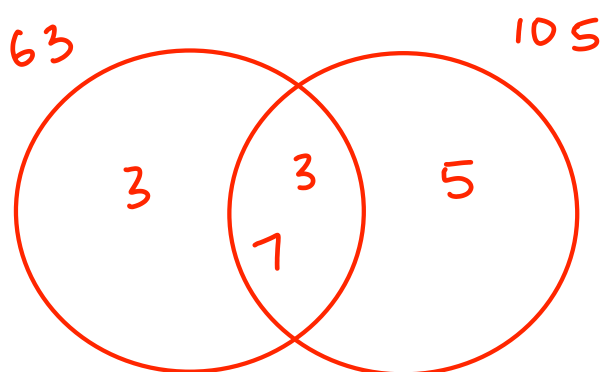


- 1 Find the highest common factor (HCF) of 63 and 105

$$63 = 3^2 \times 7$$

$$105 = 3 \times 5 \times 7$$



$$\text{HCF} = 3 \times 7$$

21

(Total for Question 1 is 2 marks)

- 2 (a) (i) Write 5.3×10^4 as an ordinary number.

53000

(1)

- (ii) Write 7.4×10^{-5} as an ordinary number.

0.000074

(1)

- (b) Calculate the value of $(9.7 \times 10^6) + (2.45 \times 10^7)$
Give your answer in standard form.

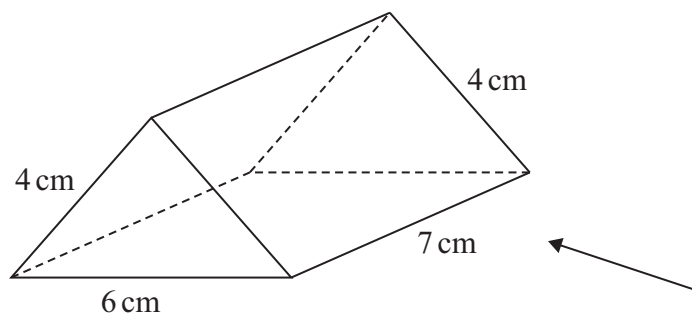
= 34200000

3.42×10^7

(2)

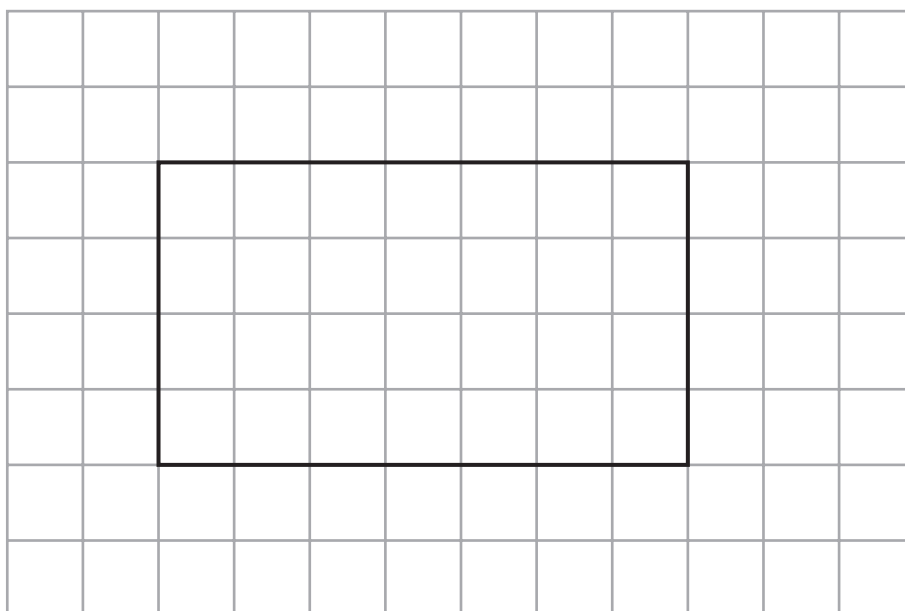
(Total for Question 2 is 4 marks)

- 3 The diagram shows a solid triangular prism.



Rana is trying to draw the side elevation of the solid prism from the direction of the arrow.

Here is her answer on a centimetre grid.



- (a) Explain why Rana's side elevation is not correct.

