^2 + 1$$

$$\boxed{\begin{array}{l} p = 3 \\ q = 1 \end{array}}$$

3) Completing the Square: Medium

2) Express $x^2 - 3x + 5$ in the form $(x + a)^2 + b$

$$(x-1.5)^2 - 1.5^2 + 5$$

$$= (x-1.5)^2 - 2.25 + 5$$

$$= (x-1.5)^2 + 2.75$$

$a = -1.5, b = 2.75$

3) Completing the Square: Harder

3) What is the minimum value of

$(x-2)^2 + 5$?

5, which occurs when $x=2$.

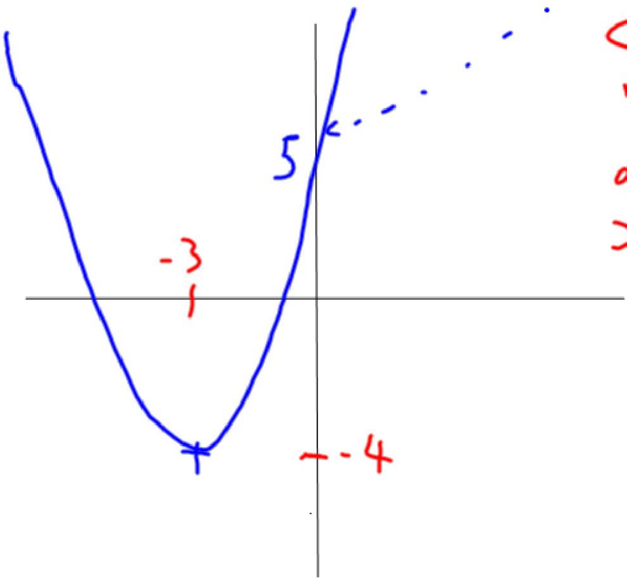
$(x-2)^2$ can never be negative.

4) a) Express $x^2 + 6x + 5$ in the form of $(x + a)^2 + b$

$(x+3)^2 - 3^2 + 5$

$= (x+3)^2 - 4$

b) Now sketch the graph of $y = x^2 + 6x + 5$ stating the minimum point of the graph and where it crosses the axis



min point at $x=-3, y=-4$

4) Upper and Lower Bounds: Easier

1. The weight of a plasma TV is 12kg to the nearest kg.

a) What is the smallest possible weight of the TV?

11.5Kg

.... **(1)**

b) What is the largest possible weight of the TV?

12.5Kg

.... **(1)**

2. The height of a wardrobe is given as 253 cm to the nearest cm. What is the maximum height the wardrobe could be?

253.5cm

.... **(1)**

3. The number of people that attended a football fixture is given as 3200 to two significant figures. What is the minimum number of people that could have attended?

3250

.... **(1)**

4) Upper and Lower Bounds: Medium

6. On sports day a girl runs 100m, to the nearest metre. She wins and finishes in 11.3 seconds, correct to the nearest tenth of a second.

What is the fastest possible speed she could have run?

$$Speed = \frac{distance}{time}$$

$$UB(Speed) = \frac{UB(distance)}{LB(time)}$$

$$UB(Speed) = \frac{100.5}{11.25}$$

=8.99m/s

…..…………… **(4)**

7. The maximum load for a crane is 5400kg, measured to the nearest 100 kg. Each crate weighs 20kg, measured to the nearest 10kg.

What is the maximum number of crates the crane can safely take?

$$Max\ number\ of\ cranes = \frac{LB(Max\ load)}{UB(weight\ of\ crate)}$$

$$= \frac{5350}{25}$$

=214 Crates

…..…………… **(4)**

4) Upper and Lower Bounds: Harder

8. The formula for density is

$$D = \frac{M}{V}$$

V is the volume of the object, M is the mass and D the density.

The Volume of a liquid is given as 500ml to the nearest 10ml and the Mass of the liquid is 600g to nearest gram

By considering bounds, give the Density of the drink to a suitable degree of accuracy. You must show all of your working and give a reason for your answer

$$UB(D) = \frac{UB(M)}{LB(V)}$$

$$UB(D) = \frac{505}{599.5} = 0.842369$$

$$LB(D) = \frac{LB(M)}{UB(V)}$$

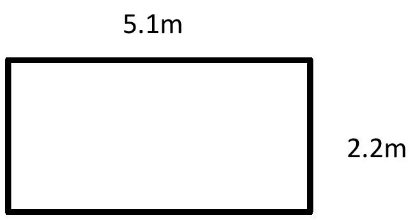
$$LB(D) = \frac{495}{600.5} = 0.824313$$

The lower bound and the upper bound are the same to one significant figure so 0.8

0.8g/ml

……..………..g/ml **(4)**

*9. Sabrina is decorating and is painting a feature wall. The measurements of the wall are shown below to the nearest 0.1m. A pot of paint covers 12m^2 of wall to the nearest 1m^2. By considering bounds, does Sabrina definitely have enough paint to cover the wall with one pot?

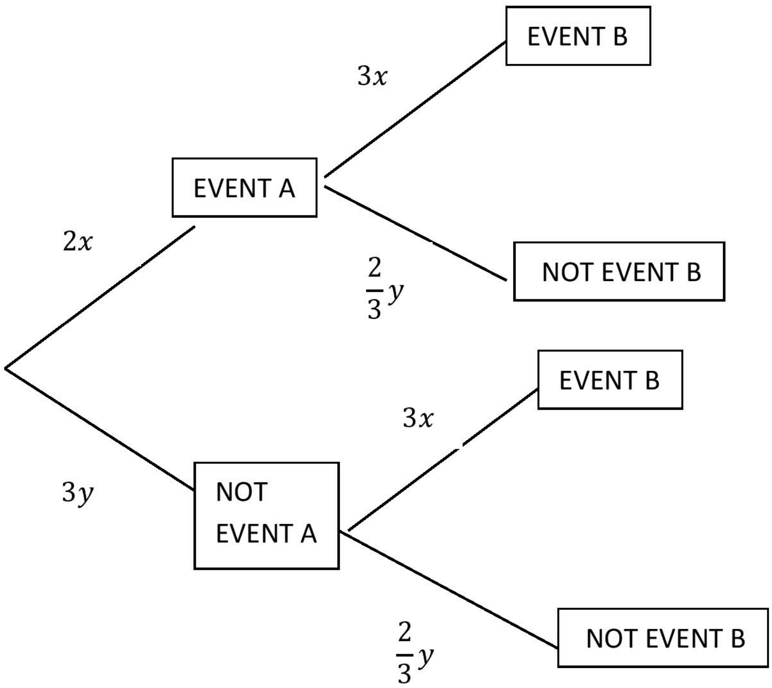


UB (area of wall)= 5.15 x 2.25=11.5875m^2

LB(area paint covers) = 11.5m^2
No she does not definitely have enough as she could only have enough for 11.5m^2 but she could need enough for 11.5875m^2

5) Extention1: Easier

1. The figure below shows a probability tree diagram for two events. What is the value of x and y?



From tree diagram (branches sum to one)

$$2x + 3y = 1$$

$$3x + \frac{2}{3}y = 1$$

Multiplying equations to eliminate x

$$6x + 9y = 3$$

$$6x + \frac{4}{3}y = 2$$

$$\frac{23}{3}y = 1$$

$$y = \frac{3}{23}$$

$$2x + \frac{9}{23} = 1$$

$$x = \frac{7}{23}$$

(4 marks)

5) Extention1: Medium

2. Given that $x^a = \frac{1}{x^b}$, What is the value of $2a + 2b$?

$$x^a = x^{-b}$$

$$a = -b$$

$$a + b = 0$$

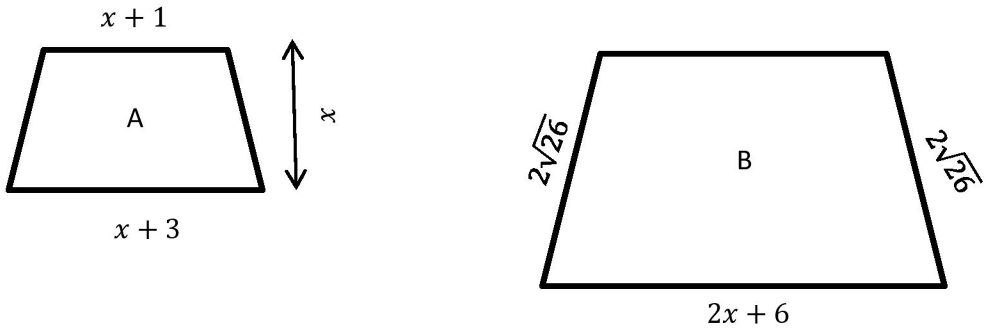
$$2(a + b) = 0$$

$$2a + 2b = 0$$

(3 marks)

5) Extention1: Harder

3. The two trapezia below are similar. The area of trapezium A is $35cm^2$. Find the perimeter of trapezium B.



The area of trapezium A is given by $\frac{1}{2}(x+1+x+3) \times x$

$$\frac{1}{2}(2x+4) \times x = 35cm^2$$

$$x^2 + 2x = 35cm^2$$

$$x^2 + 2x - 35 = 0$$

$$(x-5)(x+7) = 0$$

$$x = 5cm, \qquad (as\ x > 0)$$

The perimeter of Trapezium A is

$$2x + 6 + 2x + 2 + 4\sqrt{26}$$

When $x = 5$ $\quad 4(5) + 8 + 4\sqrt{26}$

$$= 18 + \ 4\sqrt{26}$$

(4 marks)

WATKINS Tom

9to1_AQA_PracticeSet3_3H_Whole_Qns

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Your Exam Statistics

Strand	Overall	Number	Algebra	Data	Shape	Ratio
AO1	12 from 20	0 from 1	5 from 10	3 from 5	3 from 3	1 from 1
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Total	36 from 80	4 from 12	10 from 26	10 from 14	7 from 19	5 from 9

Your Pinpoint Topics

Topic 1: Loci and Construction. Mathswatch Clip: 165

Topic 2: Distance Time Graphs. Mathswatch Clip: 143

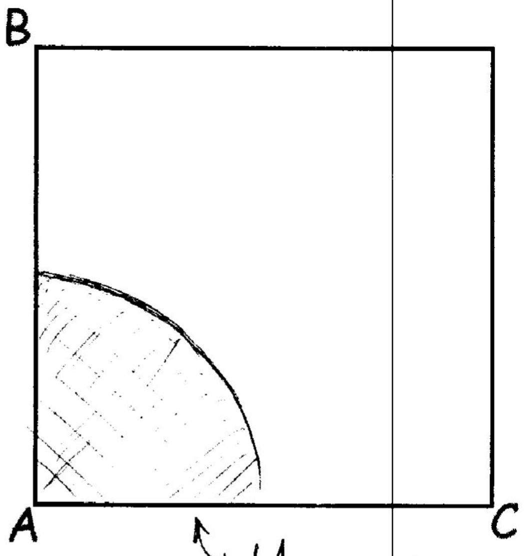
Topic 3: Simultaneous Equations. Mathswatch Clip: 162

Topic 4: Counting Methods. Mathswatch Clip: NA

Topic 5: Proof. Mathswatch Clip: 193

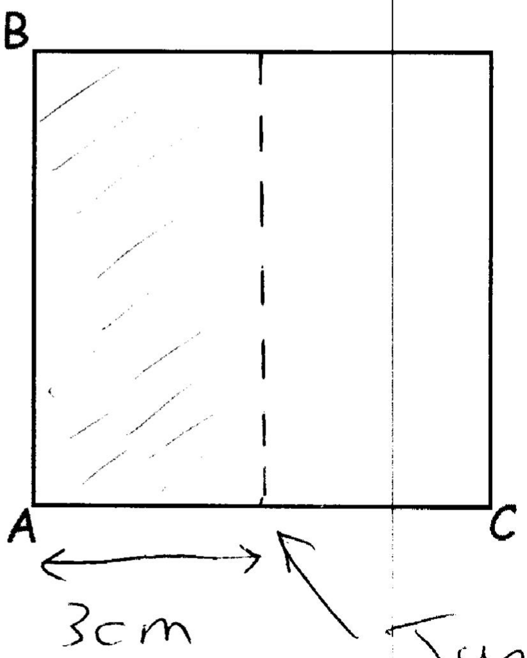
1) Loci and Construction: Easier

1) Shade the area closer than 3cm to point A within the square below:



Use compass at 3cm

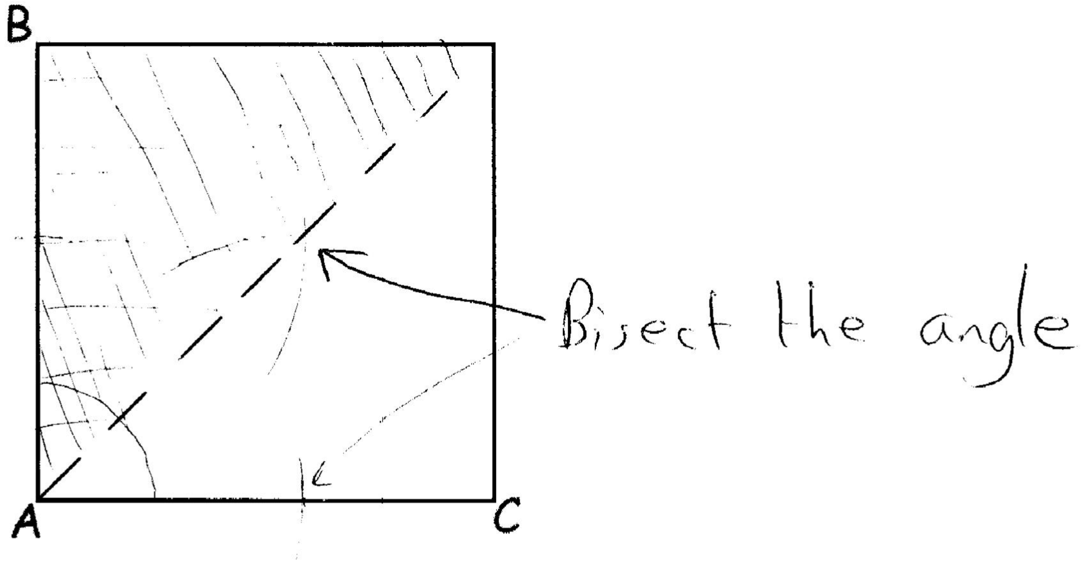
2) Shade the area closer than 3cm to the line AB within the square below:



Just measure 3cm with your ruler

1) Loci and Construction: Medium

3) Shade the area closer to the line AB than AC within the square below:



4) Two mobile phone stations transmit a signal.

Mobile phone station A transmits its signal ~~5~~ 3 miles.

Mobile phone station B transmits its signal 4 miles.

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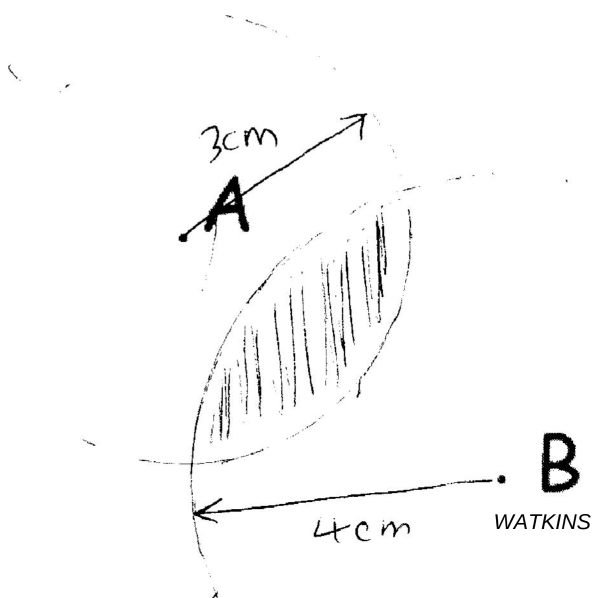


Scale: 1 cm represents 1 mile

1) Loci and Construction: Harder

5) Mariam wants to plant a flower:

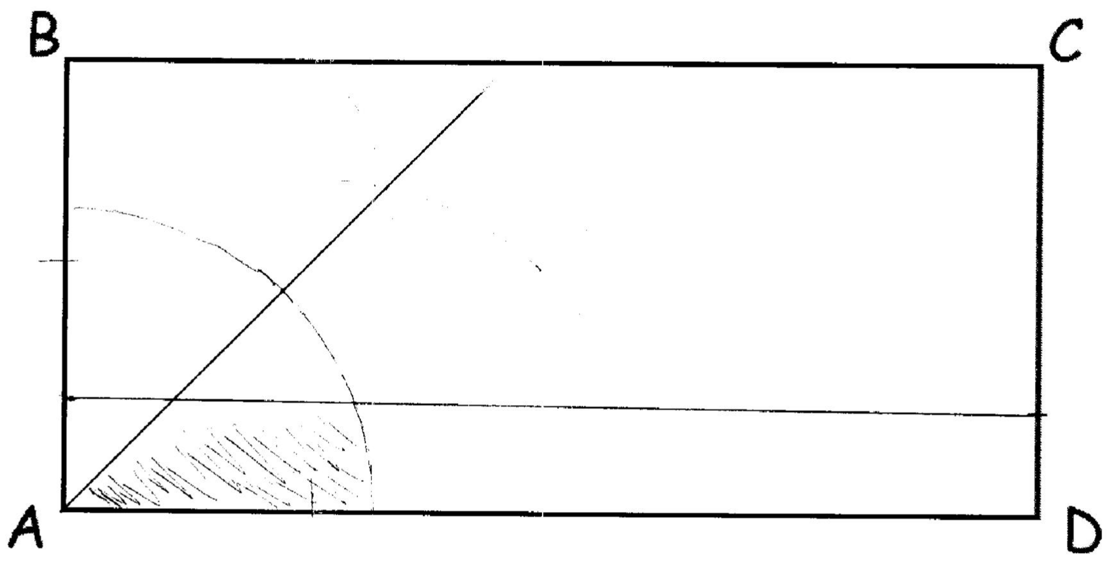
Within 4m of A

Closer to AD than AB

Less than 1.5m from AD.

Shade below the region where Mariam should plant her flower.

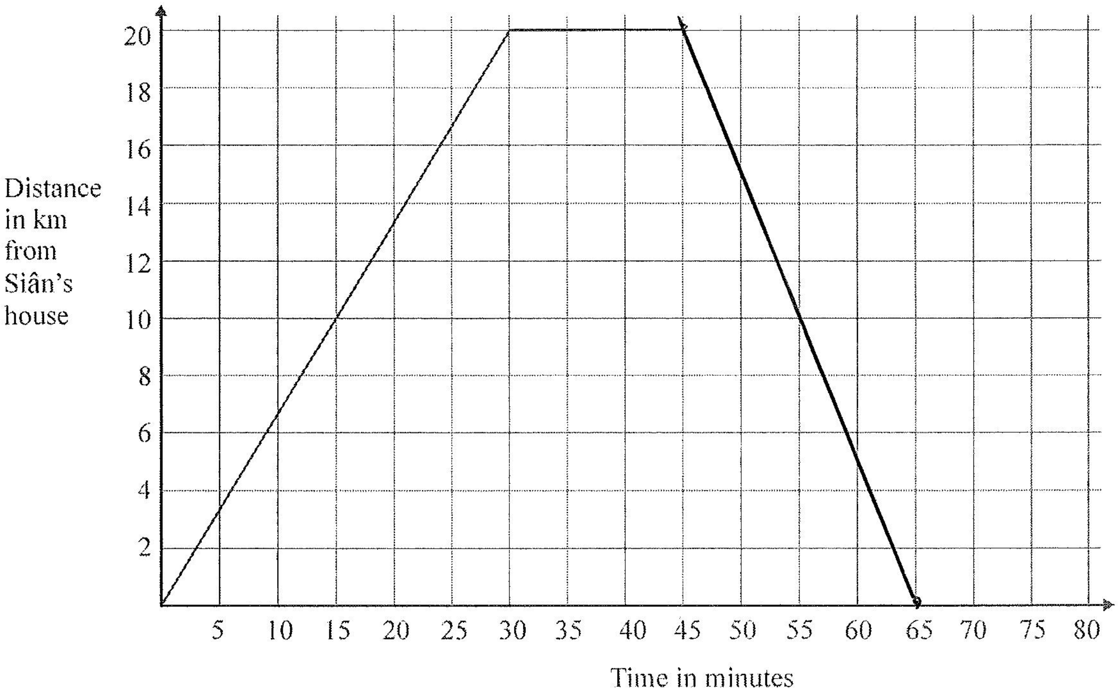
Show any construction lines your draw.



Scale: 1 cm represents 1 metre

2) Distance Time Graphs: Easier

1. Here is part of a travel graph of Siân's journey from her house to the shops and back.



(a) Work out Siân's speed for the first 30 minutes of her journey.
Give your answer in km/h.

distance ÷ time   30 minutes = 0.5 hours.

20 ÷ 0.5 = 40

40 .... km/h

(2)

Siân spends 15 minutes at the shops.
She then travels back to her house at 60 km/h.

(b) Complete the travel graph.

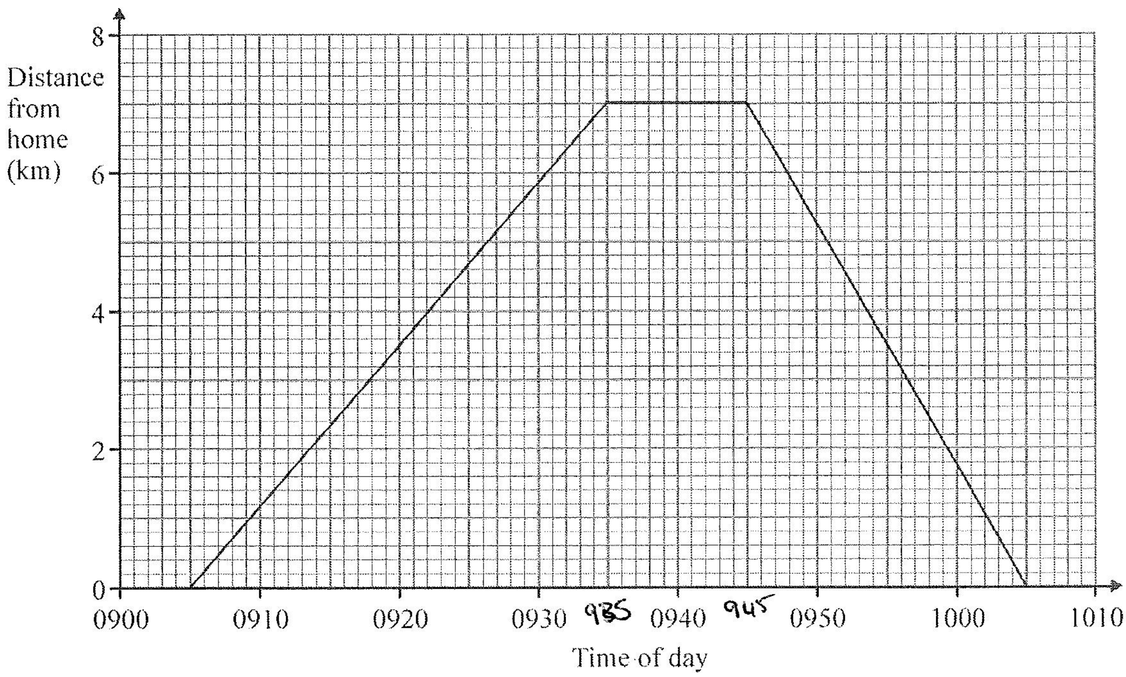
20km at 60 km/h

20 in 20minutes

(2)
(Total 4 marks)

2) Distance Time Graphs: Medium

2. Anil cycled from his home to the park.
Anil waited in the park.
Then he cycled back home.
Here is a distance-time graph for Anil's complete journey.



(a) At what time did Anil leave home?

0905 ....

(1)

(b) What is the distance from Anil's home to the park?

7.5 .... km

(1)

(c) How many minutes did Anil wait in the park?

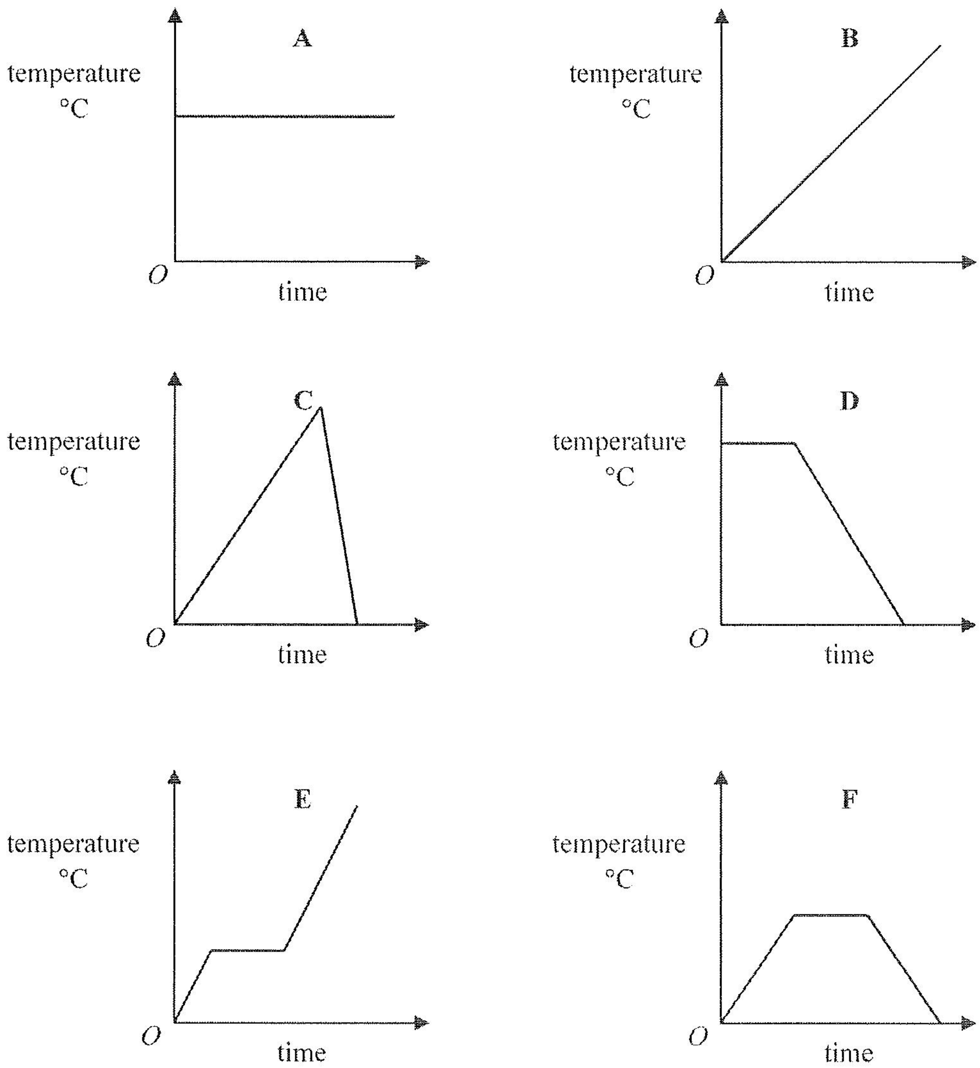
10minutes ....

(1)

(Total 3 marks)

2) Distance Time Graphs: Harder

11. Here are six temperature/time graphs.



Each sentence in the table describes one of the graphs.
Write the letter of the correct graph next to each sentence.

The first one has been done for you.

The temperature starts at 0°C and keeps rising.	**B**
The temperature stays the same for a time and then falls.	D
The temperature rises and then falls quickly.	C
The temperature is always the same.	A
The temperature rises, stays the same for a time and then falls.	F
The temperature rises, stays the same for a time and then rises again.	E

(Total 3 marks)

3) Simultaneous Equations: Easier

1) Solve the simultaneous equations.

$$(1) \quad 2x + 3y = 9$$
$$(2) \quad 5x + 3y = 18$$

(2) − (1)

$5x + 3y = 18$

$2x + 3y = 9$ −

$\frac{3x}{3} = \frac{9}{3}$

$x = 3$

Sub $x = 3$ into (1)

$2x + 3y = 9$

$6 + 3y = 9$

$3y = 3$

$y = 1$

x = 3

y = 1

(3 Marks)

---

2) Solve the simultaneous equations.

$$(1) \quad 4x + 2y = 9 \quad \times 2$$
$$(2) \quad 8x + 8y = 20$$

(3) $8x + 4y = 18$

(2) − (3)

$8x + 8y = 20$

$8x + 4y = 18$ −

$\frac{4y}{4} = \frac{2}{4}$

$y = 0.5$

Sub $y = 0.5$ into (1)

$4x + 1 = 9$

$-1 \quad -1$

$\frac{4x}{4} = \frac{8}{4}$

$x = 2$

x = 2

y = 0.5

(4 Marks)

3) Simultaneous Equations: Medium

7) Solve the simultaneous equations.

(1) $6x + 3y = 15$ $\times 3$

(2) $4x - 9y = -34$

(3) $18x + 9y = 45$

(2) + (3)

$4x - 9y = -34$

$18x + 9y = 45$ +

$22x = 11$

$\frac{22x}{22} = \frac{11}{22}$

$x = 0.5$

Sub $x = 0.5$ into (1)

$3 + 3y = 15$

$-3 \quad -3$

$\frac{3y}{3} = \frac{12}{3}$

$y = 4$

x = 0.5

y = 4

(4 Marks)

8) Solve the simultaneous equations.

(1) $5x + 2y = 29$ $\times 3$

(2) $8x - 6y = 51$

(3) $15x + 6y = 87$

(2) + (3)

$8x - 6y = 51$

$15x + 6y = 87$ +

$23x = 138$

$\frac{23x}{23} = \frac{138}{23}$

$x = 6$

Sub $x = 6$ into (1)

$30 + 2y = 29$

$-30 \quad -30$

$\frac{2y}{2} = \frac{-1}{2}$

$y = -0.5$

x = 6

y = -0.5

(4 Marks)

3) Simultaneous Equations: Harder

9) Bill goes into a chip shop and buys **3 fish** and **2 portions of chips,** it cost him £5.20

Jenny also goes into the same chip shop. She buys **5 fish** and **6 portions of chips,** it cost her £10.80

What is the cost of a portion of fish and chips?

① $3f + 2p = 5.20$ ×3

② $5f + 6p = 10.80$

③ $9f + 6p = 15.60$

③ − ②

$9f + 6p = 15.60$

$5f + 6p = 10.80$

$4f = 4.8$

$\frac{4f}{4} = \frac{4.80}{4}$

$f = 1.20$

Sub into ①

$3.60 + 2p = 5.20$

$-3.60 \quad -3.60$

$2p = 1.60$

$p = 0.80$

$p + f = £2$

(5 Marks)

10) There are some ducks and some sheep on a farm. Altogether they have 35 heads and 94 feet.
How many ducks and sheep are there?

① $d + s = 35$ (heads) ×2

② $2d + 4s = 94$ (feet)

③ $2d + 2s = 70$

② − ③

$2d + 4s = 94$

$2d + 2s = 70$ −

$2s = 24$

Sub $s = 12$ into ①

$d + 12 = 35$

$-12 \quad -12$

$d = 23$

Ducks = 23

Sheep = 12

(5 Marks)

PINPOINT

4) Counting Methods: Easier

1) Ryan has four shorts of different colours, blue, red, green and yellow.
He has three different T-shirts of different colours, black, white and orange.

Blue shorts and a black T-Shirt would be one possible outfit.
How many different outfits of Shorts and T-Shirts can Ryan wear?

4 shorts × 3 T-shirts = 12 possible outfits

____

(2 Marks)

---

2) There are 13 boys and 10 girls in a class.
Work out the total number of ways that 1 boy and 1 girl can be chosen from the class.

$13 \times 10 = 130$ ways

____

(2 Marks)

---

3) There are 7 boys and 10 girls in a class.
Work out the total number of ways that 1 boys and 2 girls can be chosen from the class.

$7 \times 10 \times 9 = 630$ ways

____

(2 Marks)

4) Counting Methods: Medium

4) Mason's bank secret pin code is a four digit number and each digit can be the numbers 0, 1, 2, 3, 4, 5, 6 , 7, 8, or 9. For example one possible pin number could be 9021.

a) Mason's bank card is stolen. What is the probability with one guess only that someone correctly guesses Mason's pin number? Leave your answer as a fraction.

$10 \times 10 \times 10 \times 10 = 10000$ possibilities.

Probability of guessing first time = $\frac{1}{10000}$

____

(2 Marks)

Ishmael's bank does not allow any digit to be repeated in his secret pin number. For example 7762 would not be allowed, nor would 5075.

b) Ishmael's bank card is stolen. What is the probability with one guess only that someone correctly guesses Ishmael's pin number? Leave your answer as a fraction.

$10 \times 9 \times 8 \times 7 = 5040$ possibilities.

Probability of guessing first time = $\frac{1}{5040}$

____

(3 Marks)

4) Counting Methods: Harder

5) A restaurant menu has 6 starters, 10 mains and 6 desserts.
A customer can choose from the following meals

- a starter and a main,
- a main and a dessert,
- a starter, a main and a dessert.

Show that there are 480 different ways of choosing a meal at this restaurant.

$$(6 \times 10) + (10 \times 6) + (6 \times 10 \times 6)$$

$$= 60 + 60 + 360$$

= 480 ways

____

(3 Marks)

6) A simple computer password only allows you to use two letters a and b.
"abaab" would be an example of one password which consists of 5 letters.
How many letters must your password contain such that the probability of someone randomly guessing it first time is less than 1 in a 1000?

Use Trial and Improvement:

2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 1024 ways with 10 letters.

Therefore a password of <u>10 letters</u> is needed as $\frac{1}{1024} < \frac{1}{1000}$

____

(3 Marks)

5) Proof: Easier

1. The nth even number is $2n$.

   The next even number after $2n$ is $2n + 2$

   (a) Explain why.

   Every alternate integer is even. As $2n$ is even $2n+1$ will be odd and so $2n+2$ is even.

   (1)

   (b) Write down an expression, in terms of n, for the next even number after $2n + 2$

   $2n + 2 + 2 = 2n + 4$

   $2n + 4$

   (1)

   (c) Show algebraically that the sum of any 3 consecutive even numbers is always a multiple of 6

   $$2n + 2n+2 + 2n+4$$
   $$= 6n + 6$$
   $$= 6(n+1)$$

   ↑ a multiple of 6.

   (3)

   (5 marks)

5) Proof: Medium

2. Prove that $(3n + 1)^2 - (3n - 1)^2$ is a multiple of 4, for all positive integer values of n.

$$(3n+1)^2 - (3n-1)^2$$

$$(3n+1)^2 = (3n+1)(3n+1)$$
$$= 9n^2 + 6n + 1$$

$$(3n-1)^2 = (3n-1)(3n-1)$$
$$= 9n^2 - 6n + 1$$

$$(3n+1)^2 - (3n+1)^2 = (9n^2 + 6n + 1) - (9n^2 - 6n + 1)$$
$$= 9n^2 + 6n + 1 - 9n^2 + 6n - 1$$
$$= 12n$$
$$= 4(3n)$$

$\uparrow$

which is a multiple of 4

(3 marks)

5) Proof: Harder

9. Prove algebraically that the sum of the squares of any two consecutive numbers always leaves a remainder of 1 when divided by 4.

consecutive numbers are n and $n+1$

$n^2 + (n+1)^2$

$= n^2 + n^2 + 2n + 1$

$= 2n^2 + 2n + 1$

$= 2n(n+1) + 1$

$n(n+1)$ is the product of 2 consecutive numbers. As one of them is even the product must be even.

$2n(n+1)$ is 2 x an even number which has to be a multiple of 4

So $2n(n+1) + 1$ is a multiple of 4 plus 1 and will leave a remainder of 1 when divided by 4

(4 marks)