

Please check the examination details below before entering your candidate information

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Centre Number				Candidate Number					
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Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Time 1 hour 30 minutes

Paper reference **1MA1/1H**

Mathematics

PAPER 1 (Non-Calculator)

Higher Tier

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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over 

P64630A

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E1/1/1/1/1/1




Pearson

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 (a) Work out 3.67×4.2

$$367 \xrightarrow{\div 100} 3.67 \quad | \quad 42 \xrightarrow{\div 10} 4.2$$

$$\therefore 3.67 \times 4.2 = (367 \times 42) \div 100 \div 10 = (367 \times 42) \div 1000$$

	3	6	7	
1	1	2	2	4
5	0	1	1	2
	4	1	4	

$$367 \times 42 = 15414$$

$$3.67 \times 4.2 = 15414 \div 1000$$

$$= \underline{\underline{15.414}}$$

15.414

(3)

(b) Work out $59.84 \div 1.6$

$$1.6 = 16 \div 10$$

$$16 \overline{) 03.74}$$

$$59.84 \div 16 = 3.74$$

$$\frac{59.84}{16} = \frac{3.74}{1}$$

$$\frac{59.84}{16 \div 10} = \frac{3.74 \times 10}{1} = \underline{\underline{37.4}}$$

37.4

(3)

(Total for Question 1 is 6 marks)



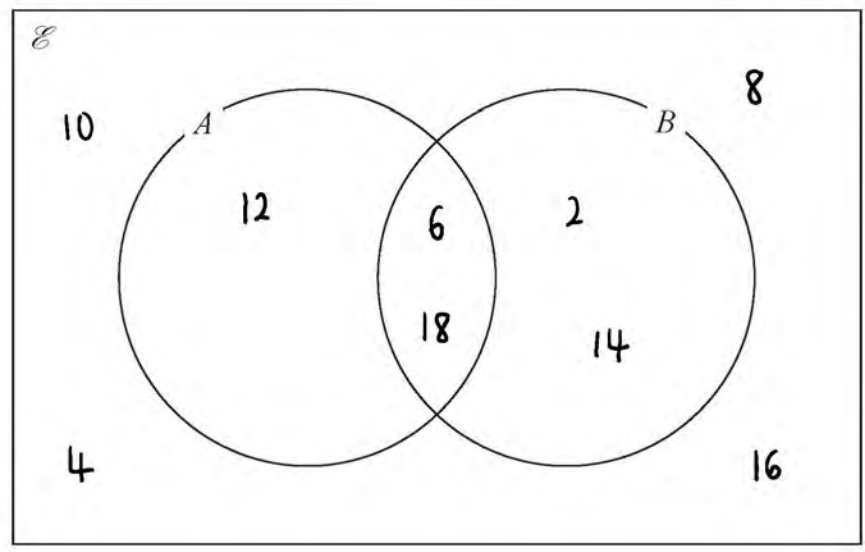
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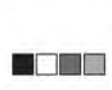
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2 $E = \{\text{even numbers less than } 19\}$ $= \{2, 4, 6, 8, 10, 12, 14, 16, 18\}$
 $A = \{6, 12, 18\}$
 $B = \{2, 6, 14, 18\}$

Complete the Venn diagram for this information.



(Total for Question 2 is 3 marks)



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

Give your answer as a mixed number.

$$4\frac{1}{5} = 4 + \frac{1}{5} = \frac{20}{5} + \frac{1}{5} = \frac{21}{5}$$

$$4\frac{1}{5} = \frac{21}{5}$$

$$2\frac{2}{3} = 2 + \frac{2}{3} = \frac{6}{3} + \frac{2}{3} = \frac{8}{3}$$

$$2\frac{2}{3} = \frac{8}{3} \quad \textcircled{1}$$

When subtracting fractions, we need a common denominator:

$$\frac{21}{5} \xrightarrow{\times 3} \frac{63}{15}$$

$$\frac{8}{3} \xrightarrow{\times 5} \frac{40}{15}$$

$$\frac{21}{5} - \frac{8}{3} = \frac{63}{15} - \frac{40}{15} = \frac{23}{15} \quad \textcircled{1}$$

$$\frac{23}{15} = \frac{15}{15} + \frac{8}{15} = 1 + \frac{8}{15} = \boxed{1\frac{8}{15}}$$

$$\textcircled{1} \quad 1\frac{8}{15}$$

(Total for Question 3 is 3 marks)



- 4 At the end of 2017
 the value of Tamara's house was £220 000
 the value of Rahim's house was £160 000

At the end of 2019
 the value of Tamara's house had decreased by 20%
 the value of Rahim's house had increased by 30%

At the end of 2019, whose house had the greater value?
 You must show how you get your answer.

TAMARA:

$$2017: £220,000$$

$$2019: £220,000 \times 0.8$$

$$= £176,000 \quad \textcircled{1}$$

RAHIM:

$$2017: £160,000$$

$$2019: £160,000 \times 1.3 \quad \textcircled{1}$$

$$= £208,000 \quad \textcircled{1}$$

$£208,000 > £176,000 \therefore \text{Rahim's house is worth more.}$

$$100\% - 20\%$$

$$= 80\%$$

$$= 0.8$$

$$20\% \downarrow = \times 0.8$$

$$100\% + 30\% \quad \textcircled{1}$$

$$= 1 + 0.3$$

$$= 1.3$$

$$30\% \uparrow = \times 1.3$$

(Total for Question 4 is 4 marks)



- 5 Rosie, Matilda and Ibrahim collect stickers.

$$\begin{array}{l} \text{number of stickers} \\ \text{Rosie has} \end{array} : \begin{array}{l} \text{number of stickers} \\ \text{Matilda has} \end{array} : \begin{array}{l} \text{number of stickers} \\ \text{Ibrahim has} \end{array} = 4:7:15$$

Ibrahim has 24 more stickers than Matilda.

Ibrahim has more stickers than Rosie.
How many more?

$$R : M : I$$

$$4 : 7 : 15$$

$$4x : 7x : 15x = 26x$$

26x stickers in total.

Ibrahim has 15x stickers

↳ Ibrahim also has 24 more stickers than Matilda.

Matilda has 7x stickers.

∴ Ibrahim has $(7x + 24)$ stickers.

$$15x = 7x + 24$$

$$\begin{array}{l} 8x = 24 \\ \div 8 \quad \quad \quad \div 8 \\ \hline x = 3 \end{array}$$

①

①

33

(Total for Question 5 is 3 marks)

$$R : M : I$$

$$4x : 7x : 15x$$

$$4(3) : 7(3) : 15(3)$$

$$12 : 21 : 45$$

①

Ibrahim has 45 stickers, while Rosie has 12 stickers.

∴ Ibrahim has 33 more stickers than Rosie.

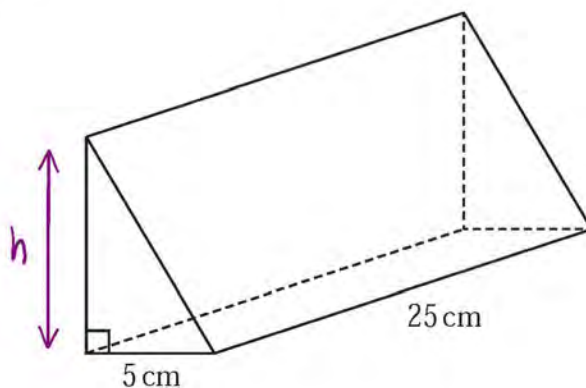
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6 The diagram shows a prism.



The cross section of the prism is a right-angled triangle.

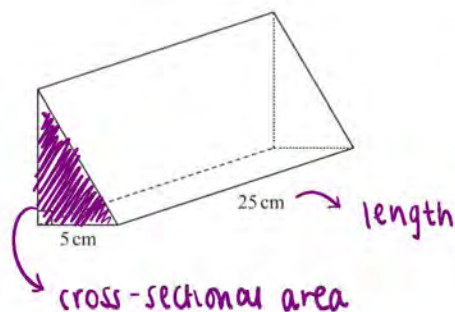
The base of the triangle has length 5 cm

The prism has length 25 cm

The prism has volume 750 cm³

Work out the height of the prism.

Find cross-sectional area:



$$\begin{aligned} \text{cross-sectional area} &= \frac{\text{volume}}{\text{length}} \\ &= \frac{750 \text{ cm}^3}{25 \text{ cm}} = 30 \text{ cm}^2 \quad \textcircled{1} \end{aligned}$$

Find height:



$$\text{cross-sectional area} = \text{area of triangle} = 30 \text{ cm}^2$$

$$\text{Area} = \frac{\text{base} \times \text{height}}{2}$$

$$30 = \frac{5 \times \text{height}}{2} \quad \textcircled{1}$$

$$\begin{aligned} \times 2 \left(\right. & 60 = 5 \times \text{height} \left. \right) \times 2 \end{aligned}$$

$$\begin{aligned} \div 5 \left(\right. & 12 = \text{height} \left. \right) \div 5 \end{aligned} \quad \textcircled{1}$$

..... 12 cm

(Total for Question 6 is 3 marks)

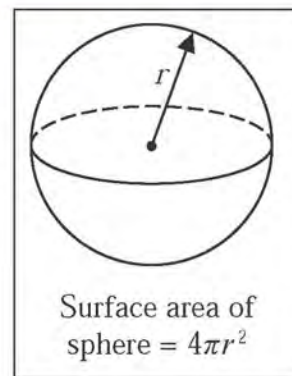
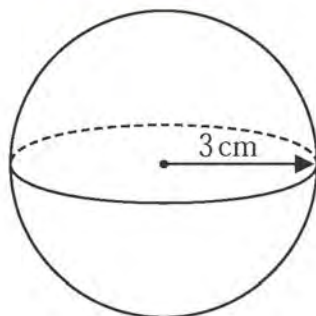
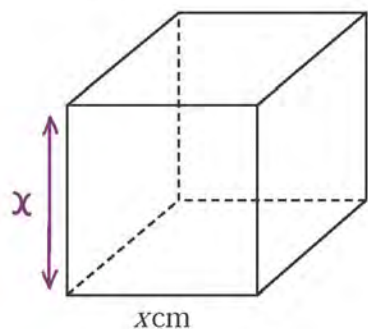
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- 7 The diagram shows a cube with edges of length x cm and a sphere of radius 3 cm.



The surface area of the cube is equal to the surface area of the sphere.

Show that $x = \sqrt{k\pi}$ where k is an integer.

Surface area of sphere :

$$4\pi r^2 = 4\pi(3)^2 = (4)(\pi)(9) = 36\pi \quad \textcircled{1}$$

Surface area of cube : \rightarrow total area of all 6 faces.

$$(x^2) \times 6 = 6x^2 \quad \textcircled{1}$$

Equate the two areas:

$$\begin{aligned} 6x^2 &= 36\pi && \textcircled{1} \\ \div 6 & && \div 6 \\ x^2 &= 6\pi \\ \text{sq. root} & && \text{sq. root} \\ x &= \sqrt{6\pi} && \textcircled{1} \end{aligned}$$

(Total for Question 7 is 4 marks)

$$x = \sqrt{6\pi} \therefore k = 6$$



8 Solve $x^2 = 5x + 24$

$$x^2 = 5x + 24$$

$$x^2 - 5x - 24 = 0 \quad (1)$$

$$(x-8)(x+3) = 0 \quad (1)$$

When $(x-8) = 0$: $x = 8$

When $(x+3) = 0$: $x = -3$

(1)

$$x = 8, x = -3$$

(Total for Question 8 is 3 marks)

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- 9 (a) Write down the value of 7^0

Any number to the power of 0 = 1

$$\textcircled{1} \quad \frac{1}{(1)}$$

- (b) Find the value of $3 \times 3^6 \times 3^{-6}$

$$x^a \times x^b = x^{a+b}$$

$$\therefore (3^1) \times (3^6) \times (3^{-6}) = 3^{1+6+(-6)} = 3^1 = 3$$

$$\textcircled{1} \quad \frac{3}{(1)}$$

- (c) Find the value of 2^{-4}

$$2^{-4} = \frac{1}{2^4} = \frac{1}{16}$$

$$\textcircled{1} \quad \frac{1}{16} \\ (1)$$

- (d) Find the value of $27^{\frac{1}{3}}$

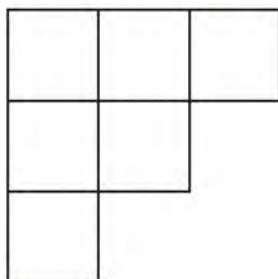
$$27^{\frac{1}{3}} = \sqrt[3]{27} = 3$$

$$\textcircled{1} \quad \frac{3}{(1)}$$

(Total for Question 9 is 4 marks)



10 The diagram shows a shape made from 6 identical squares.



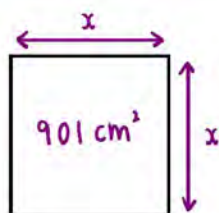
The total area of the shape is 5406 cm^2

- (a) Find an estimate for the length of one side of each square.
Give your answer correct to the nearest whole number.

Area of one square :

$$5406 \div 6 = 901 \text{ cm}^2 \quad (1)$$

Find length of one side :



$$(x)(x) = 901$$

$$x^2 = 901$$

$$x = \sqrt{901}$$

$$x \approx \sqrt{900} \quad (1)$$

$$\approx 30 \text{ cm (to the nearest whole)}$$

(1)

30 cm
(3)

- (b) Is your answer to part (a) an underestimate or an overestimate?
You must give a reason for your answer.

underestimate because the length was rounded down. (1)

(1)

(Total for Question 10 is 4 marks)

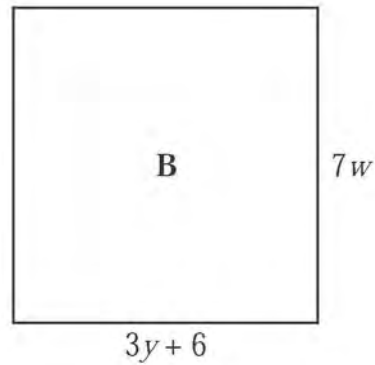
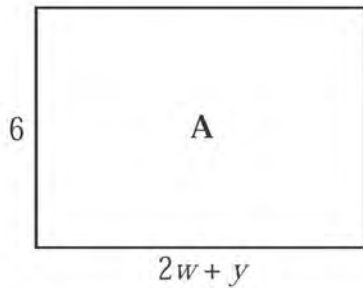
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11 The diagram shows two rectangles, A and B.



All measurements are in centimetres.

The area of rectangle A is equal to the area of rectangle B.

Find an expression for y in terms of w .

Area of Rectangle A:

$$6(2w + y) = 12w + 6y$$

Area of Rectangle B:

$$7w(3y + 6) = 21wy + 42w$$

Make y the subject:

$$12w + 6y = 21wy + 42w \quad (1)$$

$$6y - 21wy = 42w - 12w \quad (1) \quad (1)$$

$$y(6 - 21w) = 30w \quad (1)$$

$$\frac{30w}{6 - 21w}$$

$$\therefore y = \frac{30w}{6 - 21w}$$

(Total for Question 11 is 4 marks)

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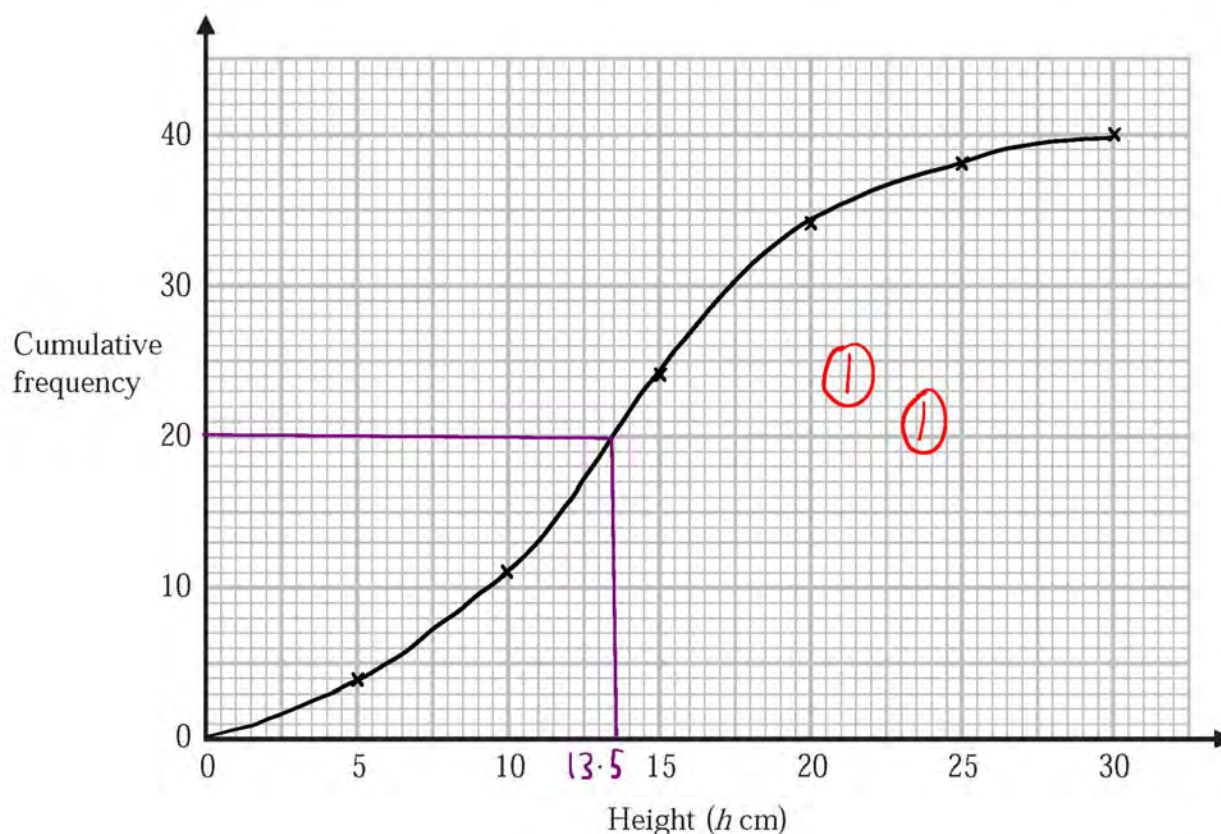
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12 The cumulative frequency table gives information about the heights, in cm, of 40 plants.

Height (h cm)	Cumulative Frequency
$0 < h \leq 5$	4
$0 < h \leq 10$	11
$0 < h \leq 15$	24
$0 < h \leq 20$	34
$0 < h \leq 25$	38
$0 < h \leq 30$	40

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



(2)

(b) Use the graph to find an estimate for the median height of the plants.

① 13.5 cm
(1)

(Total for Question 12 is 3 marks)

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13 Ted is trying to change $0.\dot{4}\dot{3}$ to a fraction.

Here is the start of his method.

$$\begin{aligned} x &= 0.\dot{4}\dot{3} & x &= 0.434343\dots \\ 10x &= 4.\dot{3}\dot{4} & 10x &= 4.343434\dots \\ 10x - x &= 4.\dot{3}\dot{4} - 0.\dot{4}\dot{3} \end{aligned}$$

Evaluate Ted's method so far.

①

Ted does not eliminate the recurring decimals.

(Total for Question 13 is 1 mark)

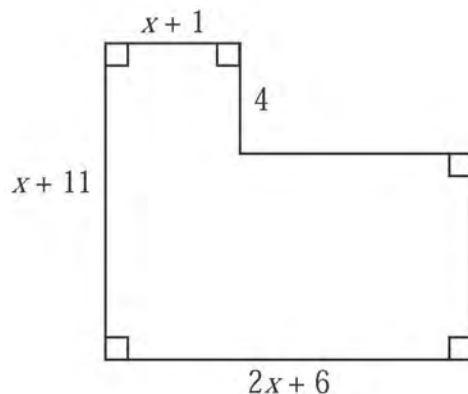
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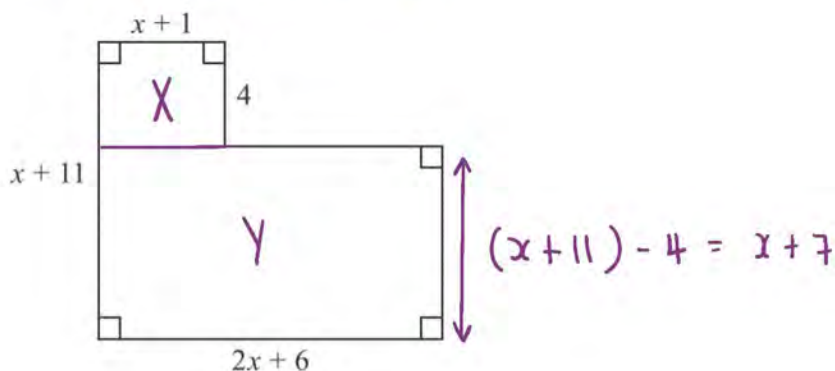


14 Here is a shape with all its measurements in centimetres.



The area of the shape is $A \text{ cm}^2$

Show that $A = 2x^2 + 24x + 46$



Area of X :

$$4(x+1) = 4x + 4$$

Area of Y : ①

$$(2x+6)(x+7)$$

$$= 2x^2 + 14x + 6x + 42$$

$$= 2x^2 + 20x + 42$$

Total area of shape: ①

$$(4x + 4) + (2x^2 + 20x + 42)$$

$$= 2x^2 + 24x + 46 \quad \text{①}$$

(Total for Question 14 is 3 marks)

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15 Show that $\frac{4x+3}{2x} + \frac{3}{5}$ can be written in the form $\frac{ax+b}{cx}$ where a , b and c are integers.

Make both fractions have a common denominator of $10x$:

$$\frac{4x+3}{2x} \xrightarrow{\times 5} \frac{(5)4x+3}{(5)2x} = \frac{20x+15}{10x}$$

$$\frac{3}{5} \xrightarrow{\times 2x} \frac{(2x)3}{(2x)5} = \frac{6x}{10x}$$

Add the fractions:

$$\frac{20x+15}{10x} + \frac{6x}{10x} = \frac{20x+15+6x}{10x}$$

$$= \frac{26x+15}{10x}$$

(Total for Question 15 is 3 marks)

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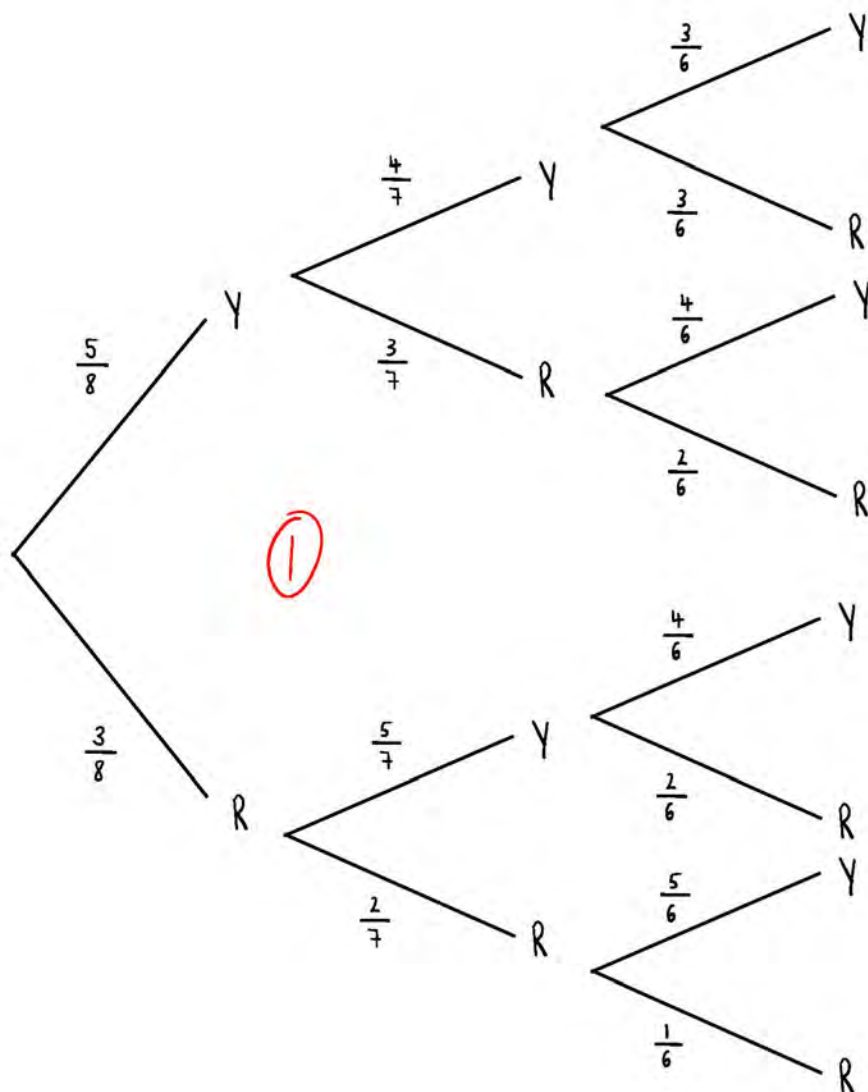
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16 There are only 3 red counters and 5 yellow counters in a bag.

Jude takes at random 3 counters from the bag.

Work out the probability that he takes exactly one red counter.



$$P(\text{exactly one Red}) = P(RYY) \text{ OR } P(YRY) \text{ OR } P(YYR)$$

$$= \left(\frac{3}{8} \times \frac{5}{7} \times \frac{4}{6}\right) + \left(\frac{5}{8} \times \frac{3}{7} \times \frac{4}{6}\right) + \left(\frac{5}{8} \times \frac{4}{7} \times \frac{3}{6}\right) \quad \textcircled{1}$$

$$= \frac{60}{336} + \frac{60}{336} + \frac{60}{336} = \boxed{\frac{180}{336}}$$

①

①

$$\frac{180}{336}$$

(Total for Question 16 is 4 marks)

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17 On the grid show, by shading, the region that satisfies all of these inequalities.

$$2y + 4 < x$$

$$x < 3$$

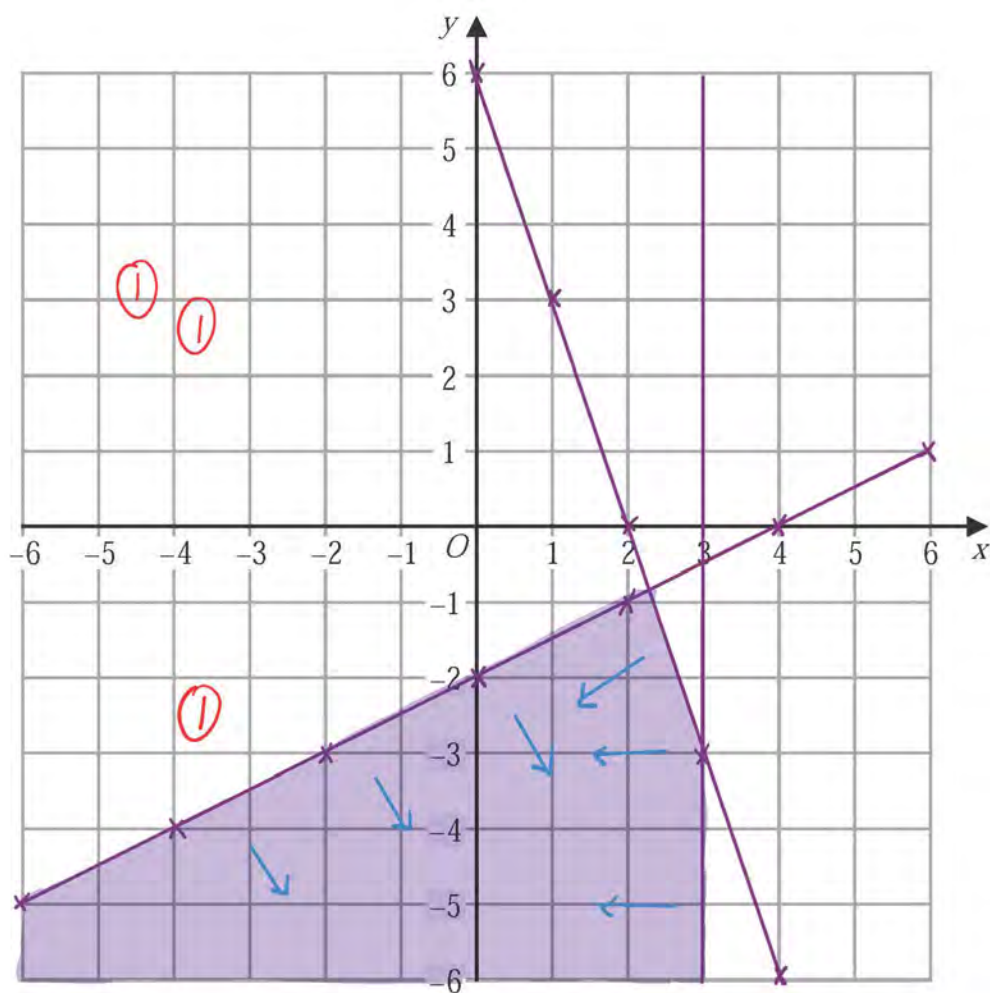
$$y < 6 - 3x$$

Label the region **R**.

$$2y < x - 4$$

$$y < -3x + 6$$

$$y < \frac{1}{2}x - 2$$



(Total for Question 17 is 3 marks)

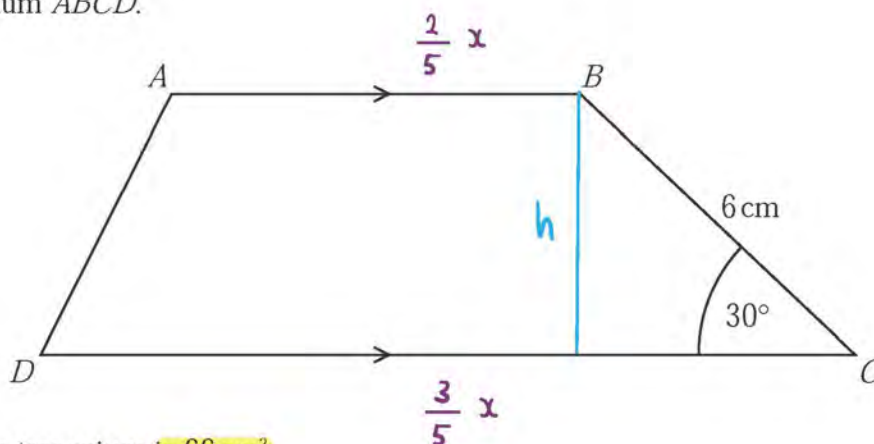
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18 Here is trapezium $ABCD$.



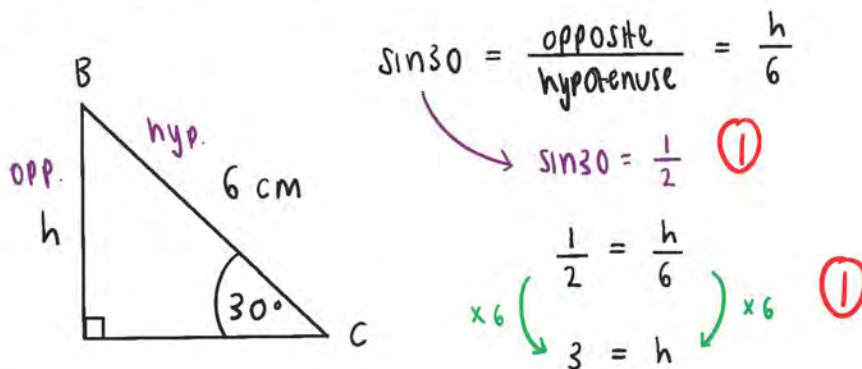
The area of the trapezium is 66 cm^2

the length of AB : the length of $CD = 2 : 3$

Find the length of AB .

$AB : CD$ 5 parts in total.
 $= 2 : 3$ AB has 2 of these 5 parts.
CD has 3 of these 5 parts.

Find height of trapezium:



Area of trapezium: (1)

$$A = \left(\frac{a+b}{2} \right) h. \quad 66 = \left(\frac{\frac{2}{5}x + \frac{3}{5}x}{2} \right) (3)$$

Find length AB : (1)

$$\begin{aligned} 66 &= \left(\frac{x}{2} \right) (3) \\ \div 3 \left(\right. & 22 = \frac{x}{2} \left. \right) \div 3 \\ \times 2 \left(\right. & 44 = x \left. \right) \times 2 \end{aligned}$$

$$\begin{aligned} AB &= \frac{2}{5}x \\ &= \frac{2}{5}(44) \\ &= \underline{\underline{17.6 \text{ cm}}} \end{aligned}$$

(Total for Question 18 is 5 marks)

17.6 cm

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19 Show that $\frac{8 + \sqrt{12}}{5 + \sqrt{3}}$ can be written in the form $\frac{a + \sqrt{3}}{b}$, where a and b are integers.

Rationalise the denominator using 'Difference of two squares.'

$$\frac{8 + \sqrt{12}}{5 + \sqrt{3}} \quad \begin{array}{l} \times (5 - \sqrt{3}) \\ \times (5 - \sqrt{3}) \end{array}$$

①

$$\boxed{\sqrt{a} \times \sqrt{a} = a}$$

$$= \frac{(8 + \sqrt{12})(5 - \sqrt{3})}{(5 + \sqrt{3})(5 - \sqrt{3})}$$

①

$$= \frac{40 - 8\sqrt{3} + 5\sqrt{12} - (\sqrt{3})(\sqrt{12})}{25 - 5\sqrt{3} + 5\sqrt{3} - (\sqrt{3})(\sqrt{3})}$$

$$\rightarrow \sqrt{12} = \sqrt{4 \times 3} = \sqrt{4} \sqrt{3} = 2\sqrt{3}$$

$$\therefore 5\sqrt{12} = 5 \times 2\sqrt{3} = 10\sqrt{3}$$

$$= \frac{40 - 8\sqrt{3} + 10\sqrt{3} - \sqrt{36}}{25 - 3}$$

$$= \frac{40 + 2\sqrt{3} - 6}{22} = \frac{34 + 2\sqrt{3}}{22}$$

①

(Total for Question 19 is 4 marks)

$$= \boxed{\frac{17 + \sqrt{3}}{11}} \quad \text{①}$$

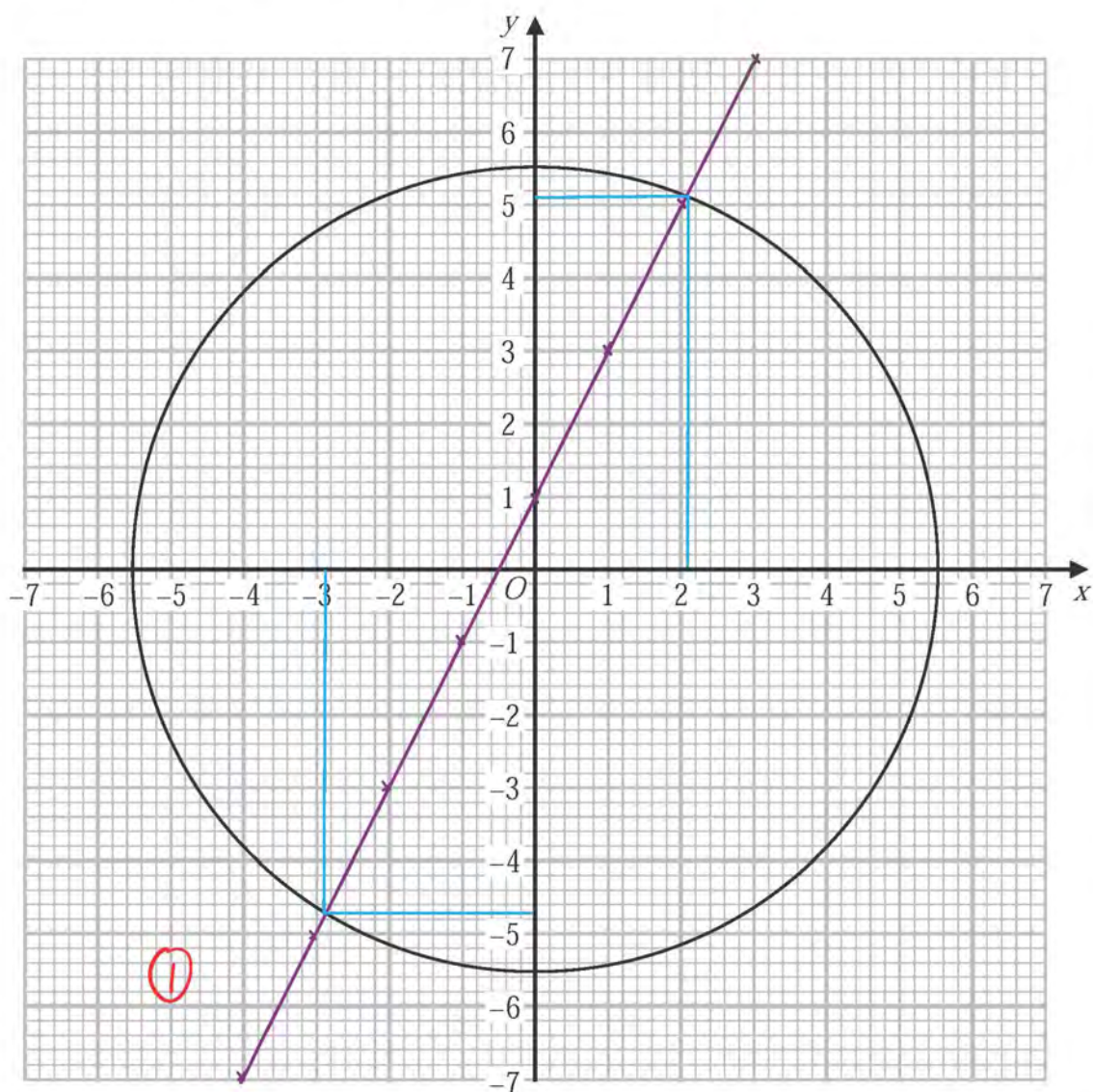
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20 The diagram shows the graph of $x^2 + y^2 = 30.25$



Use the graph to find estimates for the solutions of the simultaneous equations

point at which the circle and line intersect.

$$x^2 + y^2 = 30.25$$

$$y - 2x = 1 \quad \therefore y = 2x + 1$$

Gradient = $\frac{\text{change in } y}{\text{change in } x} = 2$

$$2 = \frac{2}{1} \therefore \Delta y = 2$$

$$\Delta x = 1$$

Δ is the Greek letter Delta, which, in Maths, generally means 'change in'.

(2.1, 5.1) and (-2.9, -4.7)

(Total for Question 20 is 3 marks)

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21 The functions f and g are such that

$$f(x) = 3x^2 + 1 \text{ for } x > 0 \quad \text{and} \quad g(x) = \frac{4}{x^2} \text{ for } x > 0$$

(a) Work out $gf(1)$ $g(f(1))$.

Start with $f(1)$: $f(1) = 3(1)^2 + 1 = 3 + 1 = 4$. (1)

$$f(1) = 4 \therefore g(f(1)) = g(4) = \frac{4}{4^2} = \frac{4}{16} = \frac{1}{4}$$

$$\frac{1}{4} \quad (2)$$

The function h is such that $h = (fg)^{-1}$

(b) Find $h(x)$

$(fg)^{-1}$ is the inverse of $f(g)$.

Find $f(g)$: $f(x) = 3x^2 + 1$.

$$f\left(\frac{4}{x^2}\right) = 3\left(\frac{4}{x^2}\right)^2 + 1$$

$$= 3\left(\frac{16}{x^4}\right) + 1 = \frac{48}{x^4} + 1$$
 (1)

$f(g) = \frac{48}{x^4} + 1$. Find inverse:

Let $y = \frac{48}{x^4} + 1$. Make x the subject

$$y - 1 = \frac{48}{x^4}$$
 (1)

$$\sqrt[4]{\frac{48}{y-1}} \quad (4)$$

x^4 $\left\{ \begin{array}{l} \times x^4 \\ \div (y-1) \end{array} \right.$

$$x^4 (y-1) = 48$$

$$x^4 = \frac{48}{y-1}$$

(1)

$$x = \sqrt[4]{\frac{48}{y-1}}$$

(Total for Question 21 is 6 marks)

Now swap the y with an x , and swap the x with $(fg)^{-1}$:

$$(fg)^{-1} = \sqrt[4]{\frac{48}{x-1}}$$

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- 22 Find the coordinates of the turning point on the curve with equation $y = 9 + 18x - 3x^2$.
You must show all your working.

$$y = -3x^2 + 18x + 9.$$

Factorise the -3 :

$$y = -3(x^2 - 6x) + 9. \quad (1)$$

We know that $(x^2 - 2ax) = (x-a)^2 - a^2$

$$\therefore y = -3[(x-3)^2 - 9] + 9. \quad (1)$$

Multiply by -3 :

$$y = -3(x-3)^2 + 27 + 9.$$

$$y = -3(x-3)^2 + 36. \quad (1)$$

If $y = (x-a)^2 + b$, T.P. is (a, b)

(3 , 36)

$$\therefore \text{turning point} = \underline{\underline{(3, 36)}}.$$

(Total for Question 22 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS

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