1 A company employed 300 workers when it started and now employs 852 workers.

(a) Calculate the percentage increase in the number of workers.

..... % [2]

(b) Of the 852 workers, the ratio part-time workers : full-time workers = 5 : 7.

Calculate the number of full-time workers.

..... [2]

(c) The company makes 40 600 headphones in one year.

Write this number

(i) in words,

..... [1]

(ii) in standard form.

..... [1]

(d) In one month, the company sells 3 000 headphones.
Of these, 48% are exported, $\frac{3}{8}$ are sold to shops and the rest are sold online.

Calculate the number of headphones that are sold online.

..... [3]

(e) One year, sales increased by 15%.
The following year sales increased by 18%.

Calculate the overall percentage increase in sales.

..... % [3]

2 The table shows some values for $y = x^2 - \frac{1}{3x}$, $x \neq 0$.
The y-values are rounded to 1 decimal place.

x	-2	-1.5	-1	-0.75	-0.5	-0.25	-0.1
y	4.2	2.5	1.3			1.4	3.3

(a) Complete the table. [2]

(b) On the grid, draw the graph of $y = x^2 - \frac{1}{3x}$ for $-2 \leqslant x \leqslant -0.1$.

The graph of $y = x^2 - \frac{1}{3x}$ for $x > 0$ has been drawn for you.

[4]

(c) By drawing a suitable line on the grid, solve the equation $x^2 - \frac{1}{3x} + 1 = 0$.

$x =$ ..... [2]

3 $f(x) = 1 + 4x$ $g(x) = x^2$

(a) Find

(i) gf(3),

..... [2]

(ii) fg(x),

..... [1]

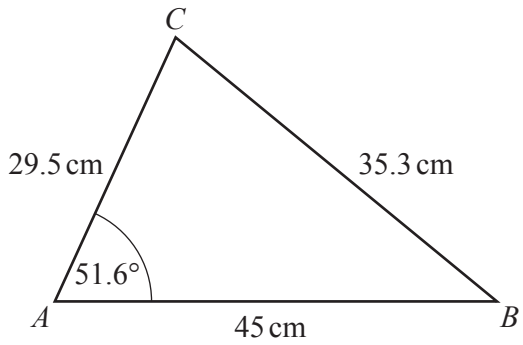
(iii) $f^{-1}f(x)$.

..... [1]

(b) Find the value of x when $f(x) = 15$.

$x =$ ..... [2]

4 (a)



NOT TO SCALE

In triangle ABC, $AB = 45$ cm, $AC = 29.5$ cm, $BC = 35.3$ cm and angle $CAB = 51.6°$.

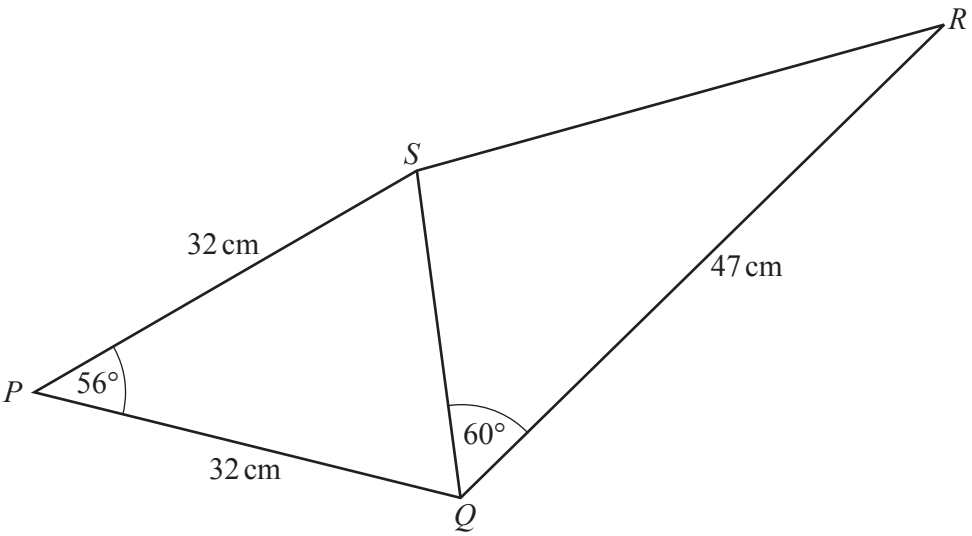
(i) Calculate angle ABC.

