

Answer **all** the questions.

- 1 (a) The ratio 2 centimetres to 5 metres can be written in the form $1 : n$.

Find the value of n .

cm

2 : 500 ✓

250 ✓

(a) $n =$ [2]

- (b) Jay, Sheila and Harry share £7200 in the ratio $1 : 2 : 5$.

How much does Harry receive?

$$7200 \times \frac{5}{8}$$

✓

4500 ✓

(b) £ [2]

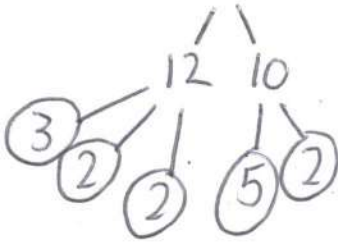
- 2 Given that $y^{18} \div y^6 = y^k$, find the value of k .

$$y^{18-6}$$

12 ✓

$k =$ [1]

- 3 (a) (i) Write 120 as a product of its prime factors.



$$5 \times 3 \times 2 \times 2 \times 2 \quad \checkmark$$

$$(\text{or } 5 \times 3 \times 2^3)$$

(a)(i) [3]

- (ii) The lowest common multiple (LCM) of x and 120 is 360.

Find the smallest possible value of x .

$$x3$$

(✓ 18, 36 etc)

9



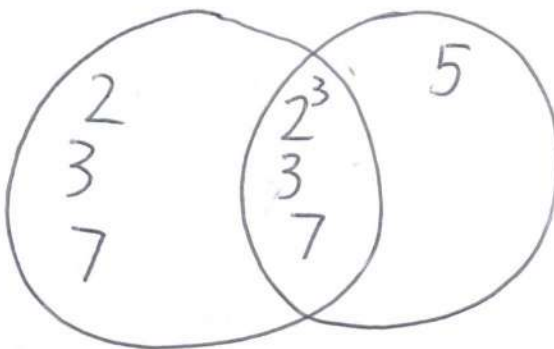
(ii) [2]

- (b) Two numbers, A and B , are written as a product of prime factors.

$$A = 2^4 \times 3^2 \times 7^2$$

$$B = 2^3 \times 3 \times 5 \times 7$$

Find the highest common factor (HCF) of A and B .



$$2^3 \times 3 \times 7 \quad \checkmark$$

168



(b) [2]

- 4 Lee wishes to find out if there is a relationship between a person's age and the time it takes them to complete a puzzle.

Lee decides to conduct an experiment.

She asks 12 people to complete the puzzle.

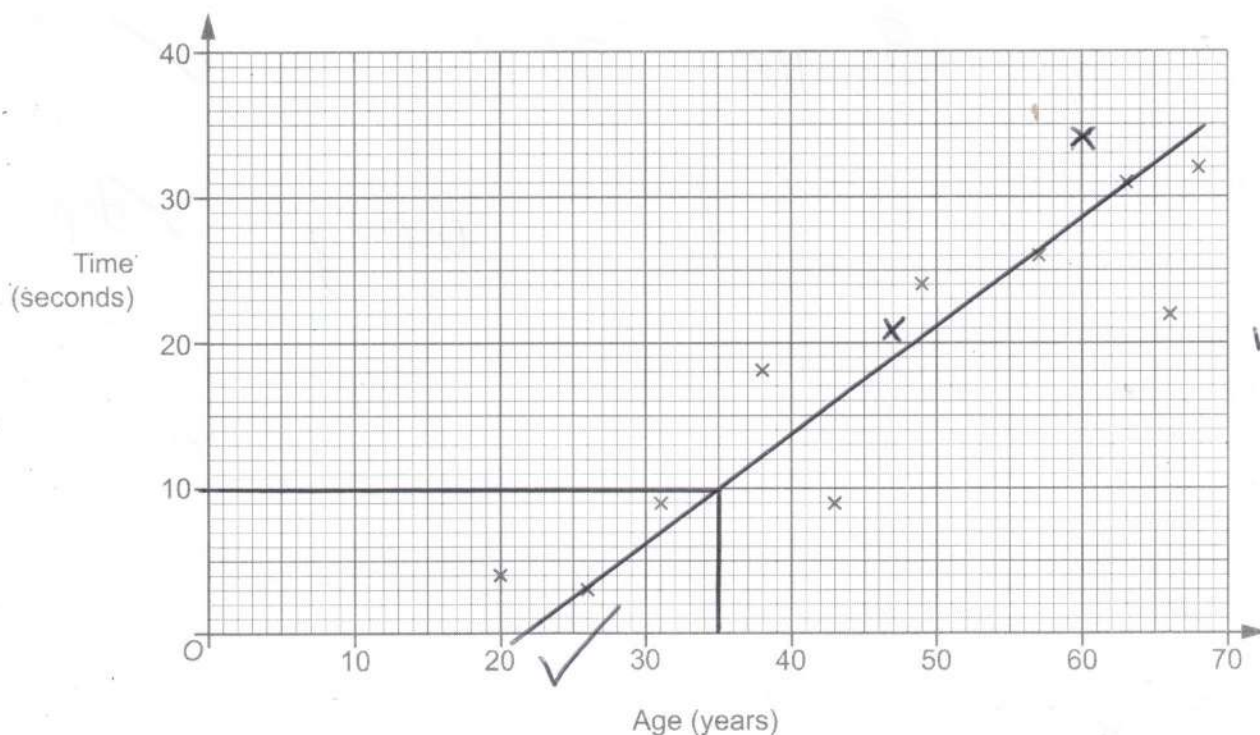
She records each person's age and the time taken to complete the puzzle.

- (a) Make one criticism of Lee's method.

Small sample size ✓ etc

[1]

- (b) This scatter diagram shows the results for ten of the people in Lee's experiment.



Here are the other two results.

Age (years)	47	60	x
Time (seconds)	21	34	y

Plot these results on the scatter diagram.

[2]

- (c) What type of correlation is shown in the scatter diagram?

(c) positive ✓ [1]

- (d) Estimate the time it would take a person aged 35 to complete the puzzle.

Show your working to justify your answer.

$$[ms \ 9 \rightarrow 15]$$

(d)

10



[2]

- (e) Lee says that at least 80% of the 12 people completed the puzzle in under 30 seconds.

Is Lee correct?

Show working to support your answer.

$$V30 = 9$$



$$\frac{9}{12} \times 100 = 75\%$$

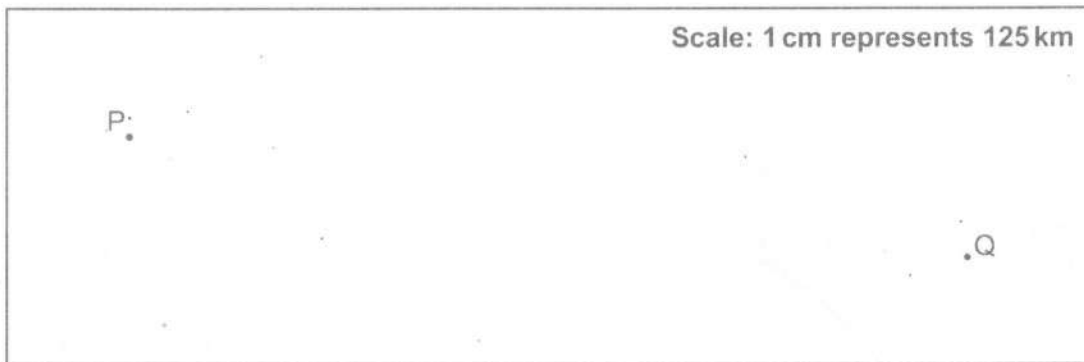


No Lee is wrong



[3]

- 5 The scale diagram below shows two cities, P and Q.



A plane departs from P at 09 47 and arrives at Q at 12 07.

- (a) Work out the average speed, in kilometres per hour, of the plane.



$$11.6 \text{ cm} \times 125 = 1450 \text{ km} \quad \checkmark$$

$$T = 12:07 - 9:47 = 2\text{h}20 \\ = 2\frac{1}{3} \text{ hr} \quad \checkmark$$

$$S = \frac{1450}{2\frac{1}{3}} = 621.428... \quad \checkmark$$

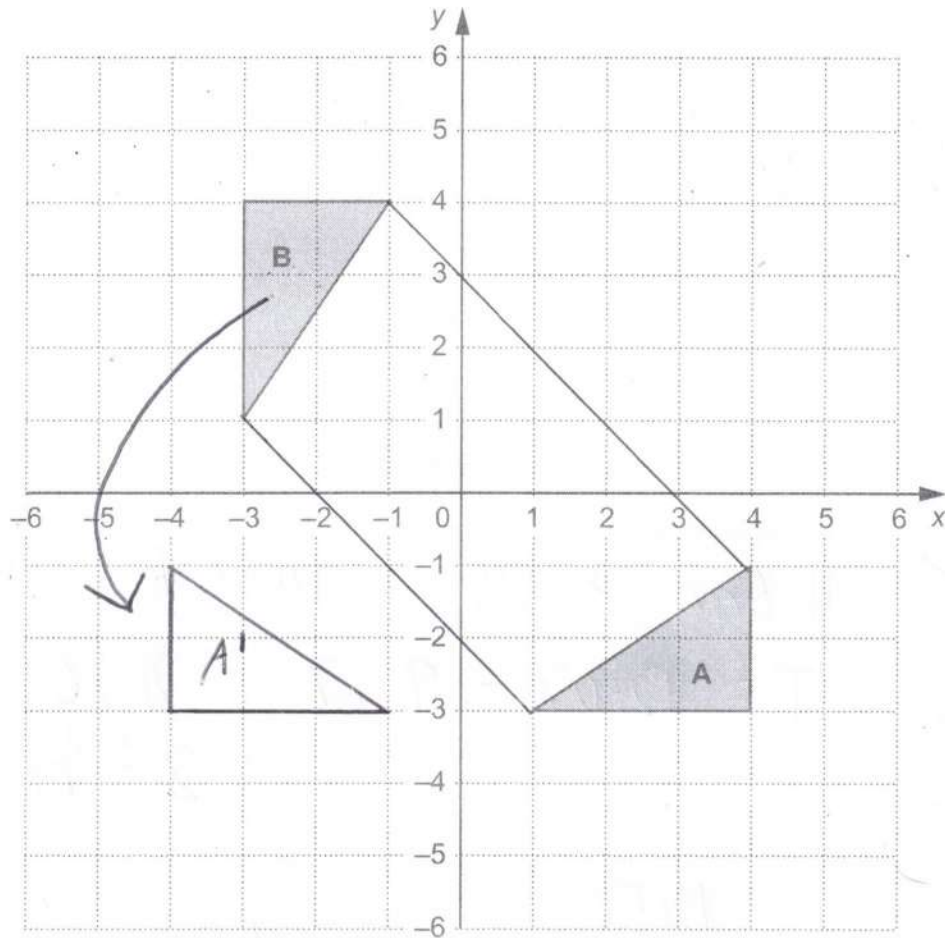
$$[ms \ 610.7 \rightarrow 632.2]$$

(a) $621.4 \quad \checkmark$ km/h [5]

- (b) Give one reason why your answer may be inaccurate.

May not fly in a straight line $\checkmark$ etc [1]

6 Triangles **A** and **B** are drawn on a coordinate grid.



(a) Describe fully the **single** transformation that maps triangle **A** onto triangle **B**.

reflection in $y = x$

[2]

(b) Triangle **A** can also be mapped onto triangle **B** using a combination of two transformations:

- a transformation **T**, followed by
- a reflection in the line $x = 0$.

$B \rightarrow T \rightarrow x = 0 \rightarrow A$

Describe fully transformation **T**.

so $A \rightarrow x = 0$

m ✓

✓ Rotation, 90° anticlockwise. ✓

about $(0, 0)$ ✓

[4]

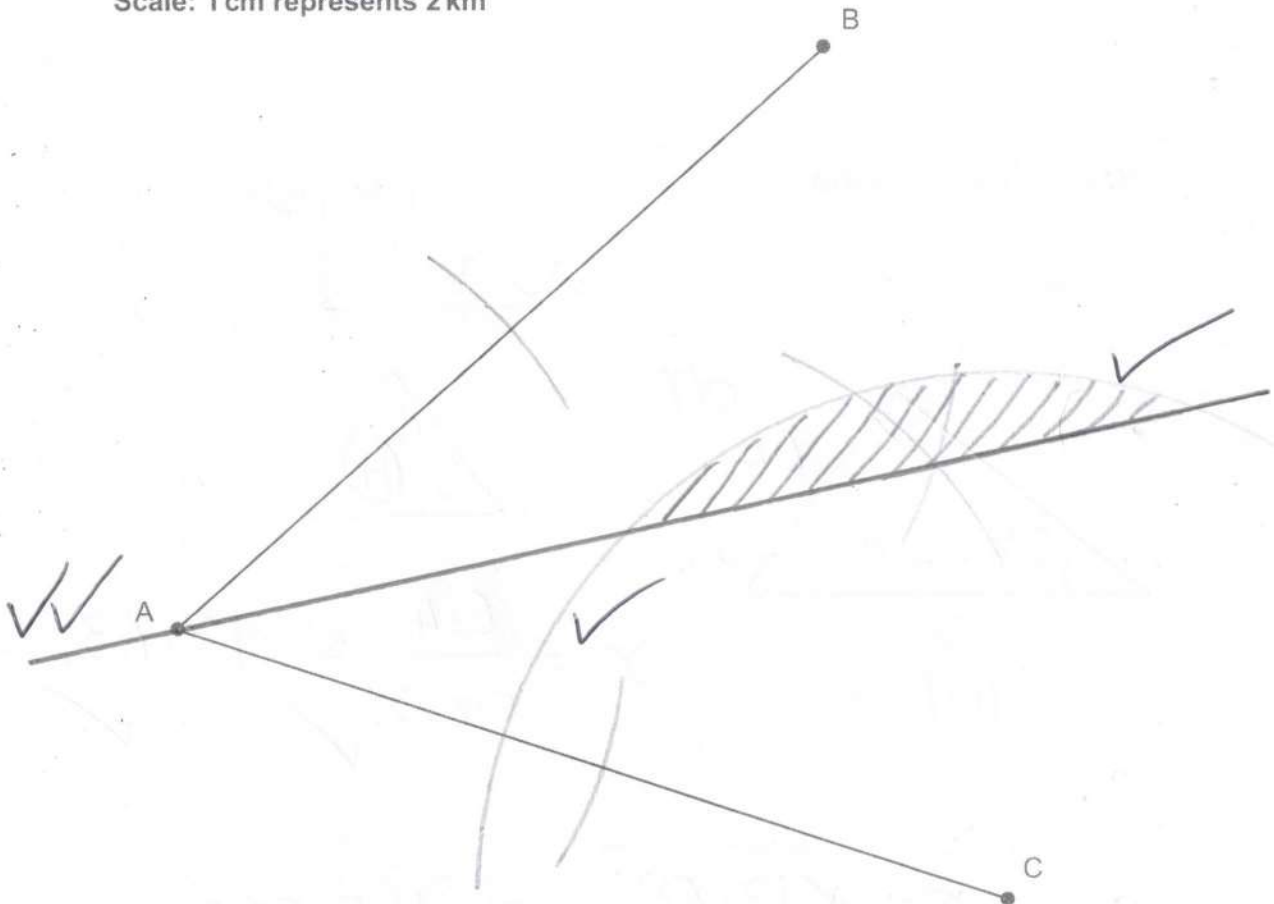
- 7 The scale diagram below shows towns, A, B and C.
Line AB represents the road from A to B and line AC represents the road from A to C.

A shopping centre is to be built so that it is

- nearer to the road from A to B than the road from A to C,
- less than 14 km from town C. → 7cm ✓

- (a) Using construction, shade the region where the shopping centre could be built.
Show all your construction lines.

Scale: 1 cm represents 2 km



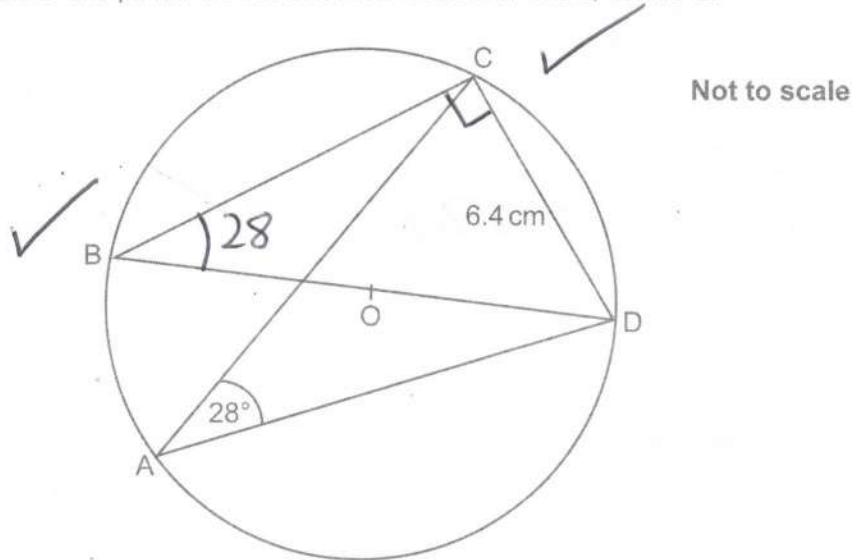
[5]

- (b) Explain why the region found in part (a) may not be an appropriate site for the shopping centre.

Roads may not be straight ✓ etc

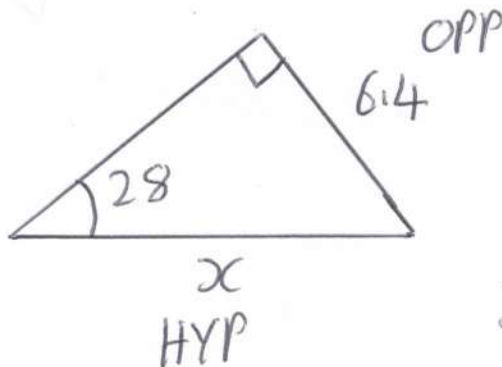
[1]

- 8 A, B, C and D are points on the circumference of a circle, centre O.



Angle CAD = 28° and CD = 6.4 cm.
BD is a diameter of the circle.

Calculate the area of the circle.



$$x = \frac{6.4}{\sin 28} = 13.63...$$

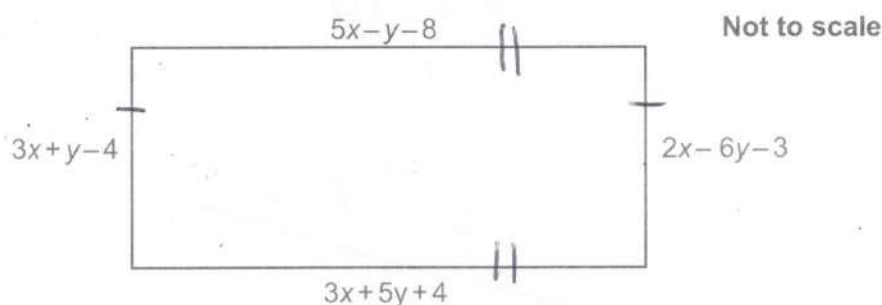
$$\text{Area} = \pi \times \left(\frac{13.63}{2} \right)^2 = 145.959...$$

146

..... cm² [5]

[ms 145.2 → 146.2]

- 9 The dimensions, in centimetres, of this rectangle are shown as algebraic expressions.



Work out the length and width of the rectangle.

$$\begin{array}{l|l}
 5x - y - 8 = 3x + 5y + 4 & 3x + y - 4 = 2x - 6y - 3 \quad \checkmark \\
 2x - 6y = 12 & x + 7y = 1 \quad \checkmark \\
 x - 3y = 6 &
 \end{array}$$

$$\begin{array}{r}
 x + 7y = 1 \\
 - \quad x - 3y = 6 \quad \checkmark \\
 \hline
 10y = -5 \\
 \hline
 \end{array}$$

$$y = -\frac{5}{10} = -0.5 \quad \checkmark$$

$$x = 1 - 7(-0.5) = 4.5 \quad \checkmark$$

$$3 \times 4.5 + (-0.5) - 4 = 9 \quad \checkmark$$

$$3 \times 4.5 + 5(-0.5) + 4 = 15$$

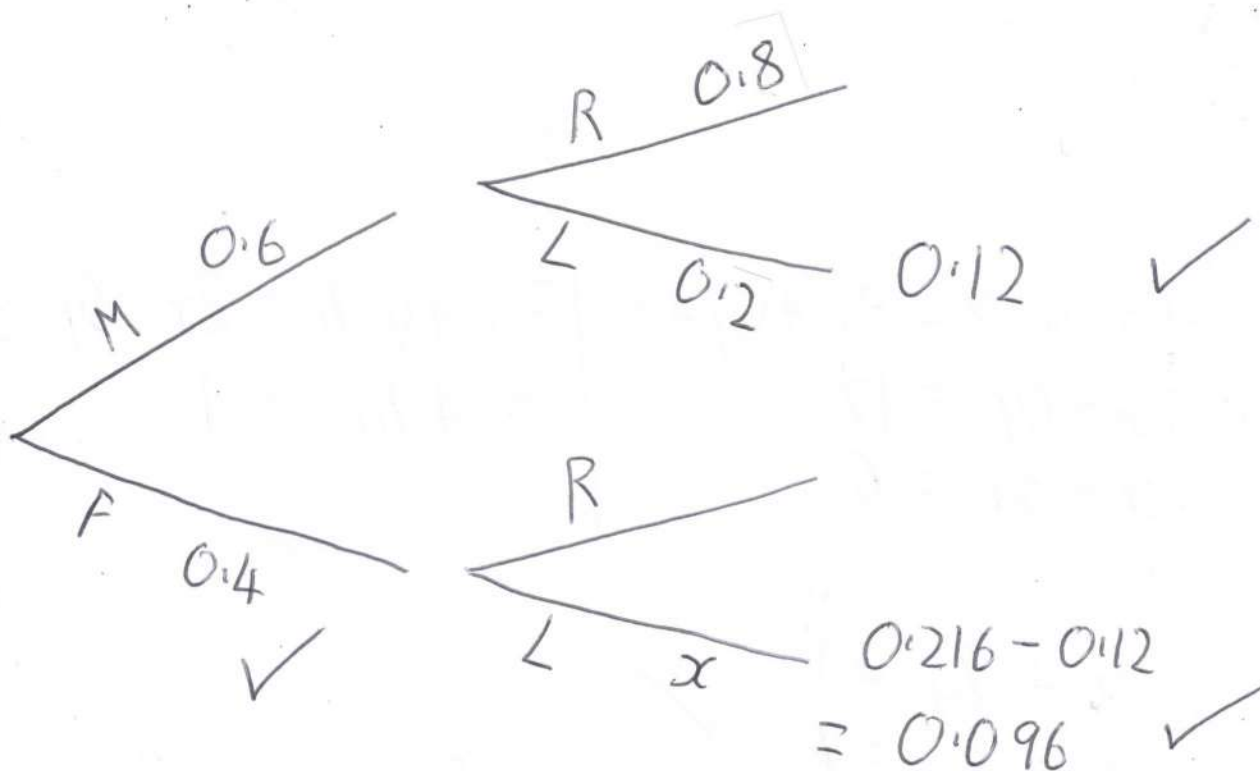
length = $\frac{15}{9}$ cm

width = $\frac{9}{9}$ cm

[6]

- 10 60% of the people in a town are males.
 20% of the males are left-handed.
 21.6% of all the people are left-handed. ≈ 0.216

Work out the percentage of the people who are not male who are left-handed.



$$x = \frac{0.096}{0.4} = 0.24 \quad \checkmark$$

24 ✓

..... % [5]

- 11 y is directly proportional to the square of x .

Find the percentage increase in y when x is increased by 15%.

$$y = Kx^2$$

$$y = K(1.15x)^2 \checkmark \checkmark$$

$$= K \times 1.3225x^2 \checkmark$$

$$0.3225 \times 100$$

$$32.25 \checkmark$$

.....% [4]

- 12 The value of a car, £ V , is given by

$$V = 16500 \times 0.82^n$$

where n is the number of years after it is bought from new.

- (a) Write down the value of the car when new.

(a) £ 16500 ✓ [1]

- (b) Write down the annual percentage decrease in the value of the car.

(b) 18 ✓ % [1]

- (c) Show that the value of the car after 4 years is less than half its value when new. [2]

$$16500 \times 0.82^4 = \pounds 7460.01 \checkmark$$

$$16500 \div 2 = 8250 \checkmark$$

13 A menu has

- 6 starters
- 10 main dishes
- 7 desserts.

(a) A three-course meal consists of a starter, a main dish and a dessert.

How many different three-course meals are possible?

$$6 \times 10 \times 7$$



$$420$$

(a) [2]

(b) A two-course meal consists either of a starter with a main dish, a starter with a dessert or a main dish with a dessert.

Show that there are 172 possible different two-course meals.

[3]

$$6 \times 10 = 60$$



$$6 \times 7 = 42$$

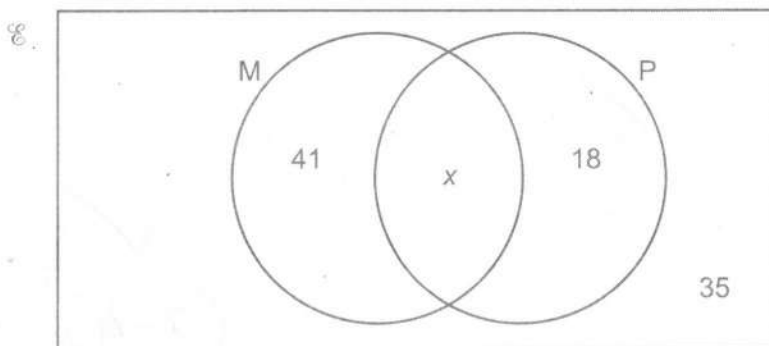


$$10 \times 7 = 70$$



$$\begin{array}{r} 60 \\ + 42 \\ + 70 \\ \hline 172 \end{array}$$

- 14 The Venn diagram shows the number of students studying Mathematics (M) and the number of students studying Physics (P) in a college. 35 students do not study either subject.



- (a) The total number of students is 121.

Find the value of x .

(a) $x = 27$ ✓ [1]

- (b) One of the 121 students is selected at random.

Find the probability that this student studies Mathematics, given that they study Physics.

(b) $\frac{27}{45}$ ✓ ✓ OE [2]

- 15 (a) Write $x^2 - 8x + 25$ in the form $(x - a)^2 + b$.

$$(x - 4)^2 - 16 + 25$$

✓

$$(x - 4)^2 + 9$$

(a) [3]

- (b) Write down the coordinates of the turning point of the graph of $y = x^2 - 8x + 25$.

✓ ✓ ft
4 9

(b) (.....,) [2]

- (c) Hence describe the single transformation which maps the graph of $y = x^2$ onto the graph of $y = x^2 - 8x + 25$.

Translation

$$\begin{bmatrix} 4 \\ 9 \end{bmatrix}$$

✓

✓

[2]

16 Solve by factorisation.

$$3x^2 + 11x - 20 = 0$$

$$ac = -60$$

$$3x^2 - 4x \mid +15x - 20 = 0$$

$$x(3x-4) \mid +5(3x-4) = 0$$

$$(3x-4)(x+5) = 0$$

✓✓

$$x = \frac{4}{3} \quad \text{or} \quad x = -5 \quad \checkmark$$

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

17 For each graph below, select its possible equation from this list.

$$y = \frac{1}{x}$$

$$y = \cos x$$

$$y = x^2$$

$$y = \left(\frac{1}{2}\right)^x$$

$$y = 2^x$$

$$y = \sin x$$

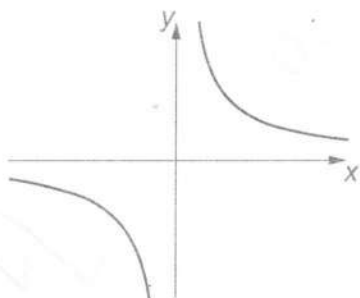
$$y = 2^{-x}$$

$$y = \tan x$$

$$y = x^3$$

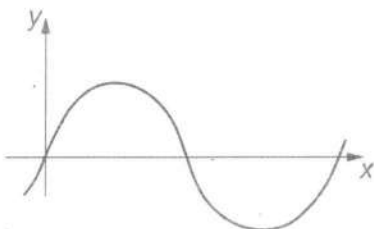
$$y = \frac{1}{x^2}$$

(a)



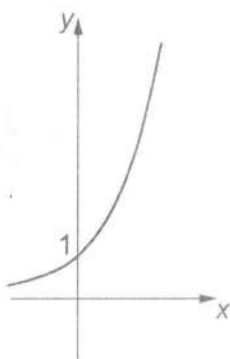
(a) $y = \frac{1}{x}$ ✓

(b)



(b) $y = \sin x$ ✓

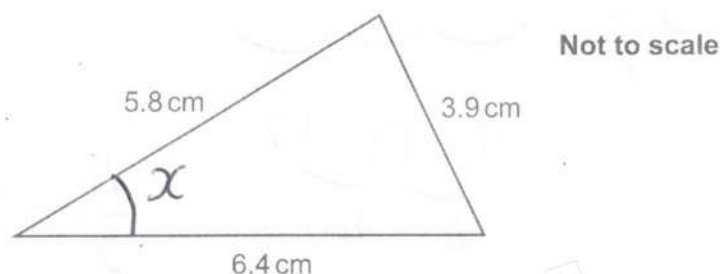
(c)



(c) $y = 2^x$ ✓

[3]

18 Calculate the area of this triangle.



$$x = \cos^{-1} \left(\frac{6.4^2 + 5.8^2 - 3.9^2}{2 \times 6.4 \times 5.8} \right) \quad \checkmark \checkmark$$

$$x = \cos^{-1}(0.79...) = 36.87^\circ \quad \checkmark$$

$$\text{Area} = \frac{1}{2} \times 5.8 \times 6.4 \times \sin 36.87 \quad \checkmark \checkmark$$

$$= 11.136...$$

$$\underline{\quad 11.1 \quad} \text{ cm}^2 \quad \checkmark \quad [6]$$

19 Here are the first four terms of a quadratic sequence.

$$S = 0 \quad 9 \quad 22 \quad 39$$

The n th term can be written as $an^2 + bn + c$.

Find the values of a , b and c .

$$9 \quad 13 \quad 17$$

$$\frac{4}{2} = 2$$

$$2n^2 = 2 \quad 8 \quad 18 \quad 32$$

$$S - 2n^2 = -2 \quad 1 \quad 4 \quad 7$$

$$3n = 3 \quad 6 \quad 9 \quad 12$$

$$a = 2 \quad \checkmark \checkmark$$

$$b = 3 \quad \checkmark$$

$$c = -5 \quad \checkmark$$

[4]

20 Solve this equation, giving your answers correct to 1 decimal place.

$$\frac{5}{x+2} + \frac{3}{x-3} = 2$$

$$\checkmark 5(x-3) + 3(x+2) = 2(x+2)(x-3) \quad \checkmark$$

$$5x - 15 + 3x + 6 = 2(x^2 + 2x - 3x - 6)$$

$$8x - 9 = 2x^2 - 2x - 12$$

$$0 = 2x^2 - 10x - 3 \quad \checkmark$$

$$x = \frac{10 \pm \sqrt{100 - 4(2)(-3)}}{4}$$

m
✓

$$= \frac{10 \pm \sqrt{124}}{4}$$

$$= 5.2838... , -0.2838 \quad \checkmark$$

$$x = 5.3 \quad \text{or} \quad x = -0.3 \quad \checkmark$$

[6]

END OF QUESTION PAPER

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