Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

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

E:1/1/1/1/1/1/

P 6 4 6 3 0 A 0 1 2 4

Pearson

Answer ALL questions.

Write your answers in the spaces provided.

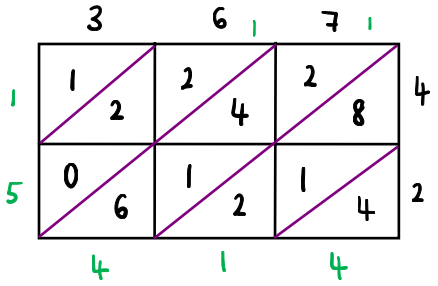
You must write down all the stages in your working.

1 (a) Work out 3.67×4.2

$367 \rightarrow 3.67$ (÷100) | $42 \rightarrow 4.2$ (÷10)

(1)

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



(1)

$367 \times 42 = 15414$

$3.67 \times 4.2 = 15414 \div 1000$

$= 15.414$

(1)

15.414

(3)

(b) Work out $59.84 \div 1.6$ $1.6 = 16 \div 10$

(1)

$59.84 \div 16 = 3.74$

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

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

$16 \overline{)59.84}$ → 03.74

(1)

(1)

37.4

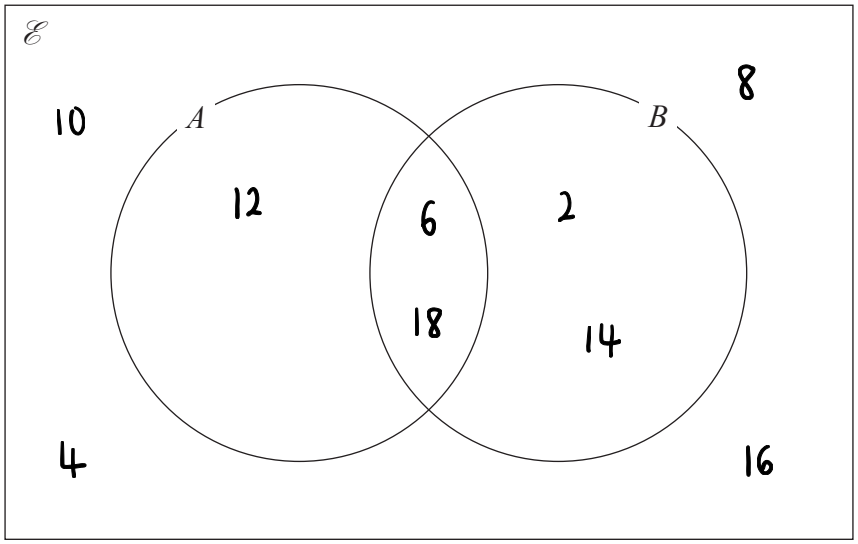
(3)

(Total for Question 1 is 6 marks)

2 $\mathscr{E}$ = {even numbers less than 19}
A = {6, 12, 18}
B = {2, 6, 14, 18}

= 2, 4, 6, 8, 10, 12, 14, 16, 18

Complete the Venn diagram for this information.



(Total for Question 2 is 3 marks)

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

Give your answer as a mixed number.

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

$2\frac{2}{3} = 2 + \frac{2}{3} = \frac{6}{3} + \frac{2}{3} = \frac{8}{3}$ $\quad 2\frac{2}{3} = \frac{8}{3}$ (1)

When subtracting fractions, we need a common denominator:

$\frac{21}{5} = \frac{63}{15}$ (×3 / ×3)

$\frac{8}{3} = \frac{40}{15}$ (×5 / ×5)

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

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

(1) $1\frac{8}{15}$

(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.

100% − 20%
= 80%
= 0·8
20% ↓ = × 0·8

100% + 30%
= 1 + 0·3
= 1·3
30% ↑ = × 1·3

TAMARA:

2017: £220,000

2019: £220,000 × 0·8

= £176,000 (1)

RAHIM:

2017: £160,000

2019: £160,000 × 1·3 (1)

= £208,000 (1)

£208,000 > £176,000 ∴ Rahim's house is worth more.

(Total for Question 4 is 4 marks)

5 Rosie, Matilda and Ibrahim collect stickers.

$$\frac{\text{number of stickers Rosie has}}{} : \frac{\text{number of stickers Matilda has}}{} : \frac{\text{number of stickers Ibrahim has}}{} = 4:7:15$$

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.

$15x = 7x + 24$

$8x = 24$ (÷8)

$x = 3$ (÷8) (1)

(1) 33

(Total for Question 5 is 3 marks)

R : M : I

$4x : 7x : 15x$

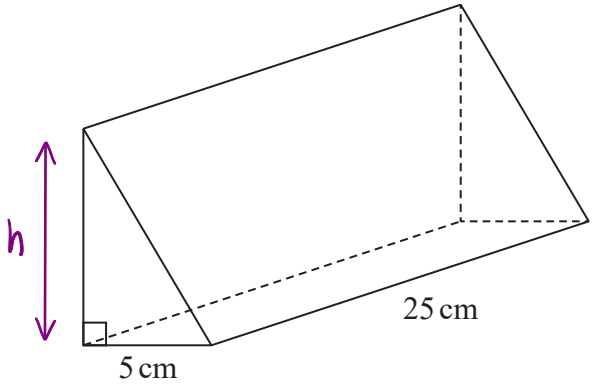
$4(3) : 7(3) : 15(3)$

12 : 21 : 45 (1)

Ibrahim has 45 stickers, while Rosie has 12 stickers.

∴ Ibrahim has 33 more stickers than Rosie.

6 The diagram shows a prism.

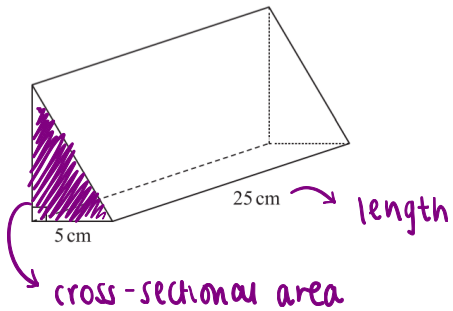


The cross section of the prism is a right-angled triangle.
The base of the triangle has length 5 cm

The prism has length 25 cm
The prism has volume 750 cm^3

Work out the height of the prism.

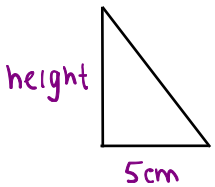
Find cross-sectional area:



$$\text{cross-sectional area} = \frac{\text{volume}}{\text{length}}$$

$$= \frac{750\ \text{cm}^3}{25\ \text{cm}} = 30\ \text{cm}^2 \quad (1)$$

Find height:



cross-sectional area = area of triangle = 30 cm^2

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

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

$\times 2$ / $\times 2$

$$60 = 5 \times \text{height}$$

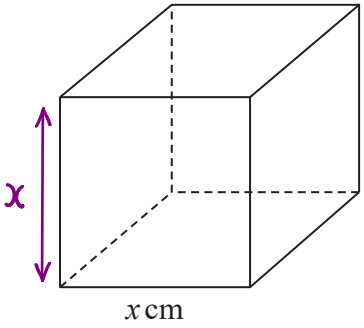
$\div 5$ / $\div 5$

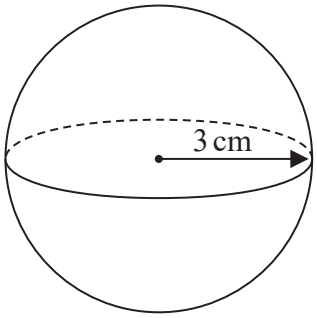
$$12 = \text{height} \quad (1)$$

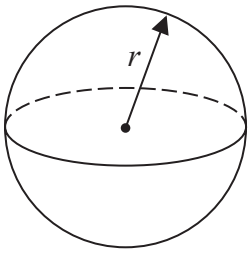
12 cm

(Total for Question 6 is 3 marks)

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







Surface area of sphere $= 4\pi r^2$

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 :

$4\pi r^2 = 4\pi(3)^2 = (4)(\pi)(9) = 36\pi$ (1)

Surface area of cube : → total area of all 6 faces.

$(x^2) \times 6 = 6x^2$ (1)

Equate the two areas: (1)

$6x^2 = 36\pi$

÷ 6 ↓ ÷ 6

$x^2 = 6\pi$

sq. root ↓ sq. root

$x = \sqrt{6\pi}$ (1)

(Total for Question 7 is 4 marks)

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

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

$x^2 = 5x + 24$

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

$(x - 8)(x + 3) = 0$ (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)

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

↳ Any number to the power of 0 = 1

(1)

1

(1)

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

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

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

(1)

3

(1)

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

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

(1)

$\frac{1}{16}$

(1)

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

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

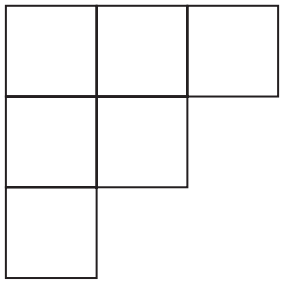
(1)

3

(1)

(Total for Question 9 is 4 marks)

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



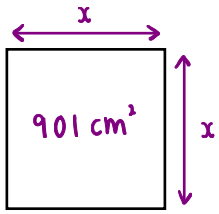
The total area of the shape is 5406 cm^2

(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:

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

Find length of one side:



$(x)(x) = 901$

$x^2 = 901$

$x = \sqrt{901}$

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

≈ 30 cm (to the nearest whole) (1)

30 cm

(3)

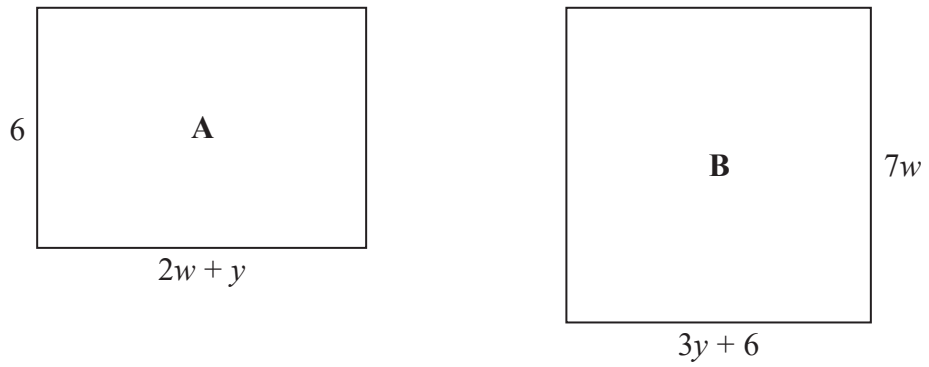
(b) Is your answer to part (a) an underestimate or an overestimate?
You must give a reason for your answer.

underestimate because the length was rounded down. (1)

(1)

(Total for Question 10 is 4 marks)

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:

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

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

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

(1)

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

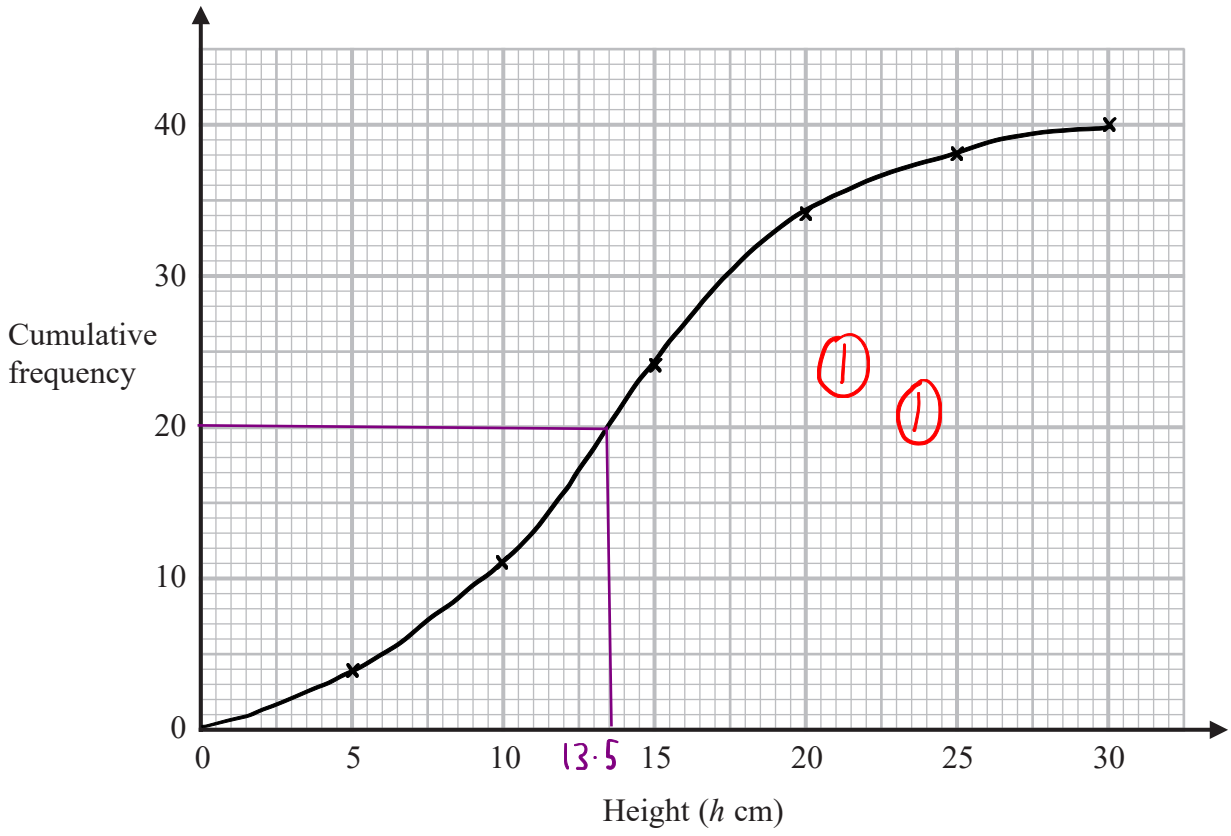
$\therefore y = \frac{30w}{6 - 21w}$

(Total for Question 11 is 4 marks)

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

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

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

Here is the start of his method.

$x = 0.\dot{4}\dot{3}$ x = 0 . 4 3 4 3 4 3 . . .

$10x = 4.\dot{3}\dot{4}$ 10 x = 4 . 3 4 3 4 3 4 . . .

$10x - x = 4.\dot{3}\dot{4} - 0.\dot{4}\dot{3}$

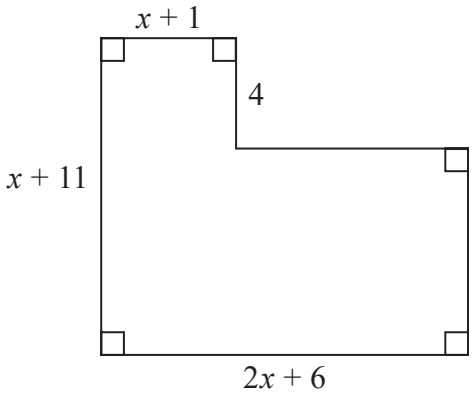
Evaluate Ted's method so far.

(1)

Ted does not eliminate the recurring decimals.

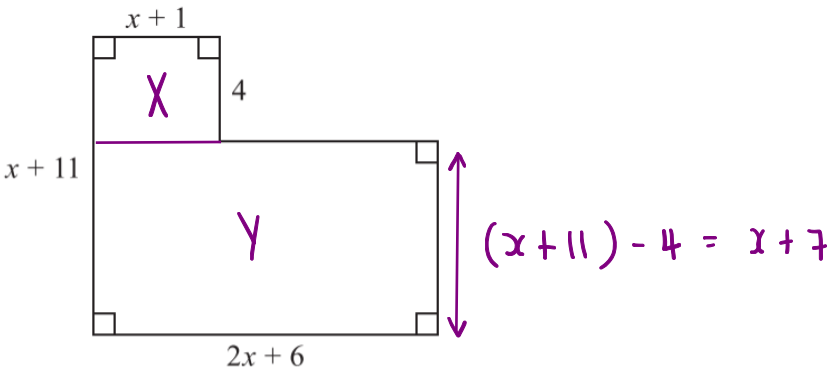
(Total for Question 13 is 1 mark)

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



The area of the shape is A 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)

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

$= 2x^2 + 24x + 46$ (1)

(Total for Question 14 is 3 marks)

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 $10x$:

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

(1)

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

Add the fractions:

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

(1)

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

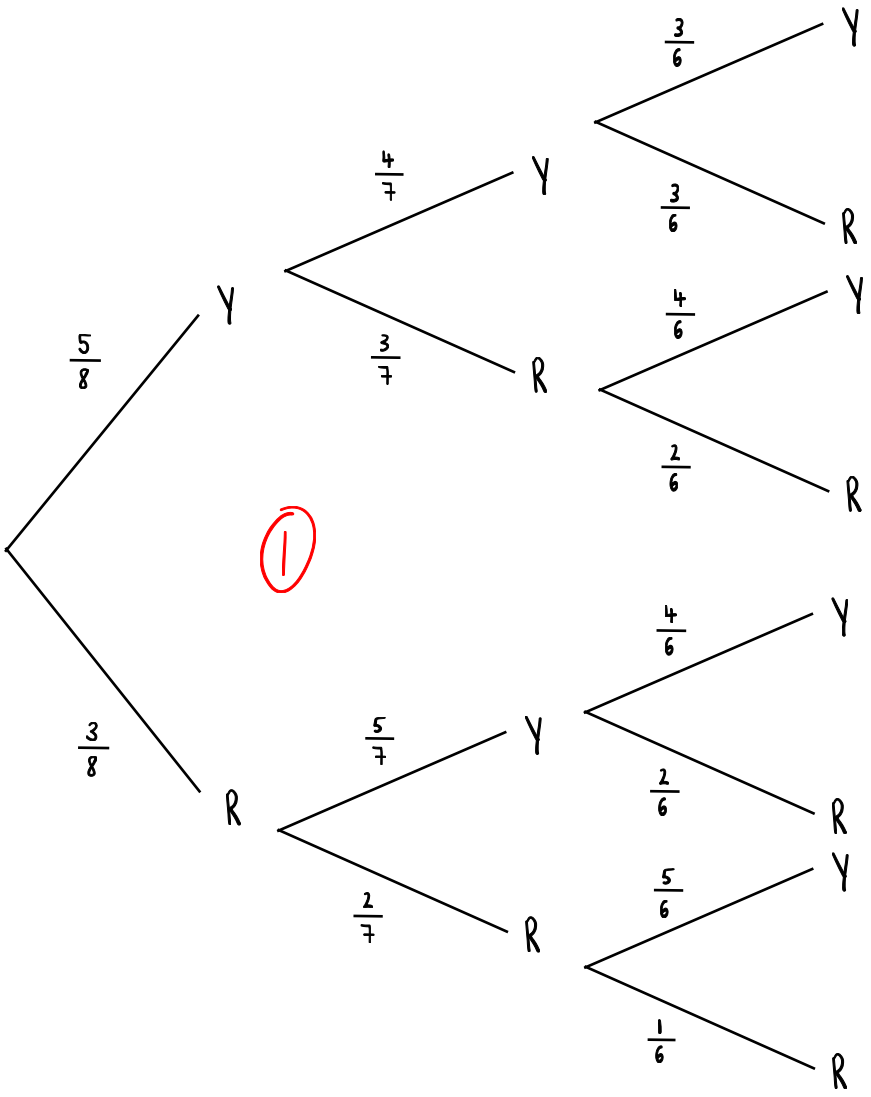
(1)

(Total for Question 15 is 3 marks)

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.



(1)

P(exactly one Red) = P(RYY) OR P(YRY) OR P(YYR)

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

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

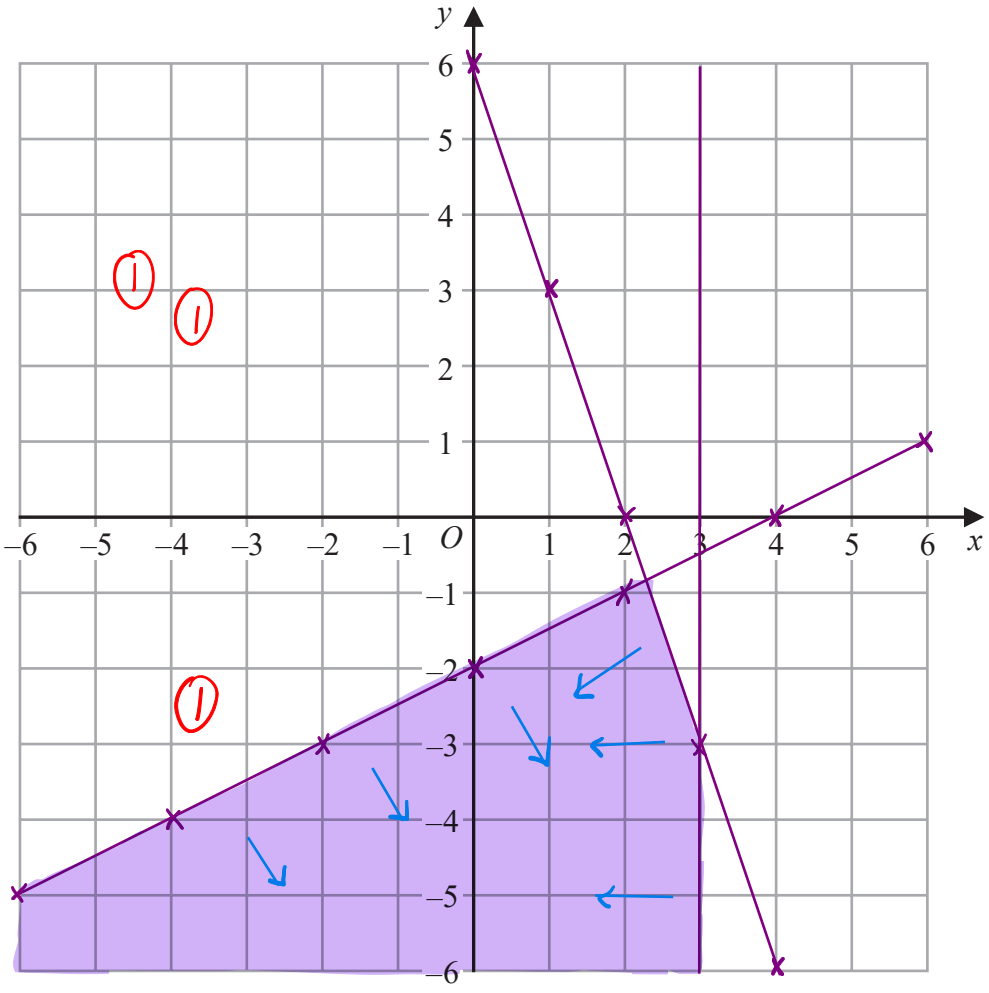
$2y + 4 < x$ $\quad$ $x < 3$ $\quad$ $y < 6 - 3x$

Label the region **R**.

$2y < x - 4$

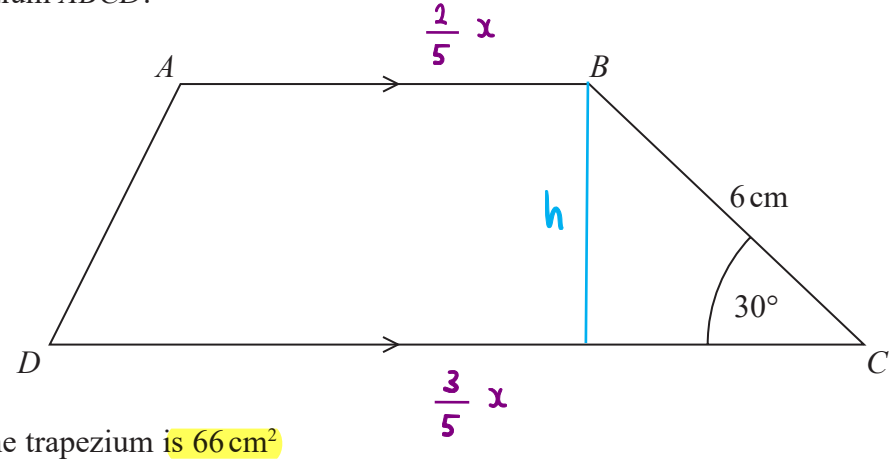
$y < -3x + 6$

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



(Total for Question 17 is 3 marks)

18 Here is trapezium $ABCD$.



$\frac{2}{5}x$

$\frac{3}{5}x$

The area of the trapezium is $66\,cm^2$

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

Find the length of AB.

5 parts in total.

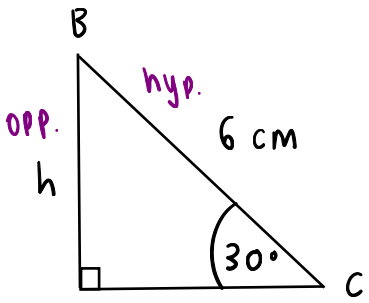
AB : CD

= 2 : 3

AB has 2 of these 5 parts.

CD has 3 of these 5 parts.

Find height of trapezium:



$\sin 30 = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{h}{6}$

$\sin 30 = \frac{1}{2}$ (1)

$\frac{1}{2} = \frac{h}{6}$

$\times 6$ $\times 6$

$3 = h$ (1)

Area of trapezium: (1)

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

Find length AB: (1)

$66 = \left(\frac{x}{2}\right)(3)$

$\div 3$ $\div 3$

$22 = \frac{x}{2}$

$\times 2$ $\times 2$

$44 = x$

$AB = \frac{2}{5}x$

$= \frac{2}{5}(44)$

$= 17.6$ cm (1)

17.6 cm

(Total for Question 18 is 5 marks)

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.'

$$\frac{8+\sqrt{12}}{5+\sqrt{3}} \quad \times (5-\sqrt{3}) \quad \times (5-\sqrt{3})$$ (1)

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

$$= \frac{(8+\sqrt{12})(5-\sqrt{3})}{(5+\sqrt{3})(5-\sqrt{3})}$$ (1)

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

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

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

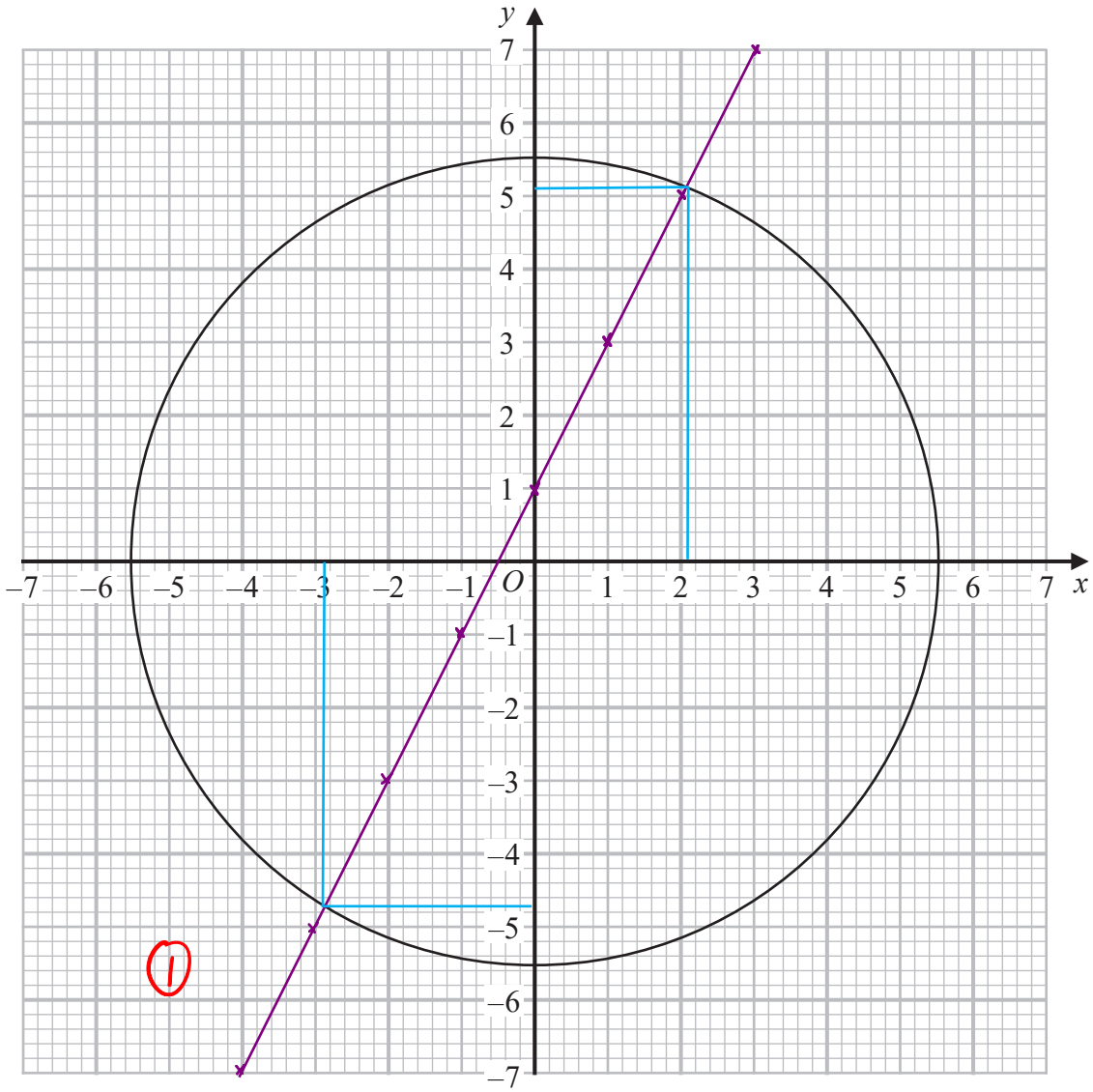
$$= \frac{40 - 8\sqrt{3} + 10\sqrt{3} - \sqrt{36}}{25 - 3}$$

$$= \frac{40 + 2\sqrt{3} - 6}{22} = \frac{34 + 2\sqrt{3}}{22}$$ (1)

(Total for Question 19 is 4 marks)

$$= \boxed{\frac{17+\sqrt{3}}{11}}$$ (1)

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.

$x^2 + y^2 = 30.25$

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

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)

21 The functions f and g are such that

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

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

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

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

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

(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

(1)

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

$\times x^4$ ↓ ↓ $\times x^4$

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

$\div(y-1)$ ↓ ↓ $\div(y-1)$

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

(1)

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

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

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

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

(4)

(Total for Question 21 is 6 marks)

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:

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

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

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

Multiply by -3:

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

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

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

$\therefore$ turning point $= (3, 36)$. (1)

(3 , 36)

(Total for Question 22 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS