Tip: Do the calculation without the decimal places and count them back in at the end. E.g. In total there are three decimal places in the question, so you need three decimal places in the answer.

1 (a) Work out 3.67×4.2

$$\begin{array}{r} 367 \\ \times\ 42 \\ \hline 734 \\ 14680 \\ \hline 15414 \end{array}$$

$367 \times 42 = 15414$

$3.67 \times 4.2 = 15.414$

15.414

(3)

(b) Work out $59.84 \div 1.6$

$$\frac{59.84}{1.6} \overset{\times 10}{=} \frac{598.4}{16}$$

Tip: By finding an equivalent fraction, we have found another division that will have the same answer.

16
32
48
64
80
96
112

$$16 \overline{)598.4} = 37.4$$

37.4

(3)

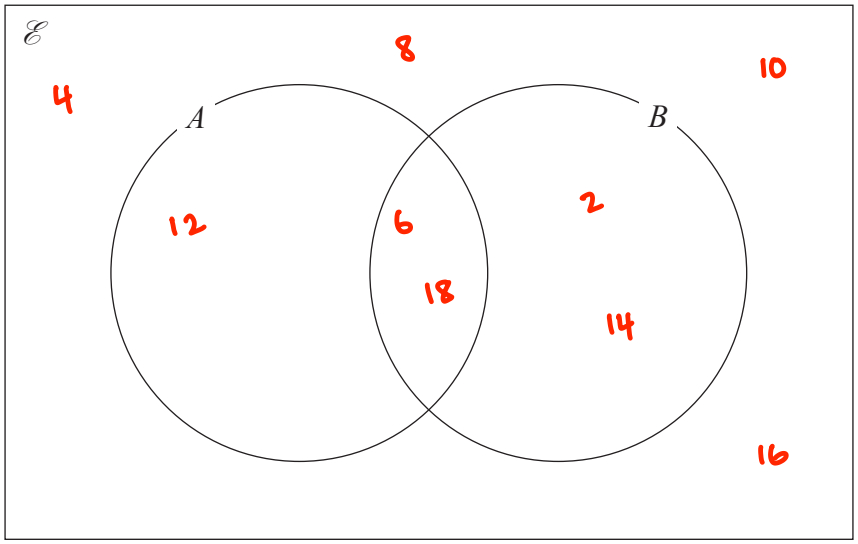
(Total for Question 1 is 6 marks)

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.



(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.

$\frac{21}{5} - \frac{8}{3}$ (×3 / ×5)

$\frac{63}{15} - \frac{40}{15} = \frac{23}{15} = 1\frac{8}{15}$

$1\frac{8}{15}$

(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

£ 220,000

10 % = 22,000
20 % = 44,000

220 000
- 44000
176000

Rahim

£ 160,000

10 % = 16,000
30 % = 48,000

160,000
+ 48,000
208 000

16
32
48

Rahim's house had the greater value

(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
×3 (4 → 12), +8 (7 → 21)
12 : 21 : 45

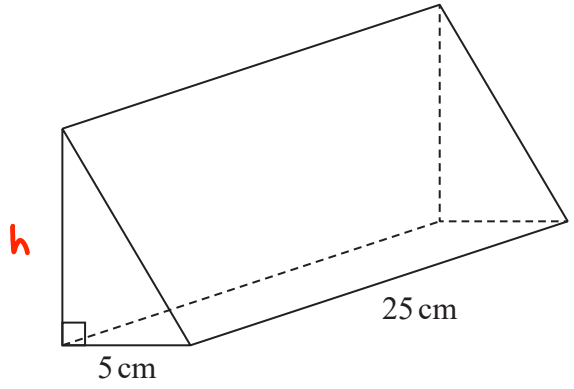
45 − 12 = 33

Tip: Because we need this difference to be 24, we multiply everything by 3.

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.

$25 \overline{)750} = 30$

Area of triangle = $30cm^2$

$\frac{1}{2} \times 5 \times h = 30$

$\times 2 \quad \times 2$

$5 \times h = 60$

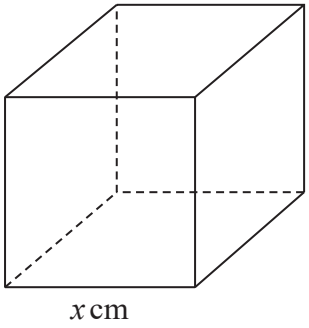
$\div 5 \quad \div 5$

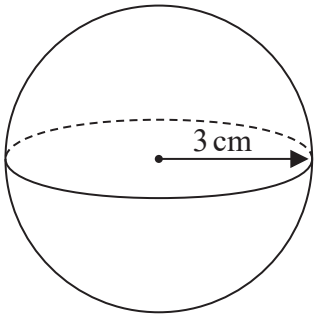
$h = 12$

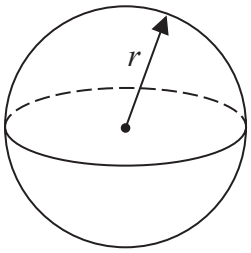
12 cm

(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.

SA of cube :

$x \times x = x^2$

$x^2 \times 6 = 6x^2$

SA Sphere :

$4\pi \times 3^2$

$= 4\pi \times 9$

$= 36\pi$

$6x^2 = 36\pi$

$\div 6 \quad \div 6$

$x^2 = 6\pi$

$\sqrt{\ } \quad \sqrt{\ }$

$x = \sqrt{6\pi}$

(Total for Question 7 is 4 marks)

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

$-5x \quad -5x$

$x^2 - 5x = 24$

$-24 \quad -24$

$x^2 - 5x - 24 = 0$

Tip: This is a quadratic equation. To solve a quadratic equation it needs to equal 0.

$+ \quad \times$

$x^2 - 5x - 24 = 0$

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

$x = 8 \quad x = -3$

$x = 8$ or $x = -3$

(Total for Question 8 is 3 marks)

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

Tip: Any number to the power of 0 equals 1.

1

(1)

(b) Find the value of $3^1 \times 3^6 \times 3^{-6}$

$3^1 \times 3^6 = 3^7$

$3^7 \times 3^{-6} = 3^1$

3

(1)

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

$2^4 = 2 \times 2 \times 2 \times 2 = 16$

$\frac{1}{16}$

(1)

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

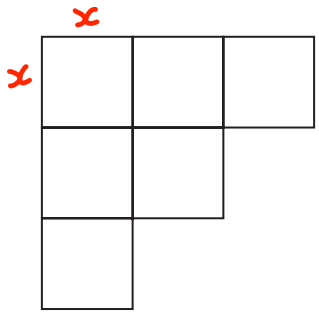
$\sqrt[3]{27} = 3^1 = 3$

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.

$$6\overline{)5406} \quad 0901$$

Area 1 square = 901 cm^2

$x^2 = 900$

$\sqrt{} \quad \sqrt{}$

$x = 30$

30 cm

(3)

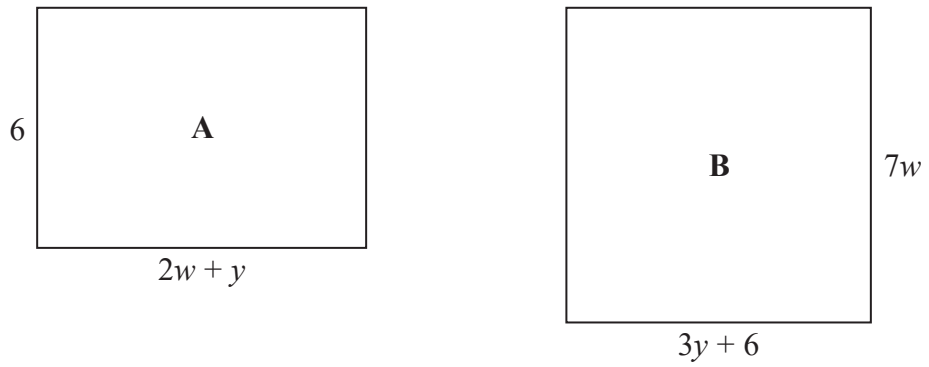
(b) Is your answer to part (a) an underestimate or an overestimate?
You must give a reason for your answer.

underestimate, the $\sqrt{901}$ would be larger than 30.

(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 A :

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

Area B :

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

$12w + 6y = 21wy + 42w$

$-21wy \quad -21wy$

$12w + 6y - 21wy = 42w$

$-12w \quad -12w$

$6y - 21wy = 30w$

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

$\div (6 - 21w) \quad \div (6 - 21w)$

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

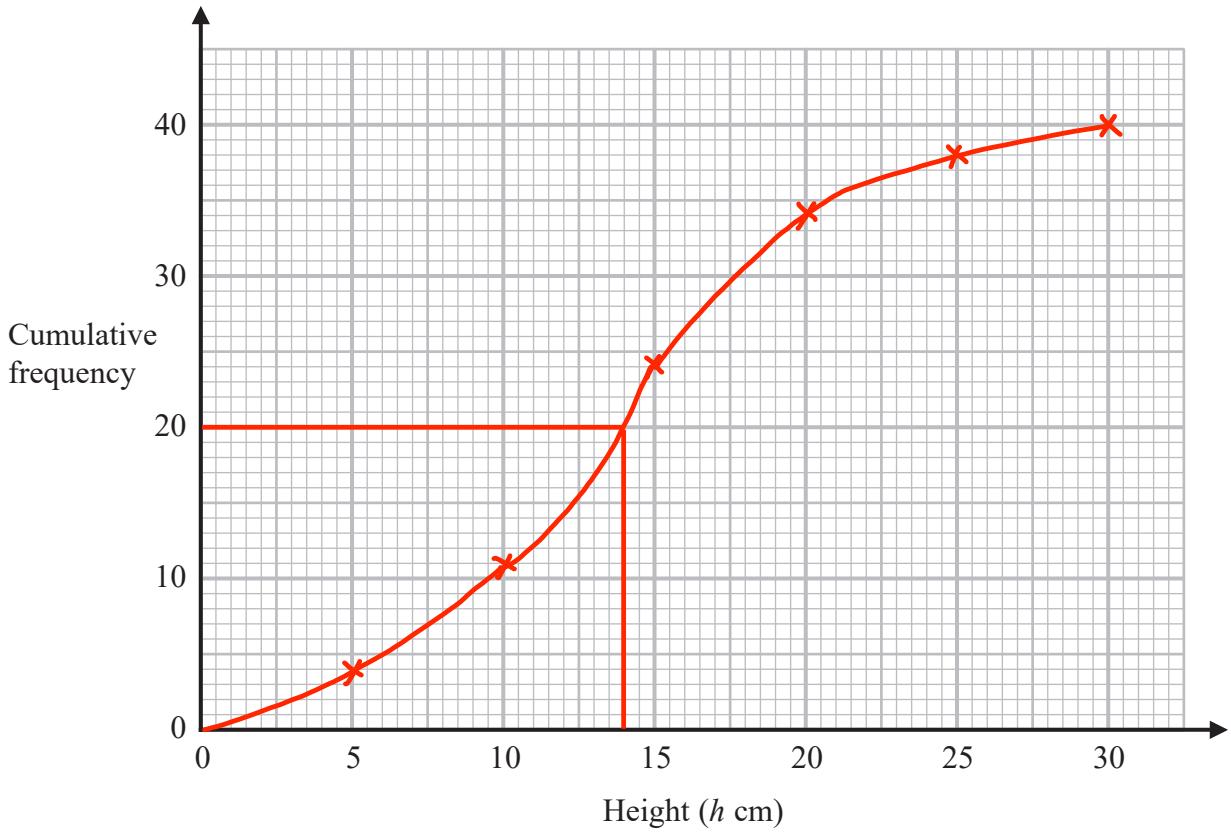
$y = \frac{30w}{6 - 21w}$

(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.

14 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.

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

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

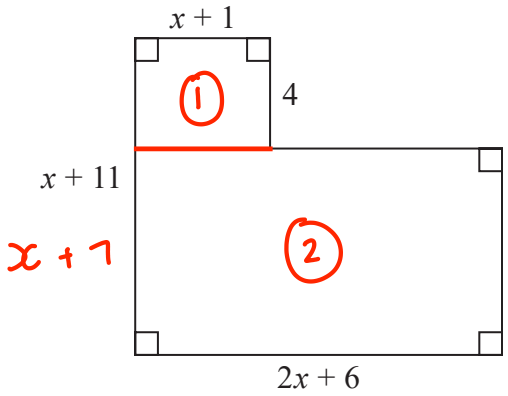
$$10x - x = 4.\dot{3}\dot{4} - 0.\dot{4}\dot{3}$$

Evaluate Ted's method so far.

4.$\dot{3}\dot{4}$ - 0.$\dot{4}\dot{3}$ would not cancel out the recurring digits. He should have found 100x.

(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 $A = 2x^2 + 24x + 46$

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

2 $(x+7)(2x+6) = 2x^2 + 6x + 14x + 42$

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

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

$= 2x^2 + 24x + 46$

(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.

Tip: To add fractions you need to have the same denominator

$\frac{4x+3}{2x} + \frac{3}{5}$ ×5 ↓ ↓ ×2x

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

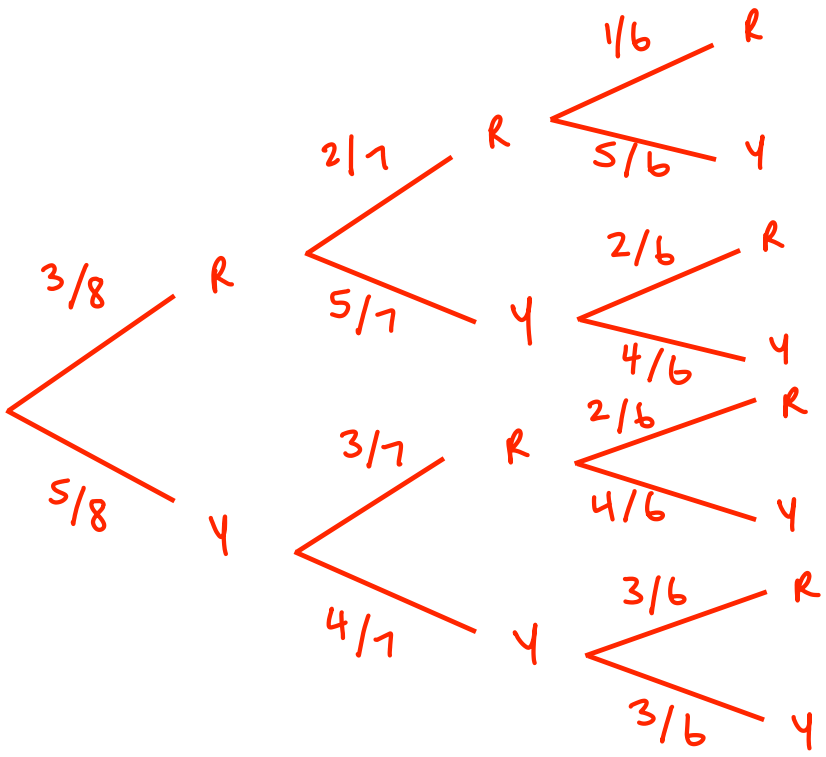
$= \frac{26x+15}{10x}$

(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.



R, Y, Y = $\frac{3}{8} \times \frac{5}{7} \times \frac{4}{6} = \frac{60}{336}$

Y, R, Y = $\frac{5}{8} \times \frac{3}{7} \times \frac{4}{6} = \frac{60}{336}$

Y, Y, R = $\frac{5}{8} \times \frac{4}{7} \times \frac{3}{6} = \frac{60}{336}$

$8 \times 7 = 56$

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

$56 \times 6 = 336$

$\frac{180}{336}$

(Total for Question 16 is 4 marks)

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

Label the region **R**.

$2y + 4 < x$ under

$-4 \quad -4$

$2y = x - 4$

$\div 2 \quad \div 2$

$y < \frac{x-4}{2}$

x	0	2	4
y	-2	-1	0

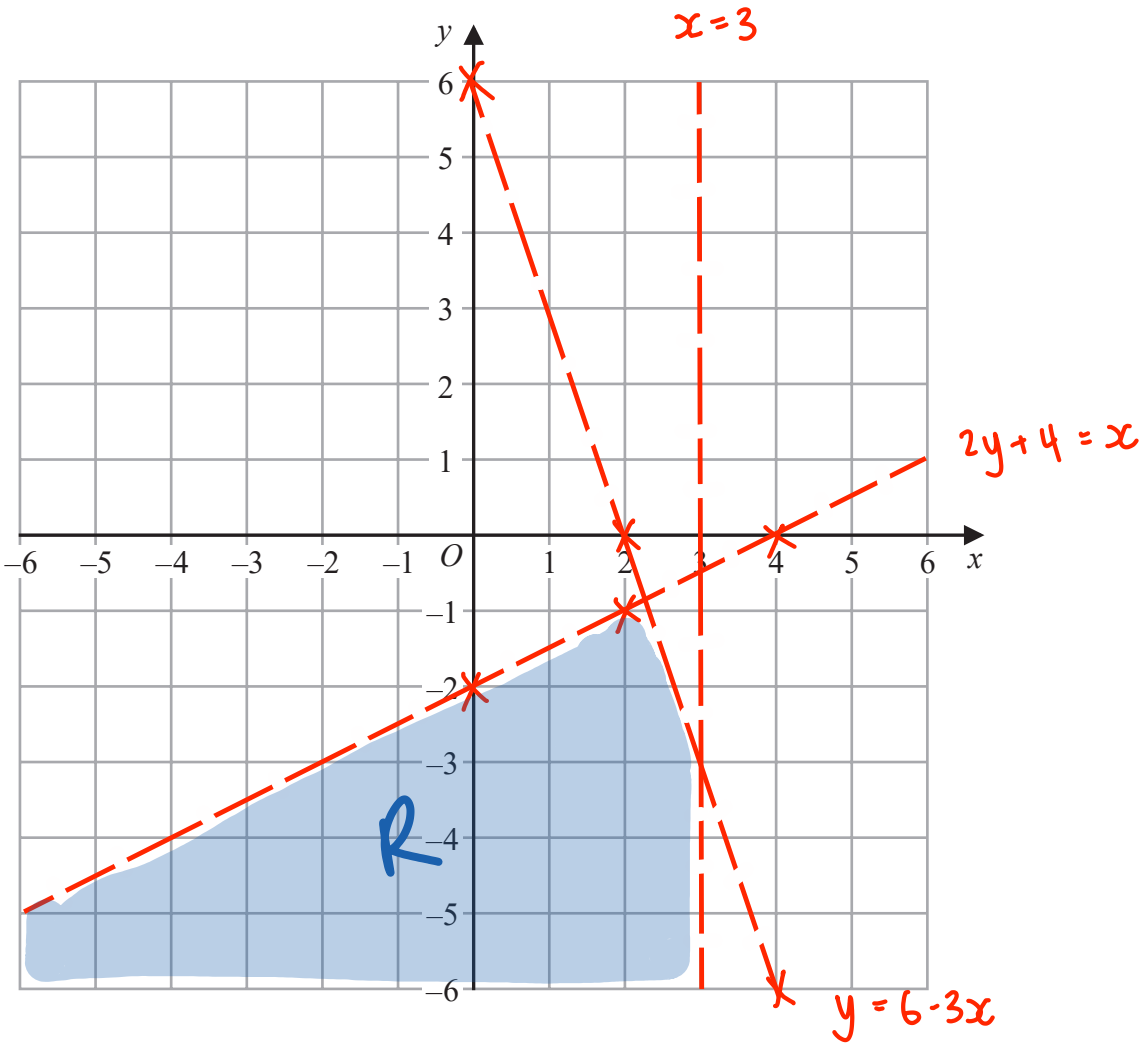
$x < 3$

$x = 3$

$y < 6 - 3x$ under

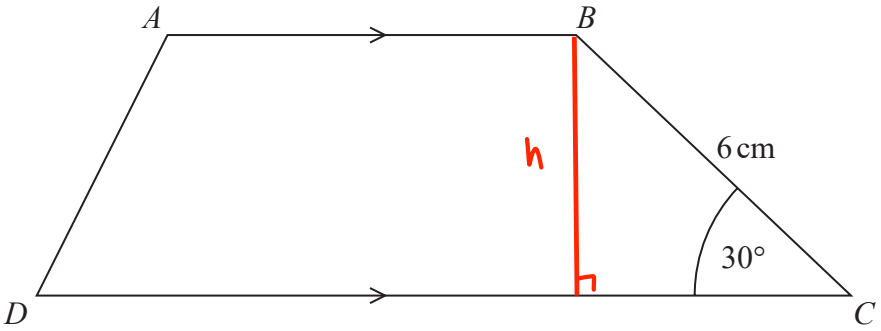
$y = 6 - 3x$

x	0	2	4
y	6	0	-6



(Total for Question 17 is 3 marks)

18 Here is trapezium $ABCD$.

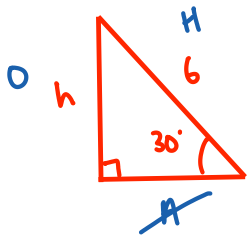


The area of the trapezium is $66\,cm^2$

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

Find the length of AB.

Area of Trapezium:
$\frac{1}{2}(a+b)h$



S H

S x H

Sin(30) x 6

$= \frac{1}{2} \times 6 = 3$

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

$h = 3$

$\frac{1}{2}(a+b) \times h = 66$

$\frac{1}{2}(a+b) \times 3 = 66$

$\div 3 \quad \div 3$

$\frac{1}{2}(a+b) = 22$

$\times 2 \quad \times 2$

$a+b = 44$

AB : BC
2 : 3
17.6 : 26.4

$8.8 \times 2 = 17.6$
$8.8 \times 3 = 26.4$

$5 \overline{)44.0}$ = 8.8

17.6 ..... cm

(Total for Question 18 is 5 marks)

$= 2\sqrt{3}$

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

$$\frac{(8+2\sqrt{3})}{(5+\sqrt{3})} \times \frac{(5-\sqrt{3})}{(5-\sqrt{3})} = \frac{40-8\sqrt{3}+10\sqrt{3}-2\sqrt{9}}{25-5\sqrt{3}+5\sqrt{3}-3}$$

$$= \frac{40-8\sqrt{3}+10\sqrt{3}-6}{25-3}$$

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

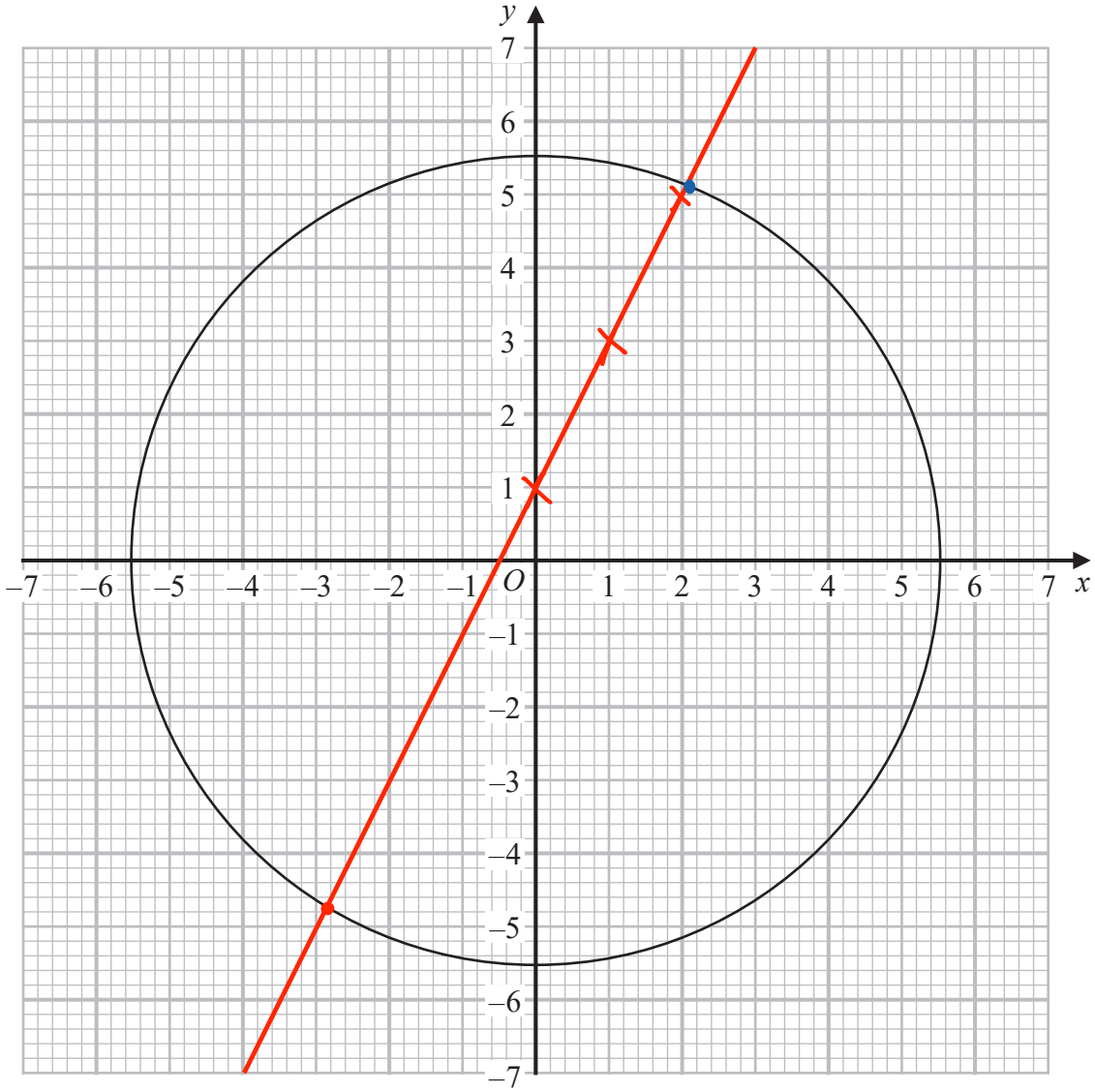
$$= \frac{17+\sqrt{3}}{11}$$

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

$2\sqrt{9} = 2(3) = 6$

(Total for Question 19 is 4 marks)

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

$$x^2 + y^2 = 30.25$$
$$y - 2x = 1$$

$y = 2x + 1$

x	0	1	2
y	1	3	5

$x = -2.8$, $y = -4.8$
$x = 2.1$, $y = 5.1$

(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)

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

$= 3 + 1$

$= 4$

$g(4) = \frac{4}{4^2}$

$= \frac{4}{16}$

$\frac{4}{16}$ OR $\frac{1}{4}$

(2)

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

(b) Find h(x)

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

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

$= \frac{48}{x^4} + 1$

To find $(fg)^{-1}$

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

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

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

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

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

Tip: When you have two fractions equal to eachother, you can flip both fractions to make it easier to solve!

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

(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.

Tip: If you are asked to find a turning point you need to complete the square

$-3x^2 + 18x + 9$

$-3[x^2 - 6x - 3]$

$-3[(x-3)^2 - 9 - 3]$

$-3[(x-3)^2 - 12]$

$-3(x-3) + 36$

(3 , 36)

(Total for Question 22 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS