

Write your name here

Surname

Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9 - 1)

Centre Number

Candidate Number

Mathematics

Paper 1 (Non-Calculator)

Solutions

Higher Tier

Mock Set 2 – Spring 2017

Time: 1 hour 30 minutes

Paper Reference

1MA1/1H

You must have: Ruler graduated in centimetres and millimetres,
protractor, pair of compasses, pen, HB pencil, eraser.
Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may not be used.**



Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 Ali and Beth divide £280 in the ratio 2 : 5

Work out how much each person gets.

$$2 + 5 = 7 \text{ shares}$$

$$£280 \div 7 = £40$$

$$1 \text{ share} = £40$$

$$\text{Ali } 2 \times £40 = £80$$

$$\text{Beth } 5 \times £40 = £200$$

Ali £ 80

Beth £ 200

(Total for Question 1 is 2 marks)

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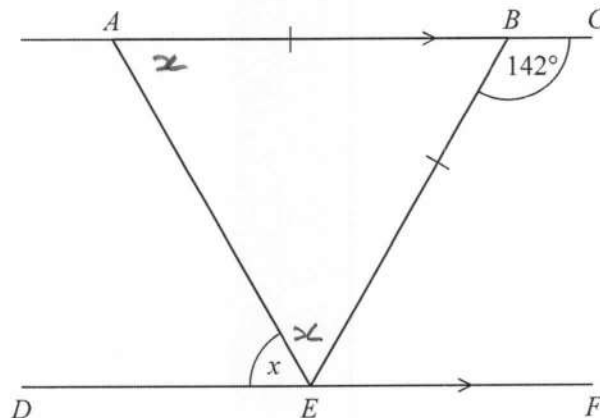
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2



ABC and DEF are parallel straight lines.
 ABE is an isosceles triangle with $AB = BE$.
 Angle $CBE = 142^\circ$

Work out the size of angle x .
 Give a reason for each stage in your working.

$$\begin{aligned} \angle BAE &= x && (\text{alternate } \angle\text{s are equal}) \\ \angle AEB &= x && (\text{base } \angle\text{s of isos } \Delta \text{ equal}) \\ \angle ABE &= 180 - 142 = 38^\circ && (\text{angles on str line add up to } 180^\circ) \end{aligned}$$

$$x + x + 38^\circ = 180 \quad (\angle \text{ sum of } \Delta)$$

$$2x + 38 = 180$$

$$2x = 180 - 38$$

$$2x = 142$$

$$x = \frac{142}{2}$$

$$x = 71^\circ$$

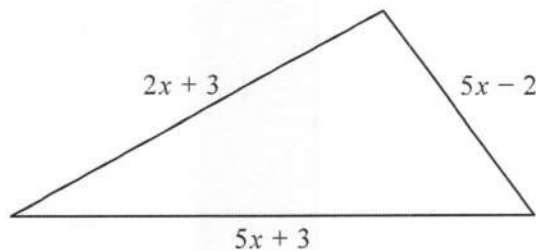
71°

(Total for Question 2 is 5 marks)



S 5 3 6 0 3 A 0 3 2 0

- 3 The perimeter of a square has the same length as the perimeter of this triangle.



All measurements are in centimetres.

Find an expression, in terms of x , for the length of a side of the square.
Give your answer in its simplest form.

$$\begin{aligned}\text{Perimeter of } \triangle &= 2x + 3 + 5x - 2 + 5x + 3 \\ &= 12x + 4 \\ &= \text{Perimeter of square}\end{aligned}$$

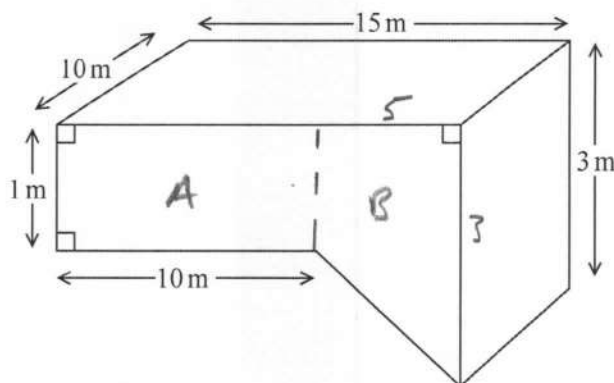
$$\begin{aligned}\text{Side of square} &= \frac{12x + 4}{4} \\ &= 3x + 1\end{aligned}$$

$$3x + 1$$

(Total for Question 3 is 3 marks)



4



The diagram shows a swimming pool.

The swimming pool is in the shape of a prism.

The swimming pool is filled with water at a rate of 5 litres per second.

Jeremy has 10 hours to fill the swimming pool.

$1 \text{ m}^3 = 1000 \text{ litres}$.

Will he completely fill the swimming pool in 10 hours?

You must show all your working.

$$\text{Area of rectangle A} = 10 \times 1 = 10 \text{ m}^2$$

$$\text{Area of trapezium B} = \frac{1}{2}(1+3) \times 5 = 10 \text{ m}^2$$

$$\text{Area of cross-section} = 10 + 10 = 20 \text{ m}^2$$

$$\text{Volume} = 20 \times 10 = 200 \text{ m}^3 \quad (\text{Area of cross-section} \times \text{length})$$

$$1 \text{ m}^3 = 1000 \text{ litres}$$

$$\text{so } 200 \times 1000 = 200,000 \text{ litres required}$$

$$5 \text{ litres per second} \quad \text{so } \frac{200,000}{5} = 40,000 \text{ seconds}$$

$$= \frac{40,000}{60} \text{ minutes} = 666\frac{2}{3} \text{ minutes to fill pool}$$

$$10 \text{ hours} = 600 \text{ minutes} \quad 600 < 666\frac{2}{3}$$

So cannot fill pool in 10 hours

(Total for Question 4 is 5 marks)



S 5 3 6 0 3 A 0 5 2 0

5

Turn over ►

5 It takes 12 men 5 days to complete a job.

(a) Work out how many days it would take 3 men to complete the same job.

12 men 5 days

1 man $5 \times 12 = 60$ days

3 men $\frac{60}{3} = 20$ days

20
(2)

(b) (i) State one assumption you made in working out your answer.

All men work at same rate

(1)

(ii) How will your answer be affected if your assumption is **not** correct?

Could be shorter if the 3 men work faster

Could be longer if the 3 men work slower

(1)

(Total for Question 5 is 4 marks)

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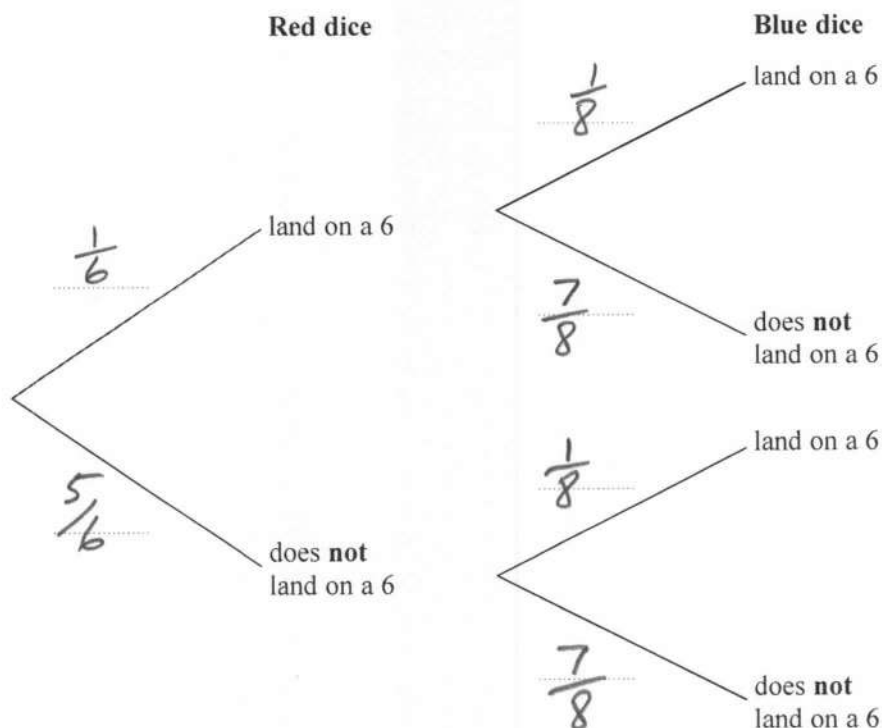
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- 6 Graham has a fair red 6-sided dice and a fair blue 8-sided dice.
The red dice can land on 1, 2, 3, 4, 5 or 6
The blue dice can land on 1, 2, 3, 4, 5, 6, 7 or 8

Graham is going to roll both dice.

- (a) Complete the probability tree diagram.



(2)

- (b) Work out the probability that neither dice will land on a 6

$$\frac{5}{6} \times \frac{7}{8} = \frac{35}{48}$$

$$\frac{35}{48}$$

(2)

(Total for Question 6 is 4 marks)



S 5 3 6 0 3 A 0 7 2 0

- 7 Here are the first 7 terms of a quadratic sequence.
- 2nd diff 2 2 2 2 2 2
- 1st diff 3 5 7 9 11 13
- 3 6 11 18 27 38 51

2nd diff constant at 2 so n^2 in formula

- (a) Find an expression, in terms of n , for the n th term of this sequence.

	3	6	11	18	27	38	51
n^2	1	4	9	16	25	36	49
2	2	2	2	2	2	2	2

$$n^2 + 2$$

(2)

- (b) Find the 50th term of this sequence.

$$50^2 + 2$$

$$= 2500 + 2$$

$$= 2502$$

$$2502$$

(1)

(Total for Question 7 is 3 marks)

- 8 Work out $2\frac{3}{4} \times 3\frac{1}{5}$

$$= \frac{11}{4} \times \frac{16}{5}$$

$$= \frac{44}{5}$$

$$= 8\frac{4}{5}$$

$$8\frac{4}{5}$$

(Total for Question 8 is 2 marks)



- 9 1 litre of a liquid **P** has a mass of p grams.
1 litre of a liquid **Q** has a mass of q grams.

A liquid **R** is made by mixing a volume of liquid **P** with a volume of liquid **Q** in the ratio 3 : 7

Find an expression, in terms of p and q , for the mass of 50 litres of liquid **R**.

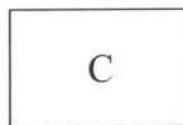
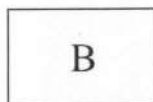
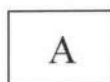
10 litres would have 3 litres of P with 7 litres of Q
Mass $3p + 7q$

50 litres Mass $(3p + 7q) \times 5$
 $= 15p + 35q$

$15p + 35q$ grams

(Total for Question 9 is 3 marks)

- 10 Here are three rectangles.



The area of rectangle **B** is 10% greater than the area of rectangle **A**.

The area of rectangle **C** is 10% greater than the area of rectangle **B**.

By what percentage is the area of rectangle **C** greater than the area of rectangle **A**?

$$1.1 \times 1.1 = 1.21$$

Area C 21% greater than Area A

21 %

(Total for Question 10 is 3 marks)



S 5 3 6 0 3 A 0 9 2 0

- 11 The cumulative frequency table gives information about the time, in minutes, Jane took to go from her home to school each day last term.

Time taken (t minutes)	Cumulative frequency
$0 < t \leq 10$	0
$0 < t \leq 20$	7
$0 < t \leq 30$	20
$0 < t \leq 40$	64
$0 < t \leq 50$	74
$0 < t \leq 60$	80

- (a) On the grid opposite, draw a cumulative frequency graph for this information.

(2)

Jane expects that it should take her x minutes to go from her home to school each day. On 25% of the days last term, Jane took longer than x minutes to go from her home to school.

- (b) Use your cumulative frequency graph to find an estimate for the value of x .

38.5 min
(3)



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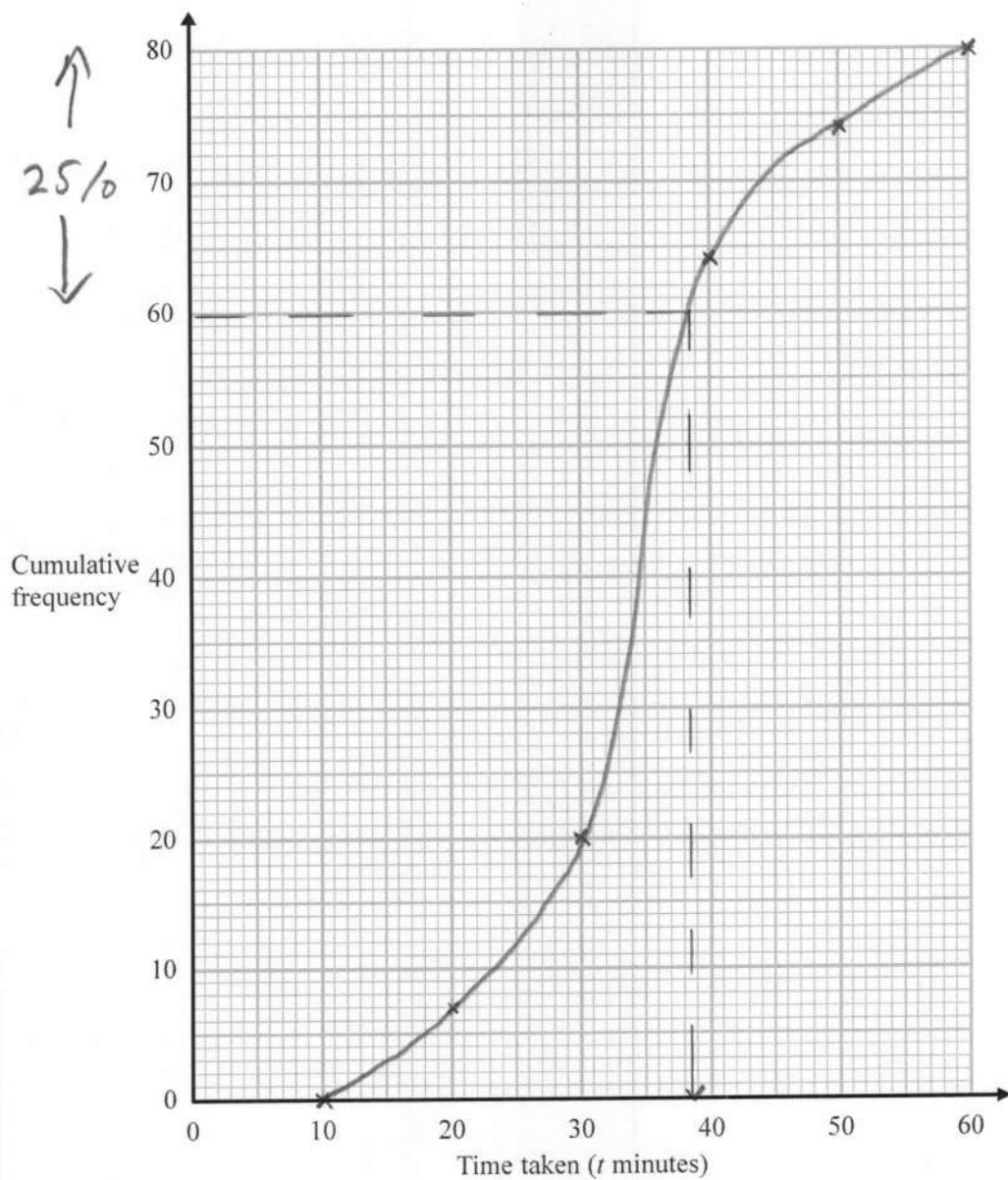
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(Total for Question 11 is 5 marks)



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12 Mark has 18 bags of counters and 12 boxes of counters.

The mean number of counters in all 30 bags and boxes is 14

The mean number of counters in the 18 bags is 10

Mark says,

"The mean number of counters per box is 4"

Is Mark right?

You must show how you get your answer.

$$\text{Total counters } 30 \times 14 = 420$$

$$\text{Total counters in bags } 18 \times 10 = 180$$

$$\text{Total counters in boxes } 240$$

$$\text{Mean per box} = \frac{240}{12} = 20 \quad \text{So Mark is wrong}$$

Alternative Method Total counters $30 \times 14 = 420$

$$\text{Total counters in bags } 18 \times 10 = 180$$

If mean is 4 per box then $12 \times 4 = 48$ in boxes

But $180 + 48 = 228$ not 420 so Mark is wrong

(Total for Question 12 is 3 marks)

13 Prove that the recurring decimal $0.4\dot{3}$ has the value $\frac{13}{30}$

$$\text{Let } x = 0.43333 \dots$$

$$\textcircled{1} \quad 10x = 4.333 \dots$$

$$\textcircled{2} \quad 100x = 43.333 \dots$$

$$\textcircled{2} - \textcircled{1} \quad 90x = 39$$

$$x = \frac{39}{90} = \frac{13}{30}$$

(Total for Question 13 is 2 marks)



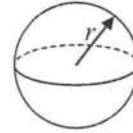
- 14 Jan has some metal that she is going to make into solid metal spheres.

Each sphere will have a radius of 2.15 cm.

Jan has 1490 cm^3 of metal.

- (a) Work out an estimate for the number of spheres that Jan can make.

$$\text{Volume of sphere} = \frac{4}{3} \pi r^3$$



$$\begin{aligned} \text{Volume Estimate } \frac{4}{3} \pi r^3 &\approx \frac{4}{3} \times 3 \times 2^3 \\ &= 4 \times 8 = 32 \text{ cm}^3 \end{aligned}$$

$$\text{Number} \approx \frac{1500}{30} = 50$$

50
(3)

- (b) If you calculate the number of spheres accurately, how do you think your answer to part (a) will change?

Give a reason for your answer.

Less because volume of each sphere
would be more as $\pi > 3$
 $2.15 > 2$

(1)

(Total for Question 14 is 4 marks)



S 5 3 6 0 3 A 0 1 3 2 0

15 (a) Find the value of $\sqrt[4]{27 \times 3 \times 10^8} = \sqrt[4]{3^4 \times 10^8} = (3^4 \times 10^8)^{\frac{1}{4}}$
 $= 3 \times 10^2$

300

(b) Find the value of $\left(\frac{216}{1000}\right)^{\frac{2}{3}} = \left(\frac{1000}{216}\right)^{\frac{2}{3}}$ (2)
 $= \left(\sqrt[3]{\frac{1000}{216}}\right)^2$
 $= \left(\frac{10}{6}\right)^2 = \left(\frac{5}{3}\right)^2 = \frac{25}{9}$

(2)

(Total for Question 15 is 4 marks)

16 Make t the subject of the formula $k = \frac{2(t+3)}{t-3}$

$$k(t-3) = 2(t+3)$$

$$kt - 3k = 2t + 6$$

$$kt - 2t = 6 + 3k$$

$$t(k-2) = 6 + 3k$$

$$t = \frac{6+3k}{k-2} \quad \text{or} \quad \frac{3(2+k)}{k-2}$$

(Total for Question 16 is 4 marks)



17 (a) Factorise $3(x-y)^2 - 2(x-y)$

$$\begin{aligned}
 &= 3(x-y)(x-y) - 2(x-y) \\
 &= (x-y)(3(x-y) - 2) \\
 &= (x-y)(3x - 3y - 2)
 \end{aligned}$$

(2)

(b) Show that $\frac{1}{2x^2 + x - 15} \div \frac{1}{3x^2 + 9x}$ simplifies to $\frac{ax}{bx + c}$ where a , b and c are integers.

$$\begin{aligned}
 &= \frac{1}{(2x-5)(x+3)} \div \frac{1}{3x(x+3)} \\
 &= \frac{1}{(2x-5)(x+3)} \times \frac{3x(x+3)}{1} \\
 &= \frac{3x}{2x-5}
 \end{aligned}$$

$$\begin{aligned}
 &2x-15 \\
 &= -30 \\
 &+6-5 \\
 &2x^2 + x - 15 \\
 &= 2x^2 + 6x - 5x - 15 \\
 &= 2x(x+3) - 5(x+3) \\
 &= (2x-5)(x+3)
 \end{aligned}$$

(3)

(Total for Question 17 is 5 marks)



S 5 3 6 0 3 A 0 1 5 2 0

18 Show that $\frac{4}{\frac{1}{\sqrt{3}} + \sqrt{3}}$ can be written as $\sqrt{3}$

$$= \frac{4}{\frac{1+3}{\sqrt{3}}} = \frac{4}{\frac{4}{\sqrt{3}}} = 4 \times \frac{\sqrt{3}}{4} = \sqrt{3}$$

(Total for Question 18 is 3 marks)

19 Prove that the sum of the squares of any three consecutive odd numbers is always 11 more than a multiple of 12

Let consecutive odd numbers be

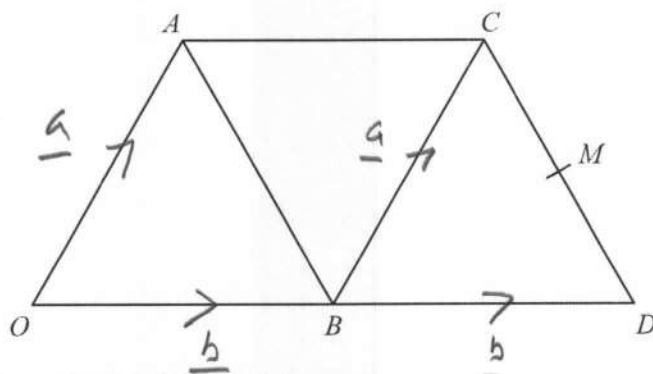
$2n+1, 2n+3, 2n+5$ where n an integer

$$\begin{aligned} \text{Sum of Squares} &= (2n+1)^2 + (2n+3)^2 + (2n+5)^2 \\ &= 4n^2 + 4n + 1 + 4n^2 + 12n + 9 + 4n^2 + 20n + 25 \\ &= 12n^2 + 36n + 35 \\ &= 12n^2 + 36n + 24 + 11 \\ &= 12(n^2 + 3n + 2) + 11 \end{aligned}$$

which is 11 more than a multiple of 12

(Total for Question 19 is 3 marks)





$OACD$ is a trapezium and $OACB$ is a parallelogram.

B is the midpoint of OD .

M is the midpoint of CD .

$$\vec{OA} = \mathbf{a} \text{ and } \vec{OB} = \mathbf{b}$$

Given that $\vec{BM} = k \times \vec{OC}$ where k is a scalar,

use a vector method to find the value of k .

$$\begin{aligned} \vec{OC} &= \vec{OB} + \vec{BC} \\ &= \underline{\mathbf{b}} + \underline{\mathbf{a}} \end{aligned}$$

$$\begin{aligned} \vec{CD} &= \vec{CB} + \vec{BD} \\ &= -\underline{\mathbf{a}} + \underline{\mathbf{b}} \end{aligned}$$

$$\begin{aligned} \vec{CM} &= \frac{1}{2} \vec{CD} \\ &= \frac{1}{2} (-\underline{\mathbf{a}} + \underline{\mathbf{b}}) \\ &= \frac{1}{2} \underline{\mathbf{b}} - \frac{1}{2} \underline{\mathbf{a}} \end{aligned}$$

$$\begin{aligned} \vec{BM} &= \vec{BC} + \vec{CM} \\ &= \underline{\mathbf{a}} + \frac{1}{2} \underline{\mathbf{b}} - \frac{1}{2} \underline{\mathbf{a}} \\ &= \frac{1}{2} \underline{\mathbf{a}} + \frac{1}{2} \underline{\mathbf{b}} \\ &= \frac{1}{2} (\underline{\mathbf{a}} + \underline{\mathbf{b}}) \\ &= \frac{1}{2} \vec{OC} \end{aligned}$$

$\frac{1}{2}$

(Total for Question 20 is 3 marks)



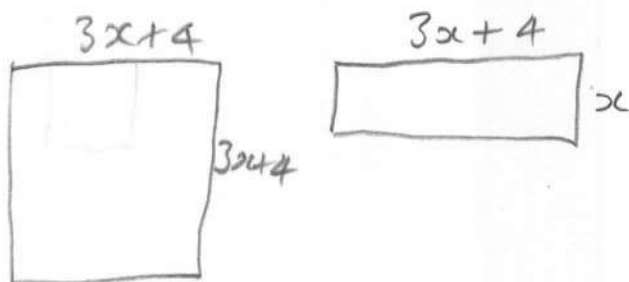
- 21 The length of a rectangle is the same as the length of each side of a square.

The length of the rectangle is 4 cm more than 3 times the width of the rectangle.

The area of the square is 66 cm² more than the area of the rectangle.

Find the length and the width of the rectangle.

You must show all your working.



Let width of rectangle
= x

$\therefore$ Length = $3x+4$

Area of Square = Area of rectangle + 66

$$(3x+4)(3x+4) = (3x+4)x + 66$$

$$9x^2 + 12x + 12x + 16 = 3x^2 + 4x + 66$$

$$9x^2 + 24x + 16 = 3x^2 + 4x + 66$$

$$9x^2 - 3x^2 + 24x - 4x + 16 - 66 = 0$$

$$6x^2 + 20x - 50 = 0$$

$$3x^2 + 10x - 25 = 0$$

$$3x^2 + 15x - 5x - 25 = 0$$

$$3x(x+5) - 5(x+5) = 0$$

$$(3x-5)(x+5) = 0$$

$$\Rightarrow \begin{array}{l} 3x-5=0 \\ 3x=5 \\ x=\frac{5}{3} \end{array} \quad \text{or} \quad \begin{array}{l} x+5=0 \\ x=-5 \end{array} \quad \text{not relevant}$$

$$\text{Width } x = \frac{5}{3}$$

$$\text{Length } 9 \text{ cm Width } \frac{5}{3} \text{ cm}$$

$$\text{Length } 3x+4 = 3\left(\frac{5}{3}\right)+4 = 9$$

(Total for Question 21 is 6 marks)

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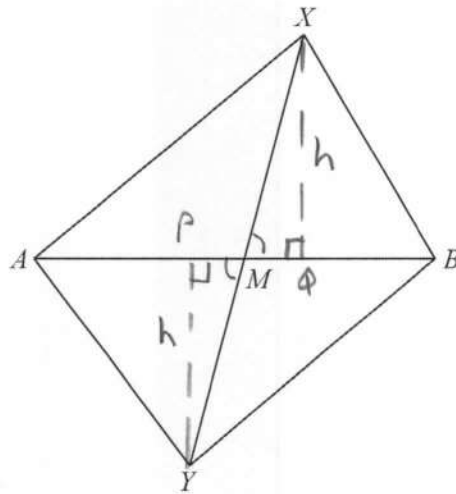
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22 The diagram shows a quadrilateral $XYBA$.



The diagonals AB and XY intersect at the point M .

Given that the area of triangle AXB is equal to the area of triangle AYB ,
prove that XY is bisected by AB .

Δ s AXB and AYB have common base AB

If Areas equal then heights h must also be equal

$\angle PMY = \angle XMQ$ (vert opp $\angle$ s)

$\therefore \Delta$ s PMY and QMX are congruent (AAS)

$\Rightarrow MY = MX$ so XY bisected by AB

(Total for Question 22 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS



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