Angle ABC = ... [3]

(ii) Calculate the area of triangle ABC.

..... cm^2 [2]

(b)



NOT TO SCALE

The diagram shows a quadrilateral $PQRS$ formed from two triangles, PQS and QRS.
Triangle PQS is isosceles, with $PQ = PS = 32$ cm and angle $SPQ = 56°$.
$QR = 47$ cm and angle $SQR = 60°$.

(i) Calculate SR.

$SR =$ ..... cm [4]

(ii) Calculate the shortest distance from P to SQ.

..... cm [3]

5 The table shows information about the mass, m grams, of each of 120 letters.

Mass (m grams)	$0 < m \leqslant 50$	$50 < m \leqslant 100$	$100 < m \leqslant 200$	$200 < m \leqslant 500$
Frequency	43	31	25	21

(a) Calculate an estimate of the mean mass.

..... g [4]

(b) Iraj draws a histogram to show this information.
He makes the height of the first bar 17.2 cm.

Calculate the height of each of the remaining bars.

height of bar for $50 < m \leqslant 100$ ..... cm

height of bar for $100 < m \leqslant 200$ ..... cm

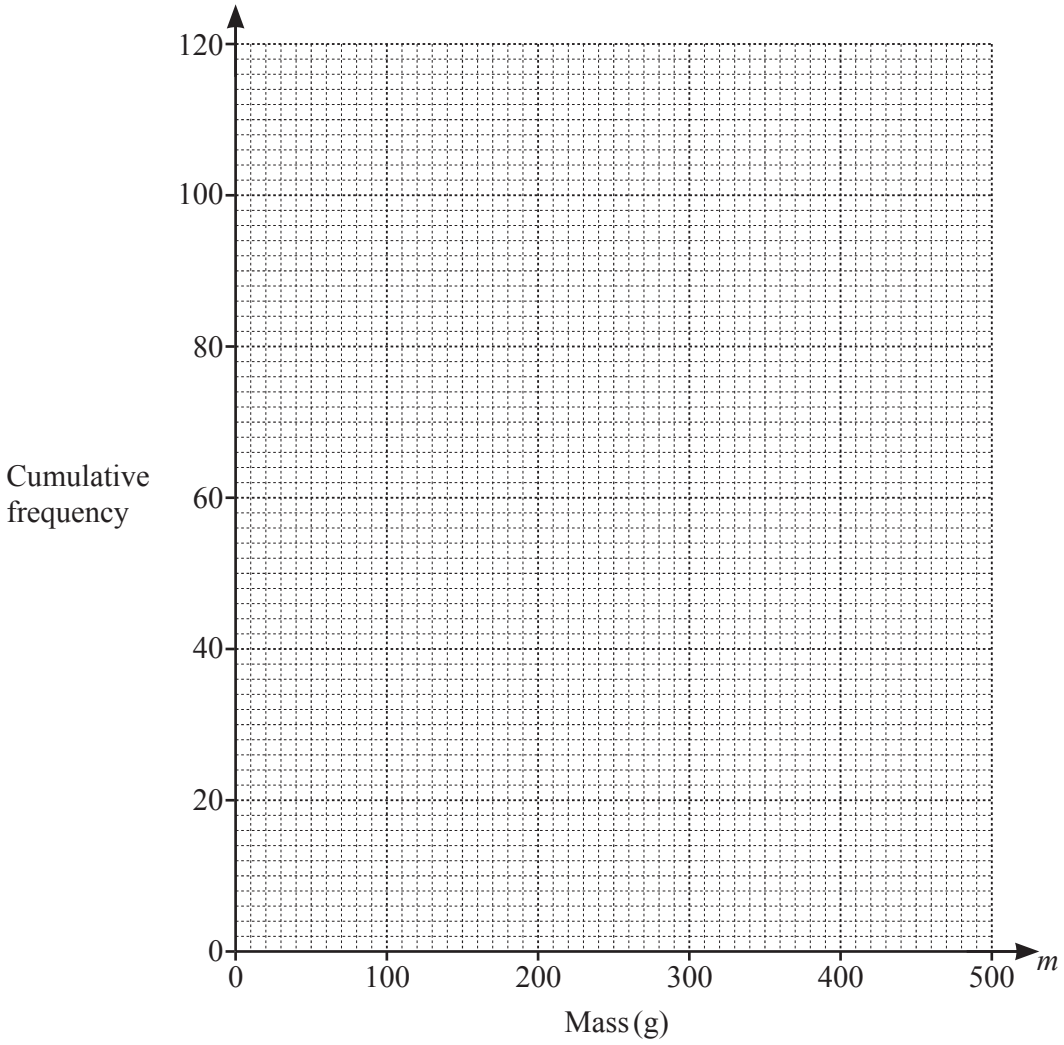
height of bar for $200 < m \leqslant 500$ ..... cm [3]

(c) Complete the cumulative frequency table.

Mass (m grams)	$m \leqslant 50$	$m \leqslant 100$	$m \leqslant 200$	$m \leqslant 500$
Cumulative frequency				

[2]

(d) Draw a cumulative frequency diagram.



[3]

(e) Use the cumulative frequency diagram to find an estimate for

(i) the median,

..... g [1]

(ii) the upper quartile,

..... g [1]

(iii) the 40th percentile,

..... g [2]

(iv) the number of letters with a mass m where $250 < m \leqslant 400$.

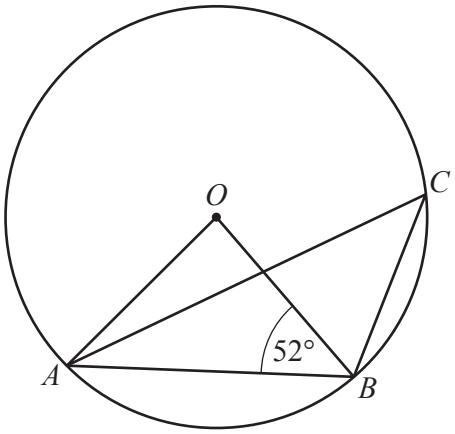
..... [2]

6 **(a)** The interior angle of a regular polygon is 156°.

Calculate the number of sides of this polygon.

..... [2]

(b)



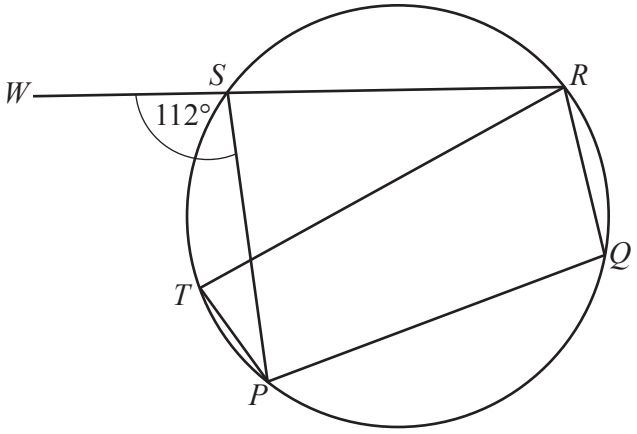
NOT TO SCALE

A, B and C lie on a circle, centre O.
Angle $OBA = 52°$.

Calculate angle ACB.

Angle ACB = ... [2]

(c)



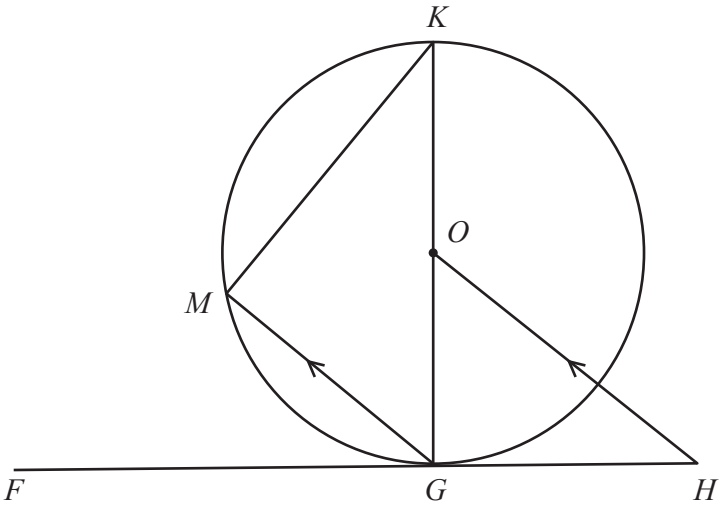
NOT TO SCALE

P, Q, R, S and T lie on a circle.
WSR is a straight line and angle $WSP = 112°$.

Calculate angle PTR.

Angle PTR = ... [2]

(d)



NOT TO SCALE

G, K and M lie on a circle, centre O.
FGH is a tangent to the circle at G and MG is parallel to OH.

Show that triangle GKM is mathematically similar to triangle OHG.
Give a geometrical reason for each statement you make.

.....

.....

.....

.....

..... [4]

7 Two rectangular picture frames are mathematically similar.

(a) The areas of the frames are 350 cm^2 and 1134 cm^2.
The width of the smaller frame is 17.5 cm.

Calculate the width of the larger frame.

..... cm [3]

(b) A picture in the smaller frame has length 15 cm and width 10.5 cm, both correct to the nearest 5 mm.

Calculate the upper bound for the area of this picture.

..... cm^2 [2]

(c) In a sale, the price of a large frame is reduced by 18%.
Parthi pays $166.05 for 5 large frames in the sale.

Calculate the original price of one large frame.

$ ..... [2]

(d) Parthi advertises a large frame for a price of $57 or 48.20 euros.
The exchange rate is $1 = 0.88 euros.

Calculate the difference between these prices, in dollars and cents, correct to the nearest cent.

$ ..... [3]

8 Darpan runs a distance of 12 km and then cycles a distance of 26 km.
His running speed is x km/h and his cycling speed is 10 km/h faster than his running speed.
He takes a total time of 2 hours 48 minutes.

(a) An expression for the time, in hours, Darpan takes to run the 12 km is $\frac{12}{x}$.

Write an equation, in terms of x, for the total time he takes in hours.

..... [3]

(b) Show that this equation simplifies to $7x^2 - 25x - 300 = 0$.

[4]

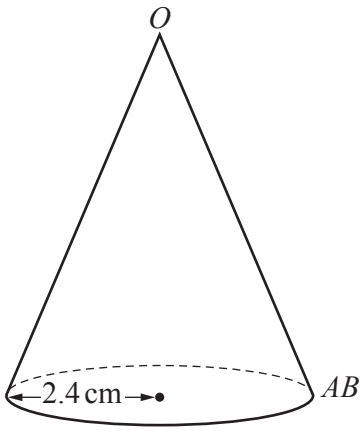
(c) Use the quadratic formula to solve $7x^2 - 25x - 300 = 0$.
You must show all your working.

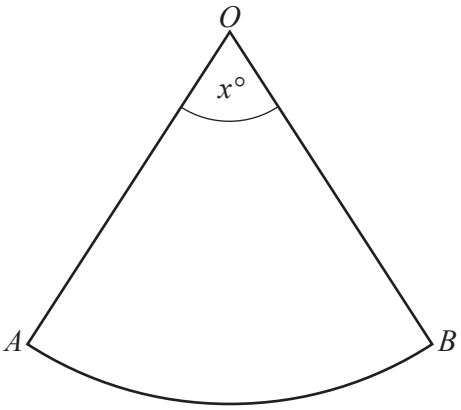
$x =$ ..... or $x =$ ..... [4]

(d) Calculate the number of minutes Darpan takes to run the 12 km.

..... min [2]

9 (a)





NOT TO SCALE

The volume of a paper cone of radius 2.4 cm is 95.4 cm^3.
The paper is cut along the slant height from O to AB.
The cone is opened to form a sector OAB of a circle with centre O.

Calculate the sector angle $x°$.
[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

..... [6]

(b) An empty fuel tank is filled using a cylindrical pipe with diameter 8 cm.
Fuel flows along this pipe at a rate of 2 metres per second.
It takes 24 minutes to fill the tank.

Calculate the capacity of the tank.
Give your answer in litres.

..... litres [4]

10 **(a)** Expand and simplify.

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

..... [3]

(b) Make g the subject of the formula.

$$M = \frac{2fg}{g-c}$$

$g =$ ..... [4]

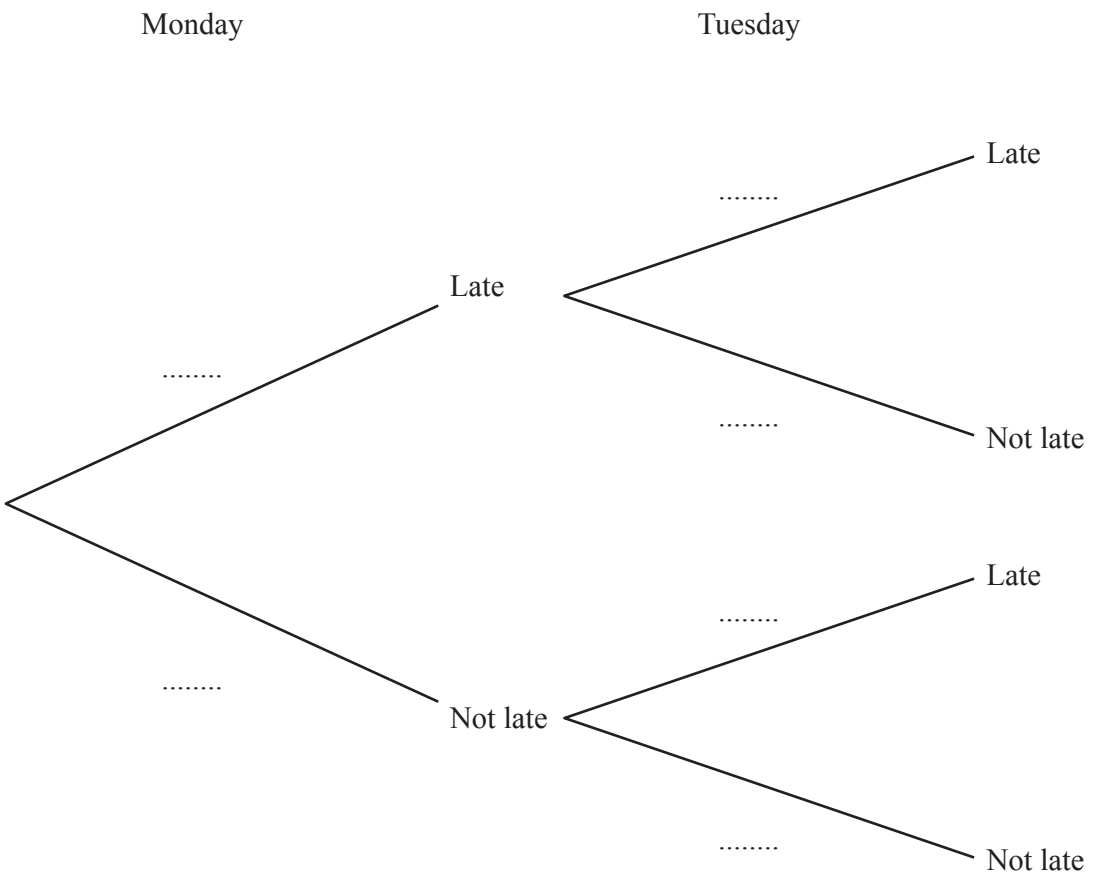
(c) Simplify.

$$\frac{4x^2-16x}{x^2-16}$$

..... [3]

11 **(a)** The probability that Shalini is late for school on any day is $\frac{1}{6}$.

(i) Complete the tree diagram for Monday and Tuesday.

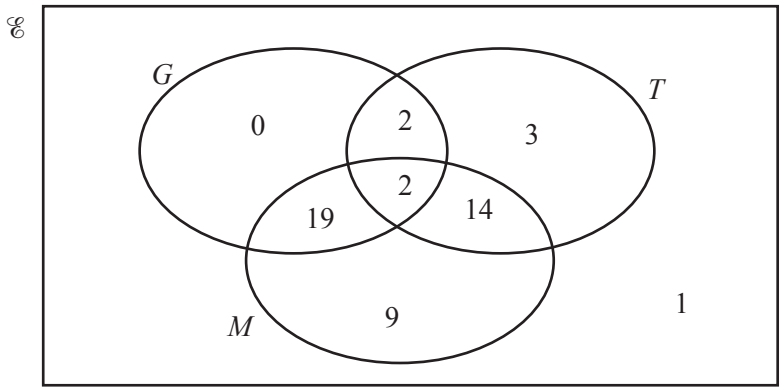


[2]

(ii) Calculate the probability that Shalini is late on Monday but is not late on Tuesday.

..... [2]

(b) The Venn diagram shows the number of students in a group of 50 students who wear glasses (G), who wear trainers (T) and who have a mobile phone (M).



(i) Use set notation to describe the region that contains only one student.

..... [1]

(ii) Find $n\left(T' \cap \left(G \cup M\right)\right)$.

..... [1]

(iii) One student is picked at random from the 50 students.

Find the probability that this student wears trainers but does not wear glasses.

..... [1]

(iv) Two students are picked at random from those wearing trainers.

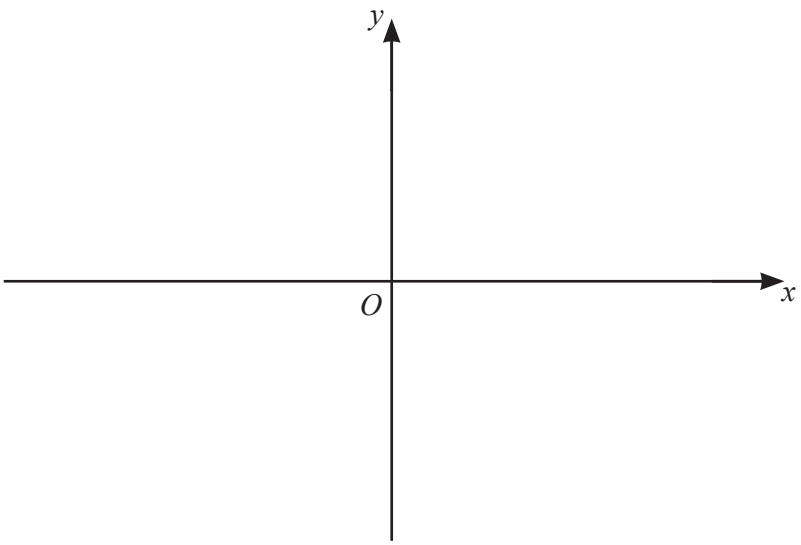
Find the probability that both students have mobile phones.

..... [3]

12 **(a)** Solve the equation $\tan x = 11.43$ for $0° \leqslant x \leqslant 360°$.

$x =$ ..... or $x =$ ..... [2]

(b) Sketch the curve $y = x^3 - 4x$.



[3]

(c) A curve has equation $y = x^3 + ax + b$.
The stationary points of the curve have coordinates $(2, k)$ and $(-2, 10 - k)$.

Work out the value of a, the value of b and the value of k.

$a =$ ..... , $b =$ ..... , $k =$ ..... [6]