She has used the slanted height not the perpendicular height

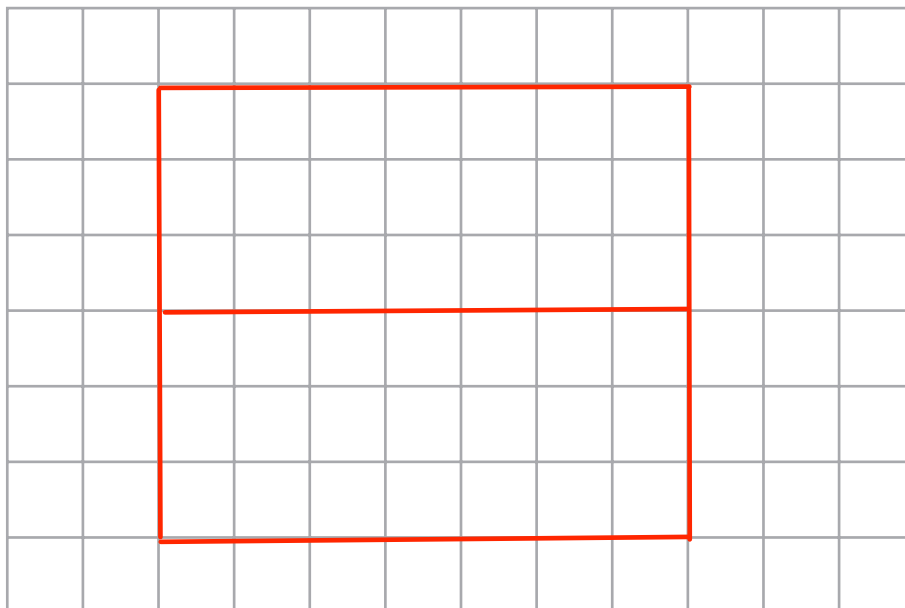
(1)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(b) On the centimetre grid below, draw a plan of the solid prism.



(2)

(Total for Question 3 is 3 marks)

- 4 A company has 25 000 workers.
The number of workers increases at a rate of 6% per year for 3 years.
Calculate the total number of workers at the end of the 3 years.

$$25\,000 \times 1.06^3 = 29\,175.4$$

29 175

(Total for Question 4 is 4 marks)



5 Habib has two identical tins.

He puts 600 grams of flour into one of the tins.

The flour fills the tin completely.

The density of the flour is 0.6 g/cm^3

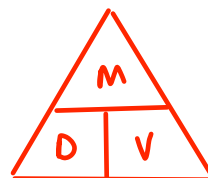
Habib puts 600 grams of salt into the other tin.

The salt does **not** fill the tin completely.

The volume of the space in the tin that is **not** filled with salt is 700 cm^3

Work out the density of the salt.

You must show all your working.



300 cm^3
filled

flour

$$D = 0.6 \text{ g/cm}^3$$

$$M = 600 \text{ g}$$

$$V = 1000 \text{ cm}^3$$



Volume of Tin

Salt

$$D = 2 \text{ g/cm}^3$$

$$M = 600 \text{ g}$$

$$V = 300 \text{ cm}^3$$

..... 2 g/cm^3

(Total for Question 5 is 4 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

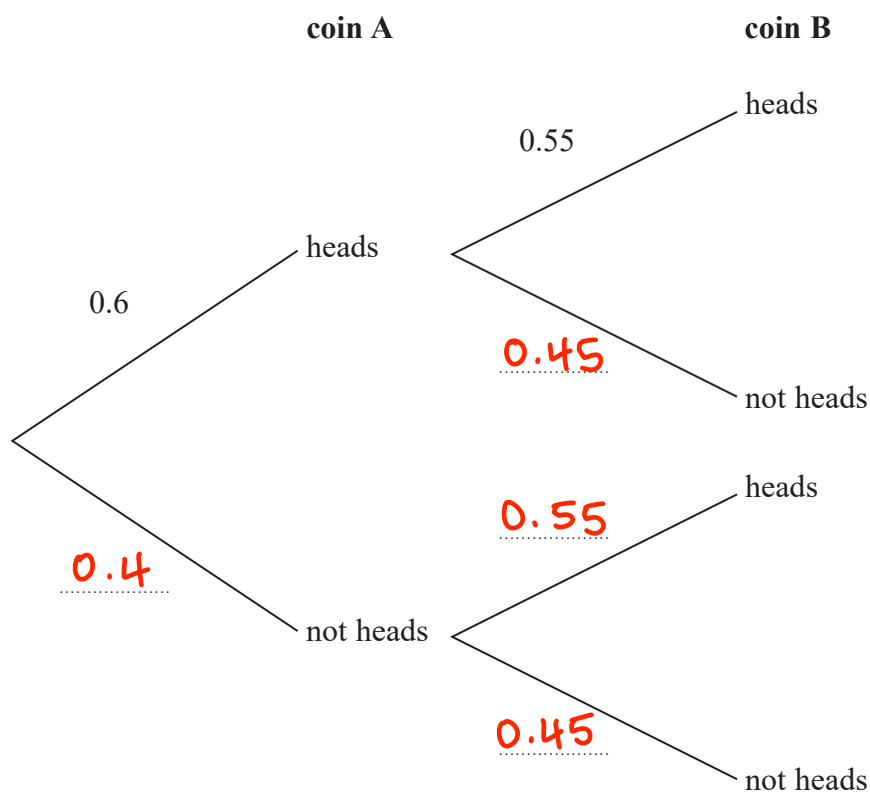
DO NOT WRITE IN THIS AREA



- 6 Tim has two biased coins, coin **A** and coin **B**.
He is going to throw both coins.

The probability that coin **A** will land on heads is 0.6
The probability that coin **B** will land on heads is 0.55

- (a) Complete the probability tree diagram.



(2)

Tim throws coin **A** once and he throws coin **B** once.

- (b) Work out the probability that both coins land on heads.

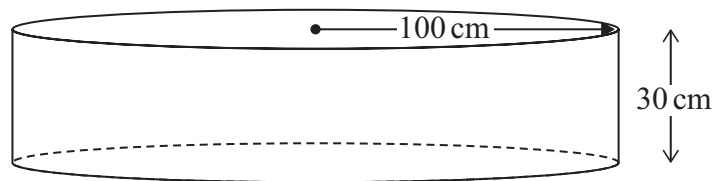
$$P(H, H) = 0.6 \times 0.55 = 0.33$$

0.33

(2)

(Total for Question 6 is 4 marks)

- 7 A paddling pool is in the shape of a cylinder.



The pool has radius 100 cm.

The pool has depth 30 cm.

The pool is empty.

It is then filled with water at a rate of 250 cm^3 per second.

Work out the number of minutes it takes to fill the pool completely.

Give your answer correct to the nearest minute.

You must show all your working.

$$\begin{aligned} \text{Volume} &= \pi r^2 \times h \\ &= \pi \times 100^2 \times 30 = 300000\pi \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} 250 \text{ cm}^3 &= 1 \text{ second} \\ \swarrow \times 1200\pi \quad \searrow \times 1200\pi \\ 300000\pi \text{ cm}^3 &= 3769.91 \text{ seconds} \end{aligned}$$

$$3769.91 \div 60 = 62.83$$

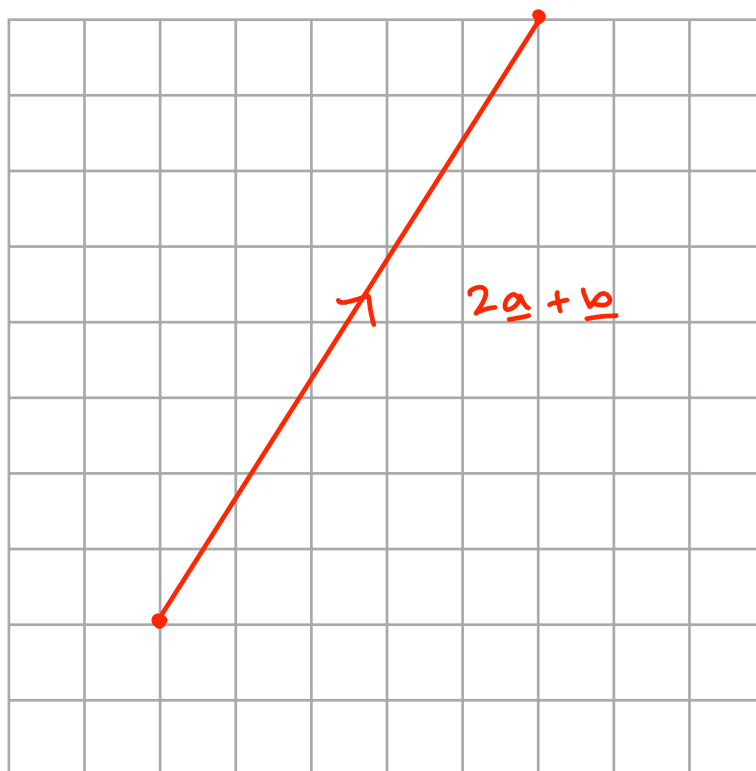
..... **63** minutes

(Total for Question 7 is 4 marks)

8 $\mathbf{a} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$ $2\mathbf{a} = \begin{pmatrix} 6 \\ 4 \end{pmatrix}$

On the grid below, draw and label the vector $2\mathbf{a} + \mathbf{b}$

$$2\mathbf{a} + \mathbf{b} = \begin{pmatrix} 6 \\ 4 \end{pmatrix} + \begin{pmatrix} -1 \\ 4 \end{pmatrix} = \begin{pmatrix} 5 \\ 8 \end{pmatrix}$$



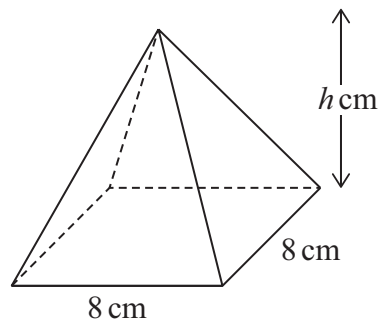
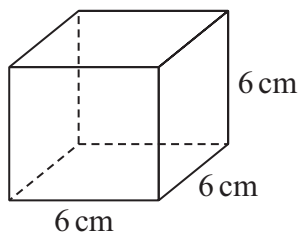
Tip: You can start to draw the vector anywhere (as long as it will fit on the grid)

(Total for Question 8 is 3 marks)



- 9 The diagram shows a cube and a square-based pyramid.

$$\begin{aligned} \text{Volume} &= \\ 6 \times 6 \times 6 \\ &= 216 \text{ cm}^3 \end{aligned}$$



$$\begin{aligned} \text{Volume} &= \\ \frac{LWH}{3} \end{aligned}$$

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

The volume of the cube is equal to the volume of the pyramid.

Work out the perpendicular height, h cm, of the pyramid.

$$\begin{array}{rcl} \frac{8 \times 8 \times h}{3} & = & 216 \\ \times 3 & & \times 3 \\ 64 \times h & = & 648 \\ \div 64 & & \div 64 \\ h & = & 10.125 \end{array}$$

$$10.125 \text{ cm}$$

(Total for Question 9 is 3 marks)



10 There are only red counters and yellow counters in bag A.

number of red counters : number of yellow counters = 3 : 5

There are only green counters and blue counters in bag B.

The number of counters in bag B is half the number of counters in bag A.

Given that there are x red counters in bag A,

use algebra to show that the total number of counters in bag A and bag B is $4x$

$$\begin{array}{c}
 \text{Bag A} \\
 \hline
 2 : 4 \\
 \times \frac{x}{3} \quad \downarrow \quad 3 : 5 \quad \downarrow \quad \times \frac{x}{3} \\
 x : \frac{5x}{3}
 \end{array}$$

$$\begin{aligned}
 \text{Total Bag A} &= \frac{x}{1} + \frac{5x}{3} \\
 &= \frac{3x}{3} + \frac{5x}{3} = \frac{8x}{3}
 \end{aligned}$$

$$\text{Total Bag B} = \frac{4x}{3} \quad (\text{Total for Question 10 is 3 marks})$$

$$A + B = \frac{8x}{3} + \frac{4x}{3} = \frac{12x}{3} = 4x$$



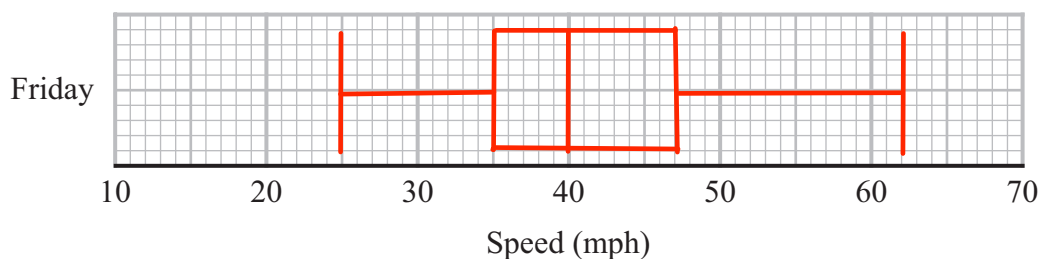
- 11 Mina records the speeds, in mph, of some cars on a road on Friday. She uses her results to work out the information in this table.

	Speed (mph)
Lowest speed	25
Lower quartile	35
Median	40
Interquartile range	12
Range	37

$$UQ = 35 + 12 = 47$$

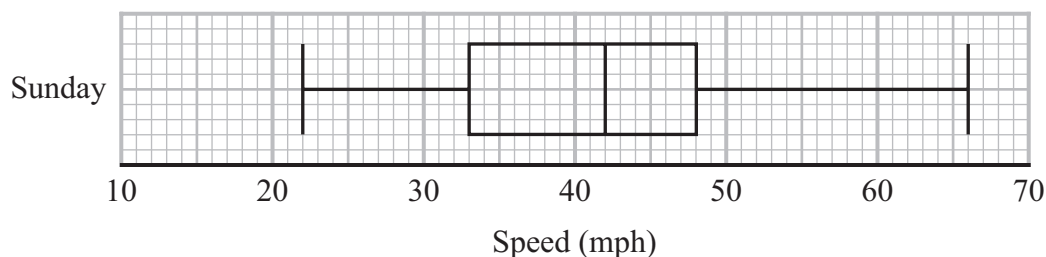
$$\text{Highest} = 25 + 37 = 62$$

- (a) On the grid, draw a box plot to show the information in the table.



(3)

Mina also records the speeds of some cars on the same road on Sunday. She uses her results to draw this box plot.



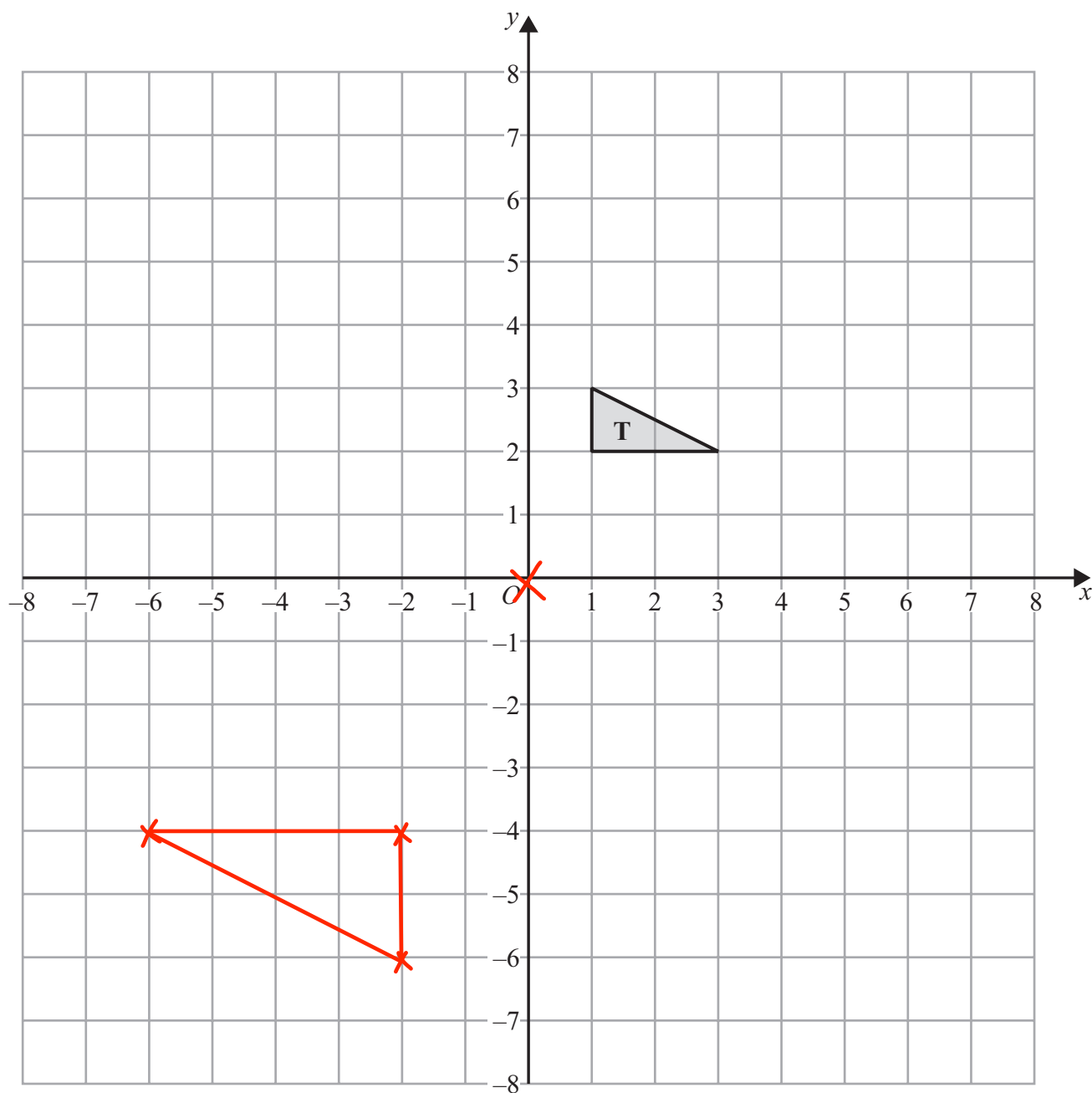
- (b) Compare the distribution of the speeds on Friday with the distribution of the speeds on Sunday.

Friday has a lower median, suggesting cars were driving slower on Friday.
 Sunday has a higher range, suggesting the speeds of the cars varied more.

(2)

(Total for Question 11 is 5 marks)

12 The diagram shows triangle T drawn on a grid.



Enlarge triangle T by scale factor -2 with centre of enlargement $(0, 0)$

(Total for Question 12 is 2 marks)

13 There are 30 students in a class.

A teacher is going to choose at random 2 of the students.

Work out the number of different pairs of students that the teacher can choose.

$$30 \times 29 = 870$$

$$870 \div 2 = 435$$

435

(Total for Question 13 is 2 marks)

Tip: When picking pairs from the same group of people, you need to divide your final answer by two to eliminate the duplicate pairs.

E.g. Sarah, David
David, Sarah

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

- 14 At the start of 2022 Kim invested some money in a savings account.
The account paid 3.5% compound interest each year.

At the end of 2022

interest was added to the account then Kim took £750 from the account.

At the end of 2023

interest was added to the account then Kim took £1000 from the account.

There was then £2937.14 in the account.

Work out how much money Kim invested at the start of 2022

You must show all your working.

$$\begin{array}{rcl} \text{end of 2023} & = & 2937.14 \\ + \text{£1000} & = & 3937.14 \end{array}$$

$$\begin{array}{rcl} x \times 1.035 & = & 3937.14 \\ \div 1.035 & & \div 1.035 \\ x & = & 3804 \end{array}$$

$$\begin{array}{rcl} \text{end of 2022} & = & 3804 \\ + \text{£150} & = & 4554 \end{array}$$

£ 4400

(Total for Question 14 is 4 marks)

$$\begin{array}{rcl} x \times 1.035 & = & 4554 \\ \div 1.035 & & \div 1.035 \\ x & = & 4400 \end{array}$$



15 (a) Simplify fully $\frac{(a-3)^2}{5(a-3)}$

$$= \frac{(a-3)(\cancel{a-3})}{5(\cancel{a-3})}$$

$$\frac{a-3}{5}$$

(1)

(b) Factorise $3k^2 + 11k - 4$

$$\begin{array}{r} -12 \\ 12, -1 \end{array} \quad \begin{array}{l} +11 \times (-12) \\ 3k^2 + 12k \mid -k - 4 \\ 3k(k+4) \mid -1(k+4) \end{array}$$

$$(3k-1)(k+4)$$

(2)

(c) Simplify fully $\frac{4-x^2}{x^2+3x} \div \frac{x+2}{x+3}$

$$\frac{(\cancel{2+x})(2-x)}{x(\cancel{x+3})} \times \frac{\cancel{x+3}}{\cancel{x+2}}$$

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

(3)

(Total for Question 15 is 6 marks)



16 The functions f and g are given by

$$f(x) = \frac{12}{x+1} \quad \text{and} \quad g(x) = 5 - 3x$$

(a) Find $f(-3)$

$$\frac{12}{-3+1} = \frac{12}{-2}$$

$$\frac{-6}{(1)}$$

(b) Find $fg(1)$

$$g(1) = 5 - 3(1) = 2$$

$$f(2) = \frac{12}{2+1} = 4$$

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

(c) Find $g^{-1}(4)$

$$\begin{array}{rcl} y & = & 5 - 3x \\ + 3x & & + 3x \\ \hline 3x + y & = & 5 \\ - y & & - y \\ \hline 3x & = & 5 - y \\ x & = & \frac{5 - y}{3} \end{array}$$

$$g^{-1}(x) = \frac{5 - x}{3}$$

$$g^{-1}(4) = \frac{5 - 4}{3} =$$

$$\frac{1}{3}$$

(2)

(Total for Question 16 is 5 marks)

- 17 A ball is thrown upwards and reaches a maximum height.
The ball then falls and bounces repeatedly.

After the n th bounce, the ball reaches a height of h_n

After the next bounce, the ball reaches a height given by $h_{n+1} = 0.55h_n$

After the 1st bounce, the ball reaches a height of 8 metres.

What height does the ball reach after the 4th bounce?

$$h_1 = 8$$

$$h_2 = 0.55 \times 8 = 4.4$$

$$h_3 = 0.55 \times 4.4 = 2.42$$

$$h_4 = 1.331$$

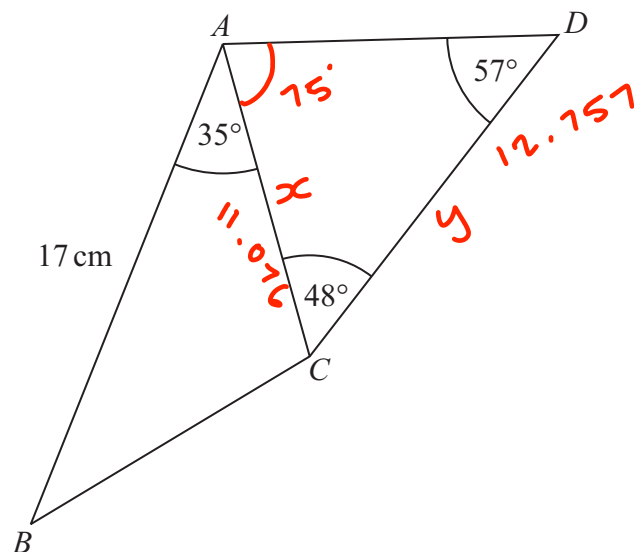
1.331

..... metres

(Total for Question 17 is 3 marks)



18 $ABCD$ is a quadrilateral.



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

The area of triangle ABC is 54 cm^2

$$\frac{1}{2} ab \sin C$$

Calculate the area of triangle ACD .

Give your answer correct to 3 significant figures.

$$\begin{array}{rcl} \frac{1}{2} \times x \times 17 \times \sin(35) & = & 54 \\ \times 2 & & \times 2 \\ x \times 17 \sin 35 & = & 108 \\ \div 17 \sin 35 & & \div 17 \sin 35 \\ x & = & 11.076 \end{array}$$

$$\begin{array}{rcl} \frac{y}{\sin(15)} & = & \frac{11.076}{\sin(57)} \\ \times \sin(15) & & \times \sin(15) \\ y & = & 12.757 \end{array}$$

$$\frac{1}{2} \times 11.076 \times 12.757 \times \sin(48) =$$

52.5 cm²

(Total for Question 18 is 5 marks)

19 $R = \frac{P}{Q}$

5.875 5.885

$P = 5.88 \times 10^8$ correct to 3 significant figures.

$Q = 3.6 \times 10^5$ correct to 2 significant figures.

3.55 3.65

Work out the lower bound for R .

Give your answer as an ordinary number correct to the nearest integer.

You must show all your working.

$$R_L = \frac{P_L}{Q_U} = \frac{5.875 \times 10^8}{3.65 \times 10^5} = 1609.589$$

1610

(Total for Question 19 is 3 marks)

20 $x - 4$, $x + 2$ and $3x + 1$ are three consecutive terms of an arithmetic sequence.

(a) Find the value of x .

$$(x + 2) - (x - 4) = (3x + 1) - (x + 2)$$

$$6 = 2x - 1$$

$$7 = 2x$$

$$3.5 = x$$

$$x = \underline{3.5} \quad (2)$$

$y - 4$, $y + 2$ and $3y + 1$ are three consecutive terms of a geometric sequence.

(b) Find the possible values of y .

$$\frac{y + 2}{y - 4} = \frac{3y + 1}{y + 2}$$

Tip: If you have two fractions equal to each other you can solve by cross multiplying

$$(y + 2)(y + 2) = (3y + 1)(y - 4)$$

$$y^2 + 4y + 4 = 3y^2 - 11y - 4$$

$$0 = 2y^2 - 15y - 8$$

$$\begin{array}{l} 16 \\ -16, 1 \end{array} \quad \begin{array}{l} + (-15) \times (-16) \\ 2y^2 - 15y - 8 = 0 \end{array}$$

$$\begin{array}{l} 2y^2 - 16y \mid + y - 8 = 0 \\ 2y(y - 8) \mid 1(y - 8) = 0 \end{array}$$

$$(2y + 1)(y - 8) = 0$$

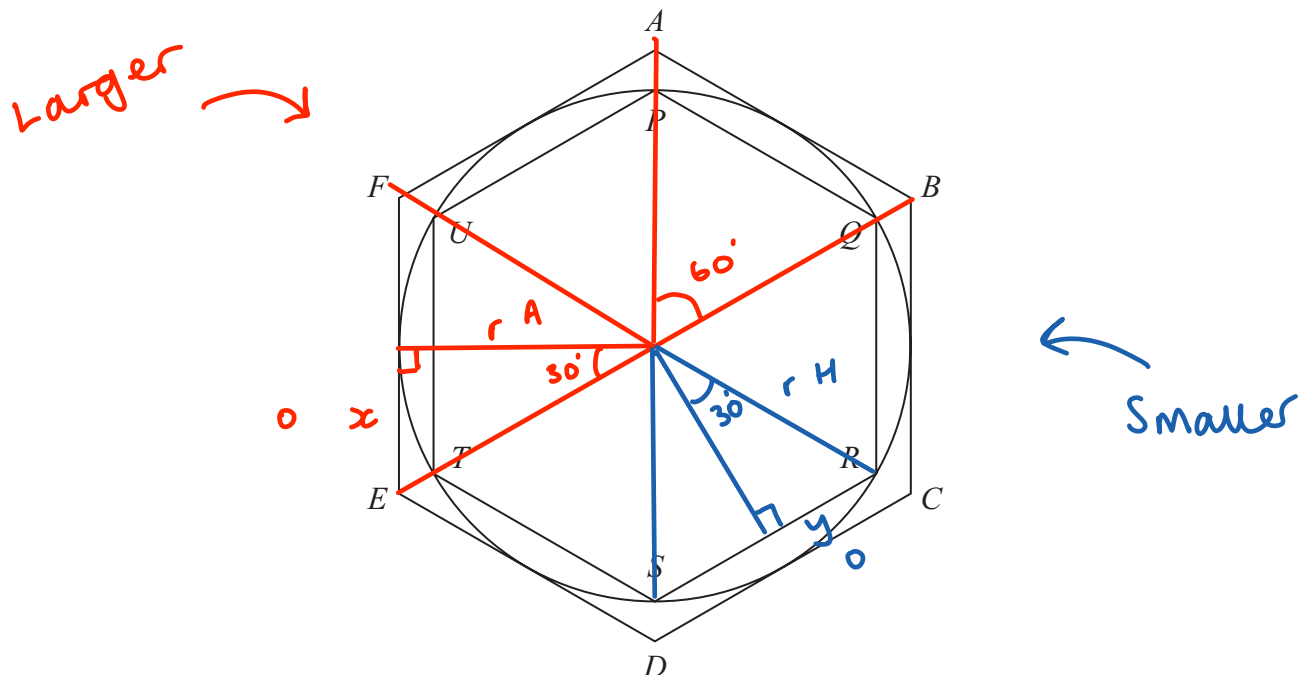
$$y = -0.5 \text{ or } 8$$

$$\underline{-0.5 \text{ or } 8} \quad (5)$$

(Total for Question 20 is 7 marks)



21 The diagram shows a circle, radius r cm and two regular hexagons.



Each side of the larger hexagon $ABCDEF$ is a tangent to the circle.
Each side of the smaller hexagon $PQRSTU$ is a chord of the circle.

By considering perimeters, show that

$$3 < \pi < 2\sqrt{3}$$

$$(6-2) \times 180 = 720$$

$$\text{To find } x: \quad T^O A \quad \tan(30) \times r = \frac{\sqrt{3}}{3} r$$

$$\text{Perimeter of larger} = \frac{\sqrt{3}}{3} r \times 2 \times 6 = 4\sqrt{3} r$$

$$\text{Perimeter of circle} = \pi \times 2r = 2\pi r$$

$$\text{Perimeter of smaller} = \frac{1}{2} r \times 2 \times 6 = 6r$$

$$6r < 2\pi r < 4\sqrt{3} r$$

$$\div 2r \quad 3 < \pi < 2\sqrt{3}$$

(Total for Question 21 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS