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 ►

Pearson

Answer ALL questions.

Write your answers in the spaces provided.

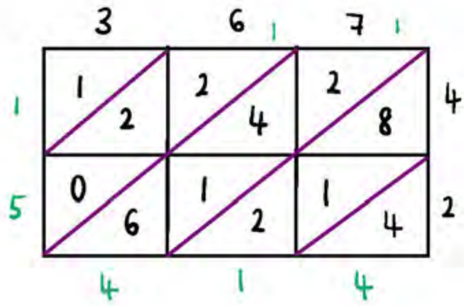
You must write down all the stages in your working.

1 (a) Work out 3.67 × 4.2

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

①

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



$367 \times 42 = 15414$ ①

$3.67 \times 4.2 = 15414 \div 1000$

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

①

15.414

(3)

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

①

$59.84 \div 16 = 3.74$

$$\begin{array}{r} 0\,3.7\,4 \\ 16\,\overline{)\,5\,9.{}^{11}8\,{}^{6}4} \end{array}$$

①

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

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

①

37.4

(3)

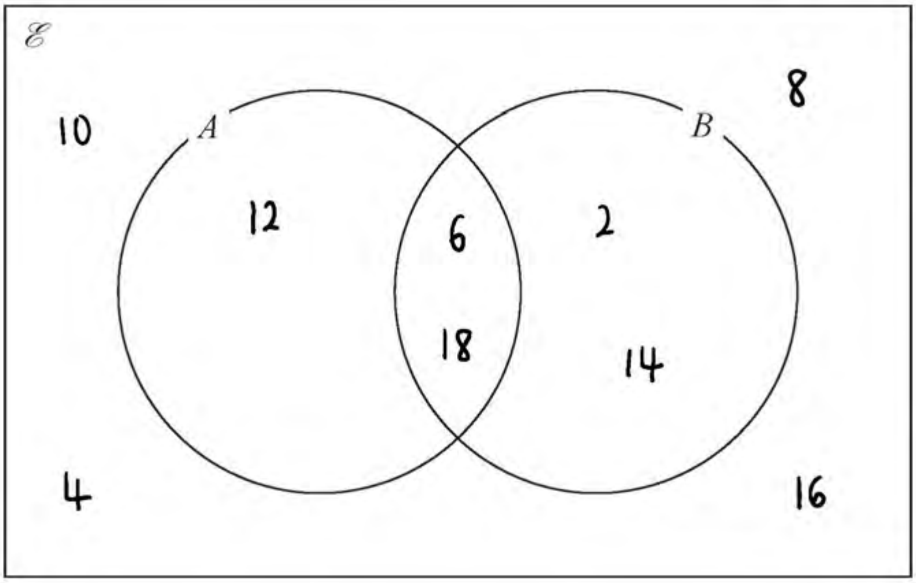
(Total for Question 1 is 6 marks)

2 $\mathscr{E}$ = {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.



① ① ①

(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:

$$\left.\begin{array}{l} \underset{\times 3}{\overset{\times 3}{\frac{21}{5} = \frac{63}{15}}} \\[2em] \underset{\times 5}{\overset{\times 5}{\frac{8}{3} = \frac{40}{15}}} \end{array}\right\} \quad \begin{array}{l} \frac{21}{5} - \frac{8}{3} = \frac{63}{15} - \frac{40}{15} = \frac{23}{15} \\[2em] \frac{23}{15} = \frac{15}{15} + \frac{8}{15} = 1 + \frac{8}{15} = \boxed{1\frac{8}{15}} \end{array}$$

①

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
= 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.

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

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.

$15x = 7x + 24$

÷8 $8x = 24$ ÷8

$x = 3$ ①

R : M : I

$4x : 7x : 15x$

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

12 : 21 : 45 ①

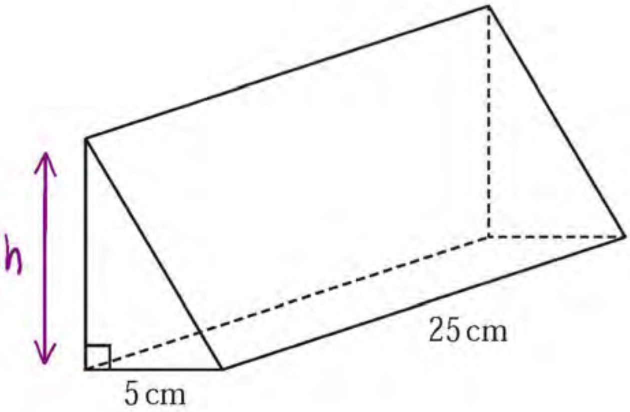
Ibrahim has 45 stickers, while Rosie has 12 stickers.

∴ Ibrahim has 33 more stickers than Rosie.

① 33

(Total for Question 5 is 3 marks)

6 The diagram shows a prism.

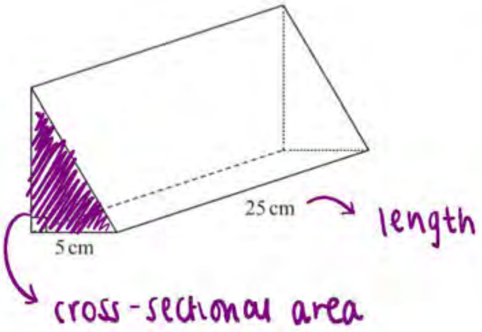


The cross section of the prism is a right-angled triangle.
The base of the triangle has length 5 cm

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

Work out the height of the prism.

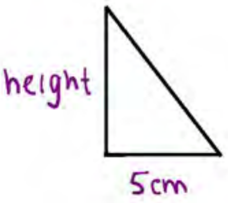
Find cross-sectional area:



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

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

Find height:



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

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

①

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

$$\times 2 \qquad 60 = 5 \times \text{height} \qquad \times 2$$

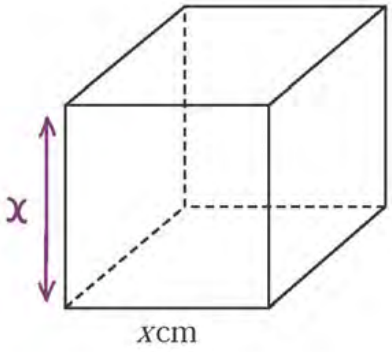
$$\div 5 \qquad 12 = \text{height} \qquad \div 5$$

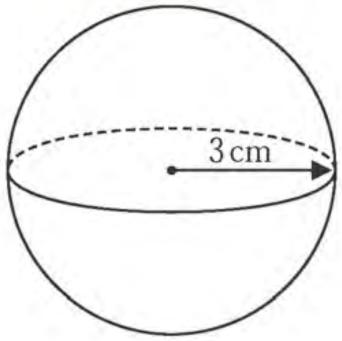
①

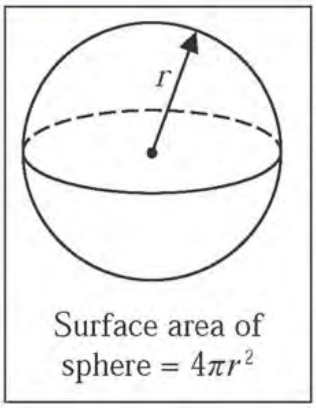
12 cm

(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

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

(Total for Question 7 is 4 marks)

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 $27^{\frac{1}{3}}$

①

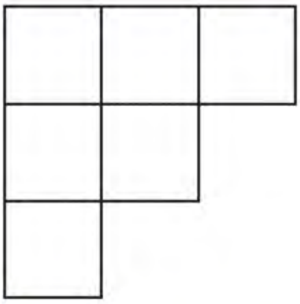
$27^{\frac{1}{3}} = \sqrt[3]{27} = 3$

3

(1)

(Total for Question 9 is 4 marks)

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



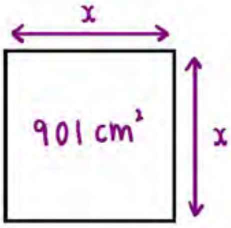
The total area of the shape is 5406 cm^2

(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)

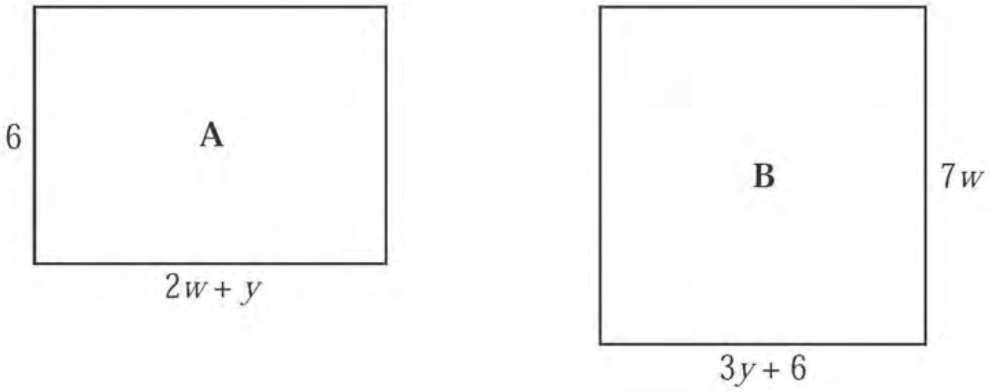
(b) Is your answer to part (a) an underestimate or an overestimate?
You must give a reason for your answer.

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

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

①

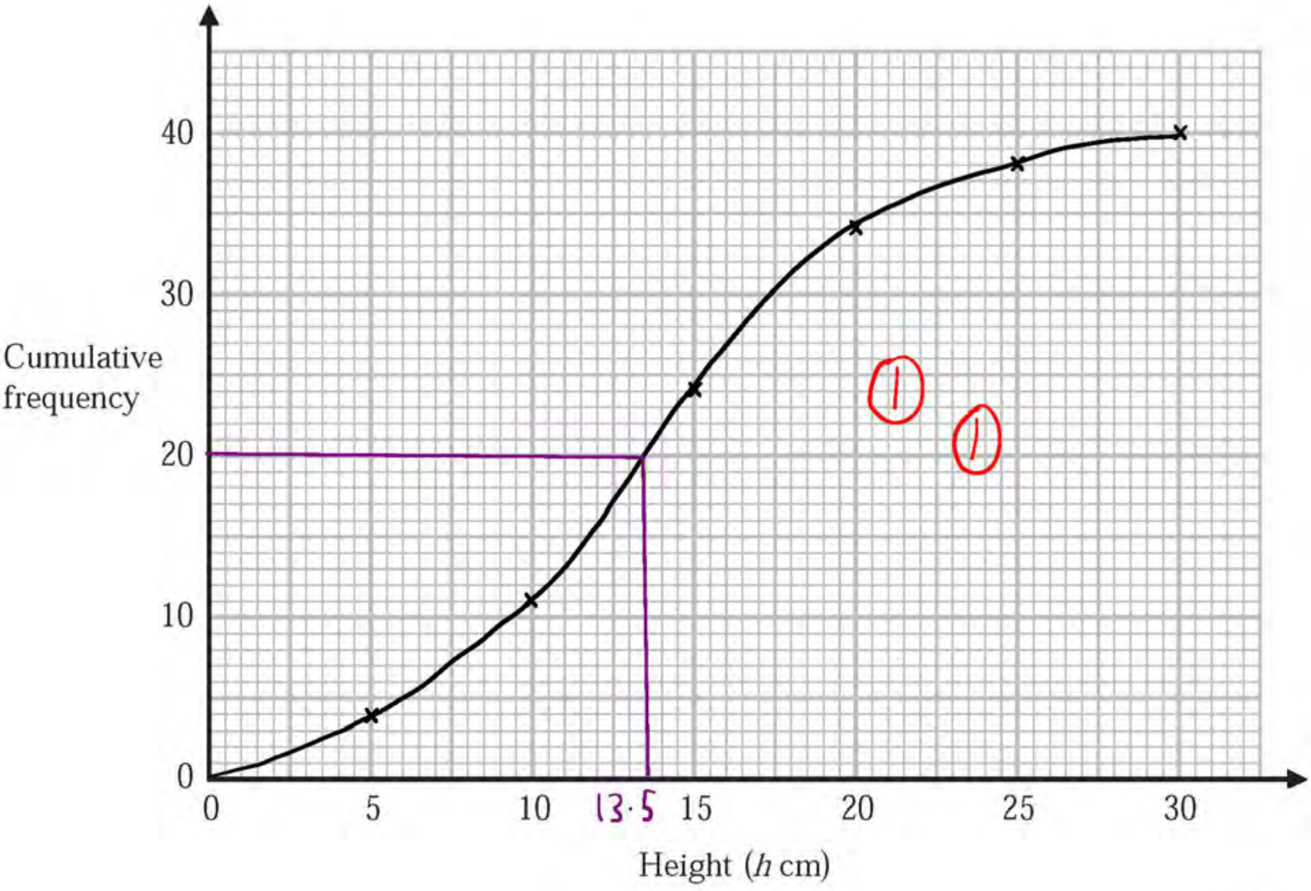
$\frac{30w}{6 - 21w}$

(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.

$x = 0.\dot{4}\dot{3}$ $x = 0.434343...$

$10x = 4.\dot{3}\dot{4}$ $10x = 4.343434...$

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

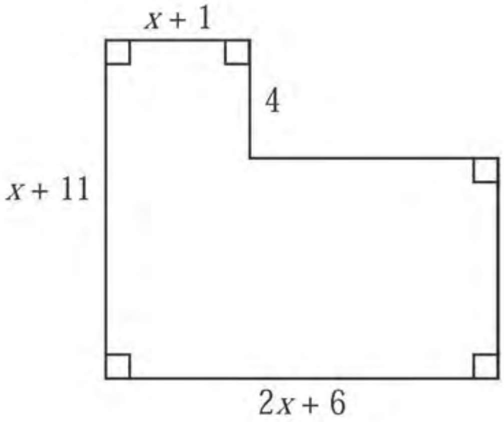
①

Evaluate Ted's method so far.

Ted does not eliminate the recurring decimals.

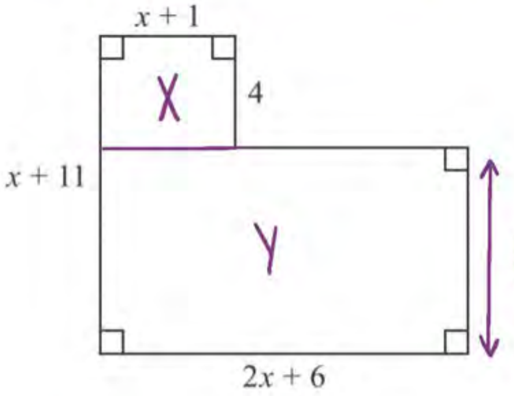
(Total for Question 13 is 1 mark)

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



The area of the shape is A cm^2

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



$(x+11) - 4 = x + 7$

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

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

$\boxed{= 2x^2 + 24x + 46}$ 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 10 x:

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

①

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

Add the fractions:

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

① ①

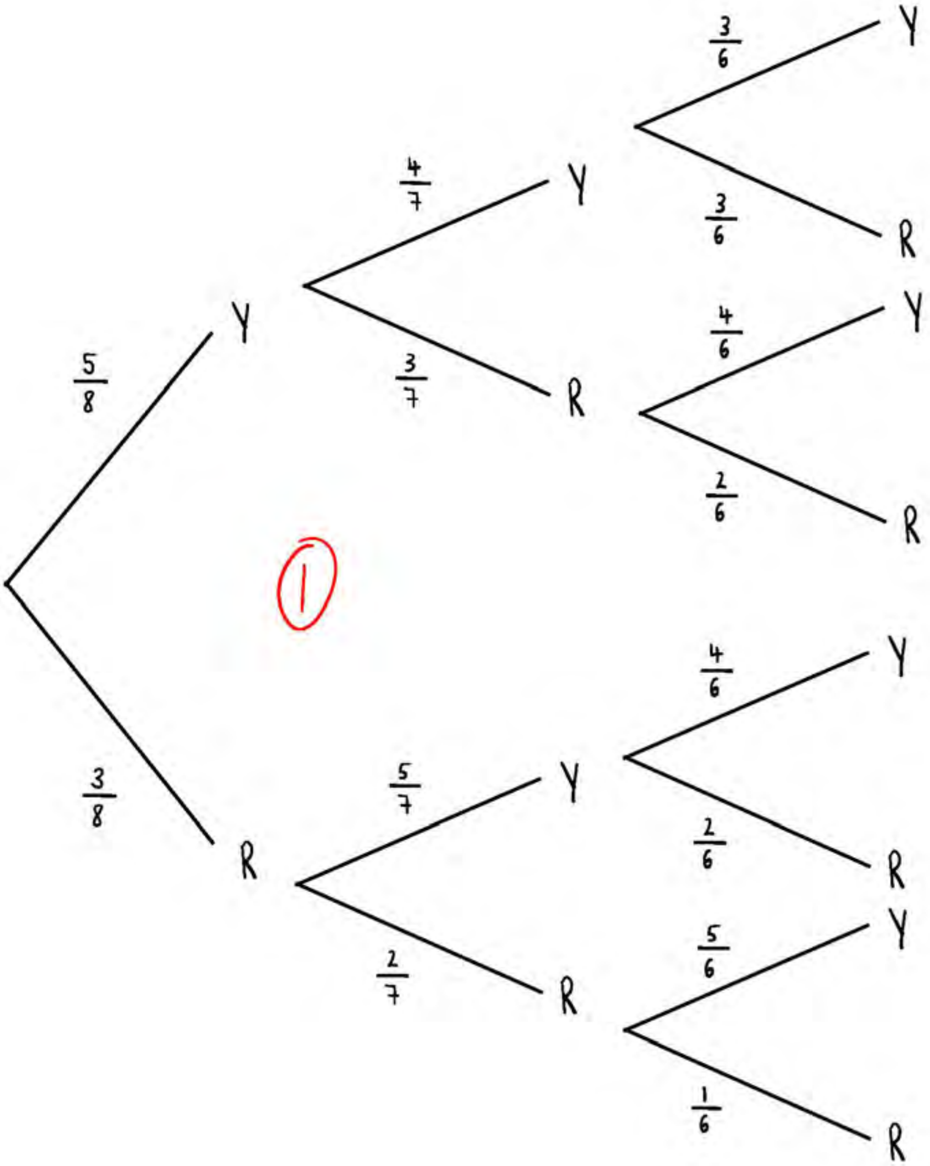
$$\boxed{= \frac{26x+15}{10x}}$$

(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.

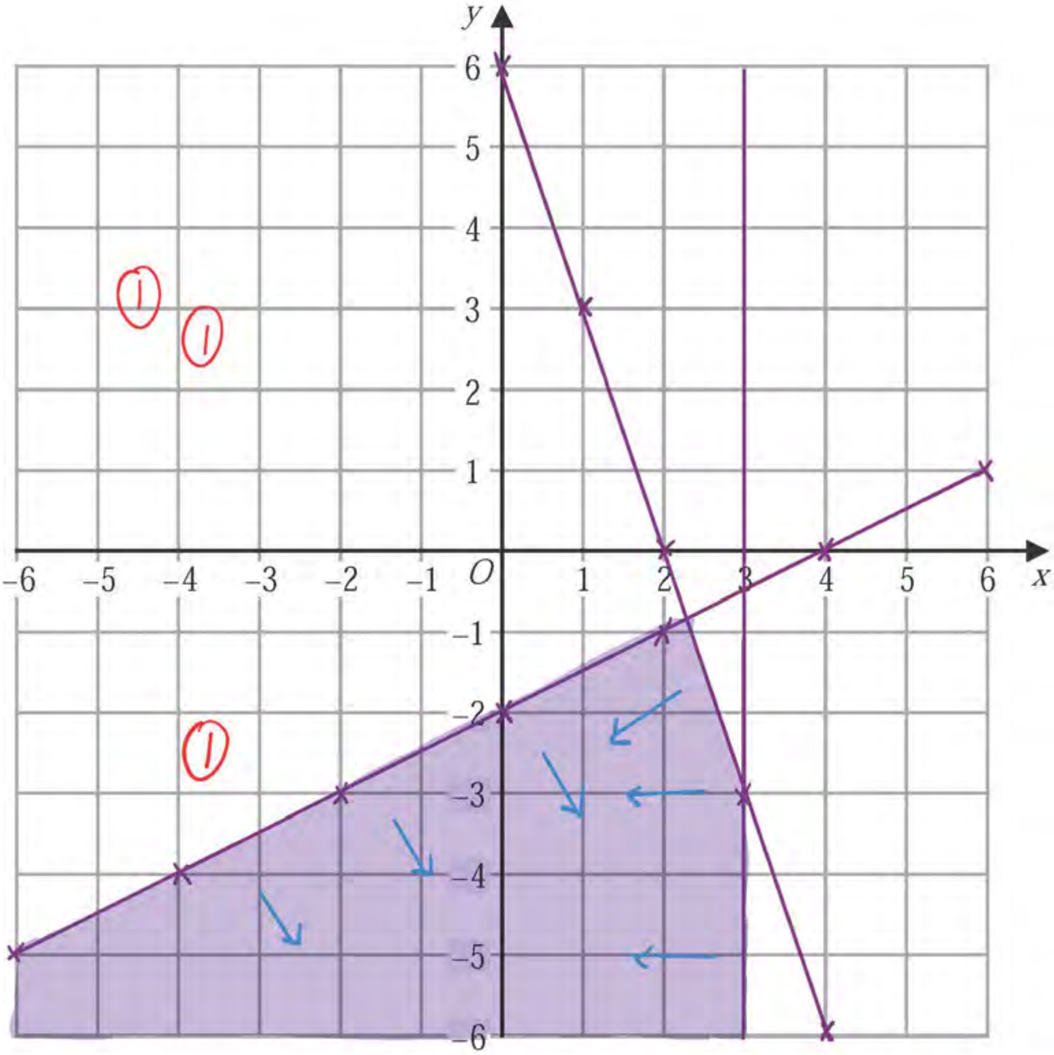
$2y + 4 < x$ $\boxed{x < 3}$ $y < 6 - 3x$

Label the region **R**.

$2y < x - 4$

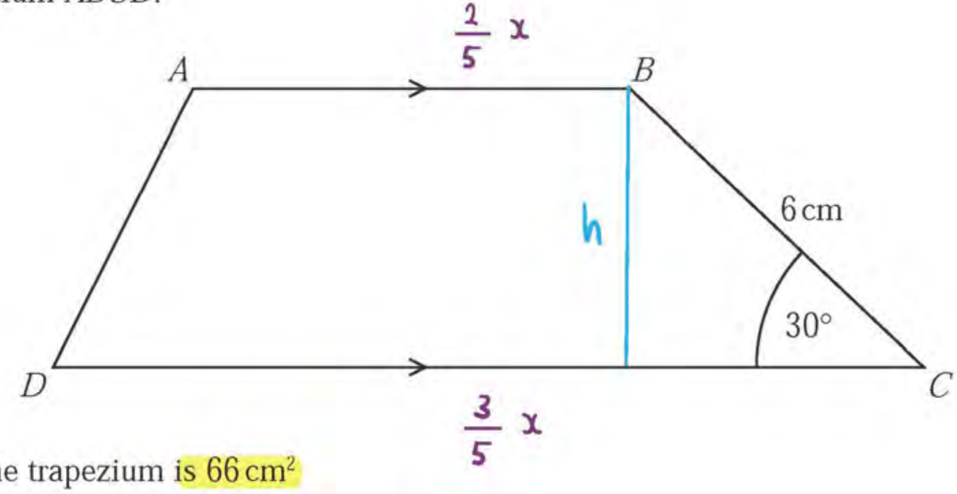
$\boxed{y < -3x + 6}$

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



(Total for Question 17 is 3 marks)

18 Here is trapezium *ABCD*.



The area of the trapezium is 66 cm²

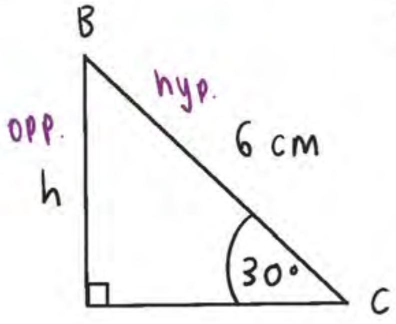
the length of *AB*: the length of *CD* = 2 : 3

Find the length of *AB*.

AB : CD
= 2 : 3

5 parts in total.
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

$\frac{1}{2} = \frac{h}{6}$ ①

×6 ×6

$3 = h$

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 ①

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

÷3 ÷3

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

×2 ×2

$44 = x$

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

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

$= \underline{\underline{17.6\text{ cm}}}$

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.'

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

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

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

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

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

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

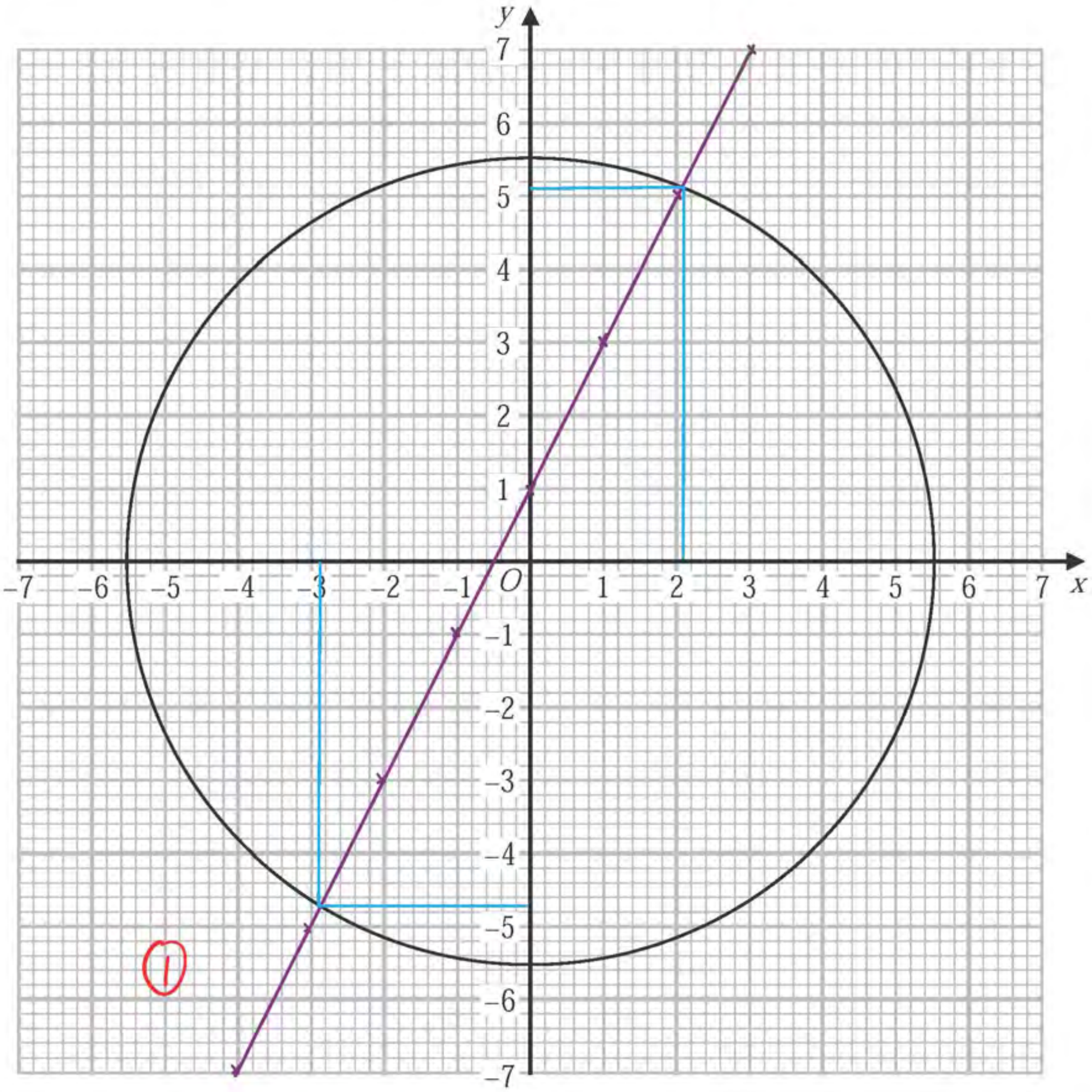
$$=\frac{40-8\sqrt{3}+10\sqrt{3}-\sqrt{36}}{25-3}$$

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

$$x^2 + y^2 = 30.25$$
$$y - 2x = 1 \quad \therefore \ y = 2x + 1.$$

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'.

① ①

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

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

①

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

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

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

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 $(x^2 - 2ax) = (x-a)^2 - a^2$

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

Multiply by -3:

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

$y = -3(x-3)^2 + 36.$ ①

①

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

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

(3 , 36)

(Total for Question 22 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS