

Please check the examination details below before entering your candidate information.

Candidate surname	Other names
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Pearson Edexcel International GCSE

Centre Number	Candidate Number
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Tuesday 7 January 2020

Morning (Time: 2 hours)	Paper Reference 4MA1/1HR
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Mathematics A
Paper 1HR
Higher Tier



You must have:
Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser, calculator. 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.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided
– there may be more space than you need.
- Calculators may be used.**
- You must **NOT** write anything on the formulae page.
Anything you write on the formulae page will gain NO credit.

Information

- The total mark for this paper is 100.
- 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.
- Check your answers if you have time at the end.

Answer **ALL TWENTY THREE** questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 Brendon, Asha and Julie share some money in the ratios 3 : 2 : 6
The **total** amount of money that Asha and Julie receive is \$36

Work out the amount of money that Brendon receives.

$$A + J = \frac{8}{11} = \$36 \quad \text{so } \frac{1}{11} = 4.5$$

$$B = \frac{3}{11}$$

$$3 \times 4.5$$

$$\$13.5$$

(Total for Question 1 is 3 marks)

- 2 Show that $3\frac{1}{5} \times 2\frac{5}{8} = 8\frac{2}{5}$

$$2\frac{16}{5} \times \frac{21}{8} = \frac{42}{5} = 8\frac{2}{5}$$

(Total for Question 2 is 3 marks)

Turn over ►



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Turn over ►

- 3 (a) Make a the subject of $d = g + 2ac$

$$d - g = 2ac$$

$$a = \frac{d - g}{2c}$$

(2)

- (b) Factorise fully $9ef - 12f$

$$3f(3e - 4)$$

(2)

- (c) Expand and simplify $(x + 2)(x - 5)$

$$x^2 - 5x + 2x - 10$$

$$x^2 - 3x - 10$$

(2)

(d) Simplify fully $\frac{n^4 \times n^7}{n^5} = \frac{n^{11}}{n^5}$

$$n^6$$

(2)

(Total for Question 3 is 8 marks)

- 4 $B = \{b, l, u, e\}$

$$G = \{g, r, e, y\}$$

$$W = \{w, h, i, t, e\}$$

- (a) List all the members of the set

(i) $B \cup G$

blue gr y

(ii) $W \cap G'$

whit

(2)

Serena writes down the statement $B \cap G \cap W = \emptyset$

- (b) Is Serena's statement correct?

You must give a reason for your answer.

No, e is in all 3

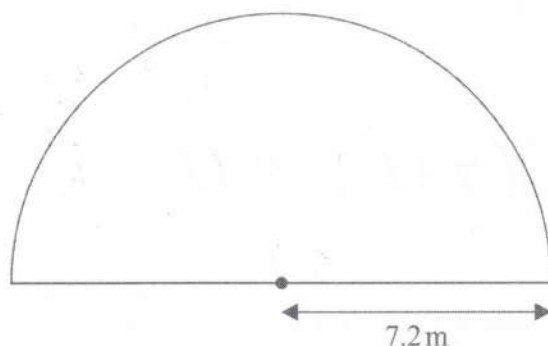
(1)

(Total for Question 4 is 3 marks)



- 5 The diagram shows Yuen's garden.

Diagram **NOT**
accurately drawn



The garden is in the shape of a semicircle of radius 7.2 m.
Yuen is going to cover his garden with grass seed.

Yuen has 12 boxes of grass seed.

Each box of grass seed contains enough seed to cover 6 m^2 of the garden.

Has Yuen enough grass seed for his garden?
Show your working clearly.

$$\begin{aligned} \text{Area} &= \frac{1}{2} \times \pi \times 7.2^2 = \frac{648}{25} \pi \\ &= 81.4 \text{ m}^2 \text{ (1dp)} \end{aligned}$$

$$12 \text{ boxes} = 12 \times 6 = 72 \text{ m}^2 \text{ coverage}$$

so No

(Total for Question 5 is 3 marks)



- 6 Solve $x^2 - 5x - 36 = 0$
Show clear algebraic working.

$$(x-9)(x+4) = 0$$

$$x = 9, x = -4$$

(Total for Question 6 is 3 marks)

- 7 In a sale, the normal price of a hat is reduced by 15%
The sale price of the hat is 20.40 euros.

Work out the normal price of the hat.

$$? \times 0.85 = 20.40$$

$$20.4 \div 0.85 = 24$$

euros

(Total for Question 7 is 3 marks)



- 8 5 children are playing on a trampoline.
The mean weight of the 5 children is 28 kg.

$$28 \times 5 = 140$$

2 of the children get off the trampoline.

The mean weight of these 2 children is 26.5 kg.

$$26.5 \times 2 = 53$$

Work out the mean weight of the 3 children who remain on the trampoline.

$$140 - 53 = 87$$

$$\frac{87}{3}$$

$$= 29$$

kg

(Total for Question 8 is 3 marks)



9 Pablo made a solid gold statue.

He melted down some gold blocks and used the gold to make the statue.
Each block of gold was a cuboid, as shown below.

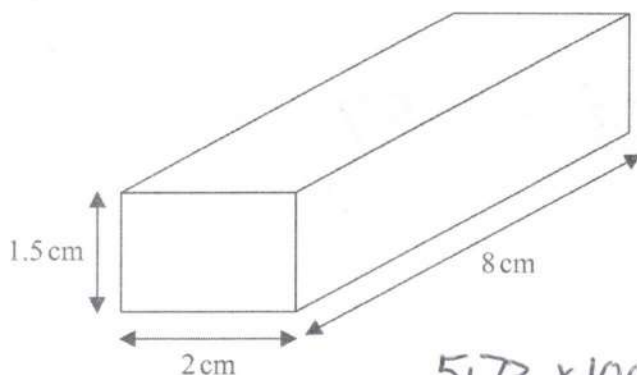


Diagram NOT
accurately drawn

The mass of the statue is 5.73 kg.
The density of gold is 19.32 g/cm³

$V =$
statue

$$\frac{5.73 \times 1000}{19.32} = 296.58...$$

Work out the least number of gold blocks Pablo melted down in order to make the statue.
Show your working clearly.

$$V = 1.5 \times 2 \times 8 = 24 \text{ cm}^3$$

Cuboid

$$\frac{296.58}{24} = 12.35...$$

$$= 13$$

(Total for Question 9 is 5 marks)



- 10 The diagram shows a regular hexagon, $ABCDEF$, and an isosceles triangle, GHI .

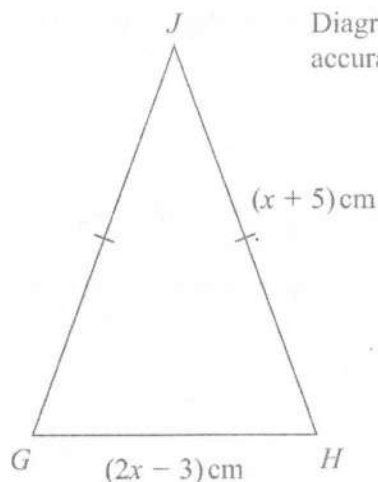
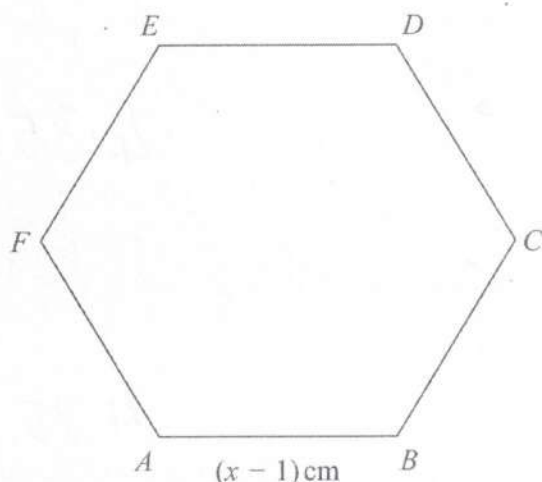


Diagram **NOT** accurately drawn

The perimeter of the hexagon is equal to the perimeter of the triangle.

Find the length of each side of the hexagon.

Show clear algebraic working.

$$\begin{aligned} \text{Hex} &= 6(x-1) = 6x-6 \\ \triangle &= 2(x+5) + (2x-3) \\ &= 2x+10 + 2x-3 = 4x+7 \end{aligned}$$

$$6x-6 = 4x+7$$

$$2x = 13$$

$$x = 6.5$$

$$\text{hexagon} = 5.5$$

cm

(Total for Question 10 is 5 marks)



11 The weight of a cat is 4.3 kg correct to 2 significant figures.

(a) Write down the upper bound of the weight of the cat.

4.35

kg

(1)

(b) Write down the lower bound of the weight of the cat.

4.25

kg

(1)

$$G = e - f$$

$e = 17$ correct to the nearest integer

$f = 9.4$ correct to one decimal place

$$\textcircled{e} 17 < \begin{matrix} 17.5 \\ 16.5 \end{matrix}$$

(c) Work out the upper bound for the value of G .

$$\textcircled{f} 9.4 < \begin{matrix} 9.45 \\ 9.35 \end{matrix}$$

$$G = e - f$$

$$= 17.5 - 9.35$$

$$= 8.15$$

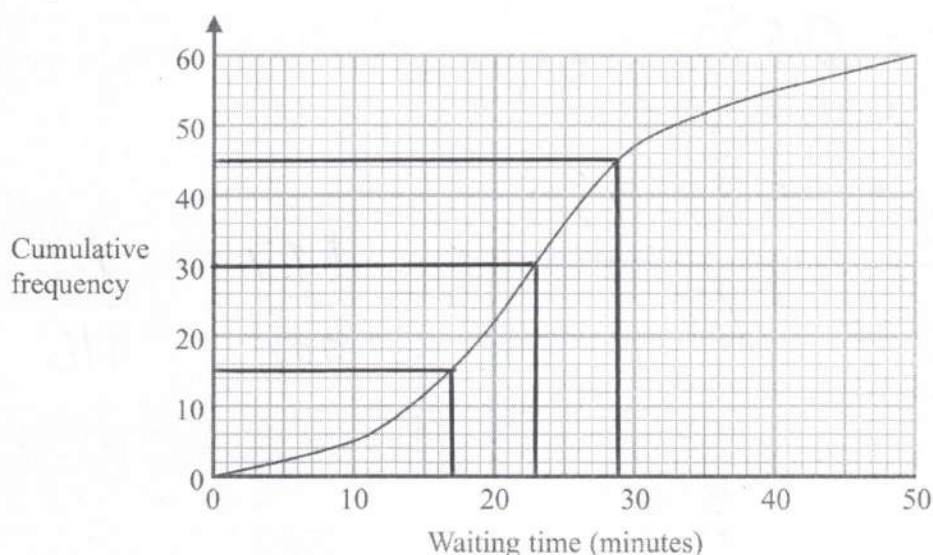
(2)

(Total for Question 11 is 4 marks)



P 5 8 4 4 3 A 0 1 1 2 4

- 12 The cumulative frequency graph gives information about the waiting times, in minutes, of people with appointments at Hospital A.



- (a) Use the graph to find an estimate of the median waiting time at Hospital A.

[ms 22 → 24]

23

minutes

(1)

- (b) Use the graph to find an estimate of the interquartile range of the waiting times at Hospital A.

29 - 17

[ms 10 → 14]

= 12

minutes

(2)

At a different hospital, Hospital B, the median waiting time is 28 minutes and the interquartile range of the waiting times is 19 minutes.

- (c) Compare the waiting times at Hospital A with the waiting times at Hospital B.

On average, waiting times at A are shorter

Waiting times at B are more varied

(2)

(Total for Question 12 is 5 marks)



13 (a) Use algebra to show that $0.5\dot{7}\dot{2} = \frac{63}{110}$

$$\begin{aligned} x &= 0.5\dot{7}\dot{2} \\ 10x &= 5.\dot{7}\dot{2} \\ 1000x &= 572.\dot{7}\dot{2} \\ \hline 990x &= 567 \end{aligned}$$

$$x = \frac{567}{990} = \frac{63}{110}$$

(2)

Given that y is a prime number,

(b) express $\frac{3}{2-\sqrt{y}}$ in the form $\frac{a+b\sqrt{y}}{c-y}$ where a , b and c are integers.

$$\begin{aligned} \frac{3}{2-\sqrt{y}} \times \frac{2+\sqrt{y}}{2+\sqrt{y}} &= \frac{6+3\sqrt{y}}{4-\sqrt{y}^2} \\ &= \frac{6+3\sqrt{y}}{4-y} \end{aligned}$$

(2)

(Total for Question 13 is 4 marks)



P 5 8 4 4 3 A 0 1 3 2 4

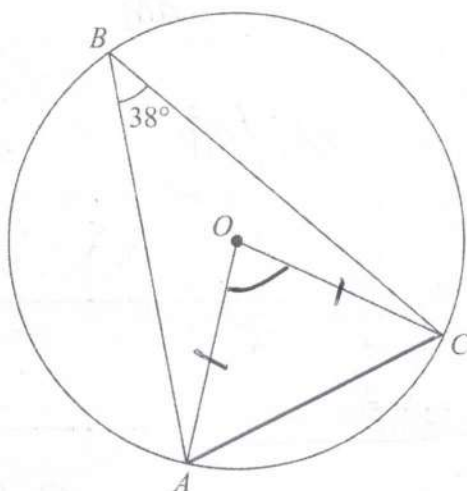


Diagram **NOT**
accurately drawn

A , B and C are points on a circle, centre O .
Angle $ABC = 38^\circ$

Work out the size of angle OAC .
Give a reason for each stage of your working.

$$\angle AOC = 76^\circ$$

(angle at centre is twice on the
circumference / arc)

$$OA = OC \text{ (both are radii)}$$

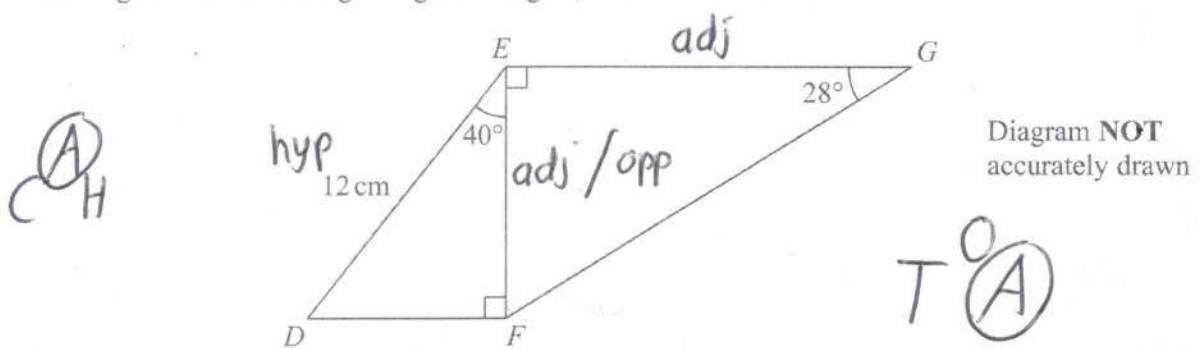
base angles of isosceles triangle
are equal so $\angle OAC = \frac{180 - 76}{2}$

$$= 52$$

(Total for Question 14 is 4 marks)



- 15 The diagram shows two right-angled triangles, DEF and EFG .



Work out the length of EG .

Give your answer correct to 3 significant figures.

$$EF = \cos 40 \times 12 = 9.19...$$

$$EG = \frac{9.19}{\tan 28} = 17.283...$$

17.3

cm

(Total for Question 15 is 4 marks)



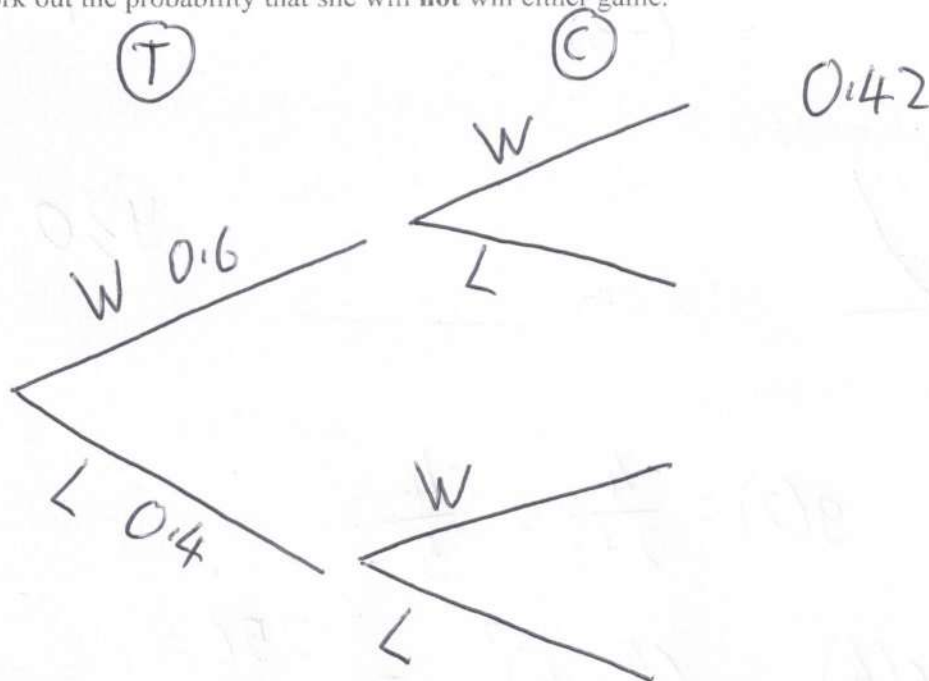
P 5 8 4 4 3 A 0 1 5 2 4

16 Steffi is going to play one game of tennis and one game of chess.

The probability that she will win the game of tennis is 0.6

The probability that she will win **both** games is 0.42

Work out the probability that she will **not** win either game.



$$\text{Win chess} = 0.42 \div 0.6 = 0.7$$

$$LL = 0.4 \times 0.3 = 0.12$$

(Total for Question 16 is 4 marks)



17 The function f is such that $f(x) = (x - 4)^2$ for all values of x .

(a) Find $f(1)$.

$$= (1 - 4)^2$$

$$= (-3)^2$$

9

(1)

(b) State the range of the function f .



$y \geq 0$

(1)

The function g is such that $g(x) = \frac{4}{x+3}$ $x \neq -3$

(c) Work out $fg(2)$

$$g(2) = \frac{4}{2+3} = \frac{4}{5}$$

$$f\left(\frac{4}{5}\right) = \left(\frac{4}{5} - 4\right)^2 = \frac{256}{25}$$

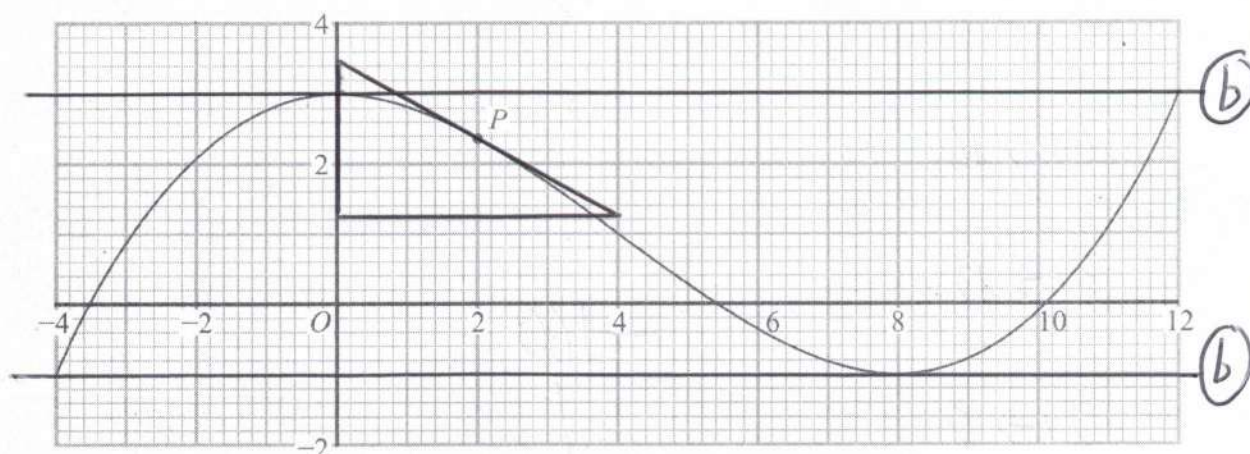
or 10.24

(2)

(Total for Question 17 is 4 marks)



18 The diagram shows the graph of $y = f(x)$ for $-4 \leq x \leq 12$



The point P on the curve has x coordinate 2

(a) (i) Use the graph to find an estimate for the gradient of the curve at P .

$$m \approx \frac{-2.2}{4} = -0.55$$

$$[ms - 0.4 \rightarrow -0.7]$$

(3)

(ii) Hence find an equation of the tangent to the curve at P .

Give your answer in the form $y = mx + c$

$$c = 3.5$$

$$[ms \quad c > 3]$$

$$y = -0.55x + 3.5$$

(2)

The equation $f(x) = k$ has exactly two different solutions for $-4 \leq x \leq 12$

(b) Use the graph to find the two possible values of k .

$$3 \quad -1$$

(2)

(Total for Question 18 is 7 marks)



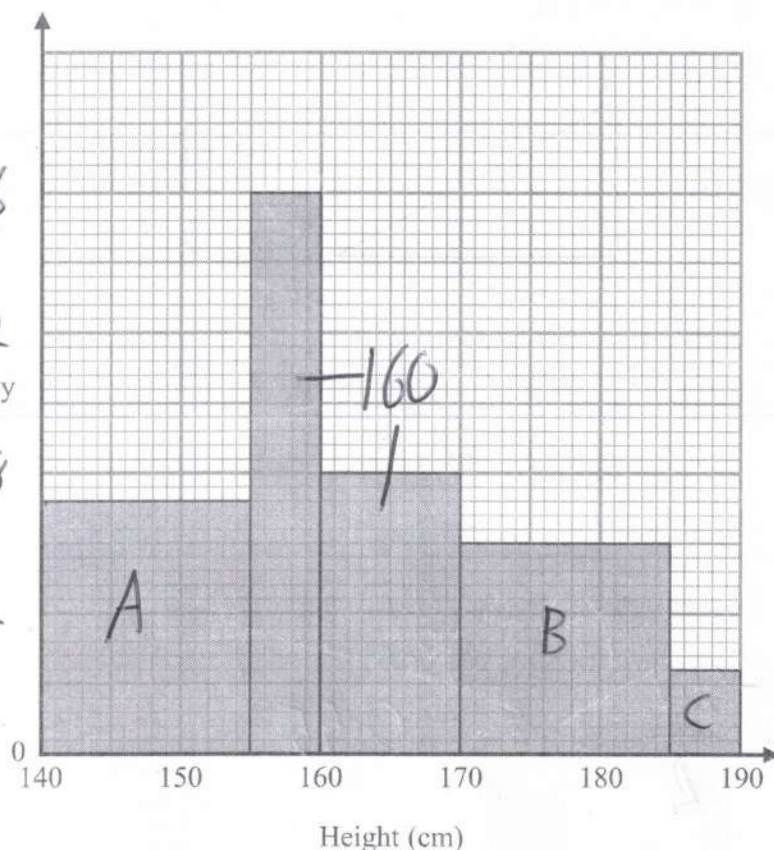
$$4x \rightarrow 16$$

$$3x \rightarrow 12$$

Frequency
density

$$2x \rightarrow 8$$

$$x \rightarrow 4$$



The histogram gives information about the heights of all the Year 11 students at a school.

There are 160 students in Year 11 with a height between 155 cm and 170 cm.

Work out the total number of students in Year 11 at the school.

$$160 = (5 \times 4x) + (10 \times 2x) = 40x$$

$$x = 4$$

$$\begin{aligned} \text{Total} &= (15 \times 7) + 160 + (15 \times 6) + (5 \times 3) \\ &= 105 + 160 + 90 + 15 \end{aligned}$$

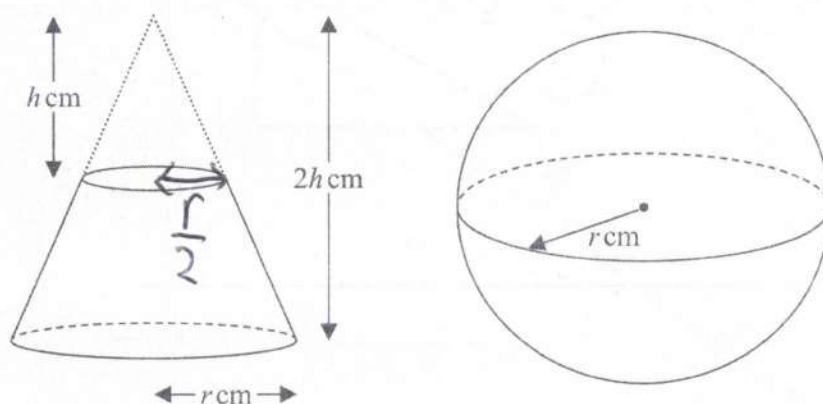
$$= 370$$

(Total for Question 19 is 4 marks)



- 20 The diagram shows a frustum of a cone and a sphere.

The frustum is made by removing a small cone from a large cone.
The cones are similar.



The height of the small cone is h cm.
The height of the large cone is $2h$ cm.
The radius of the base of the large cone is r cm.

The radius of the sphere is r cm.

Given that the volume of the frustum is equal to the volume of the sphere,

find an expression for r in terms of h .

Give your expression in its simplest form.

$$\frac{1}{3} \pi r^2 \times (2h) - \frac{1}{3} \pi \left(\frac{r}{2}\right)^2 \times h = \frac{4}{3} \pi r^3$$

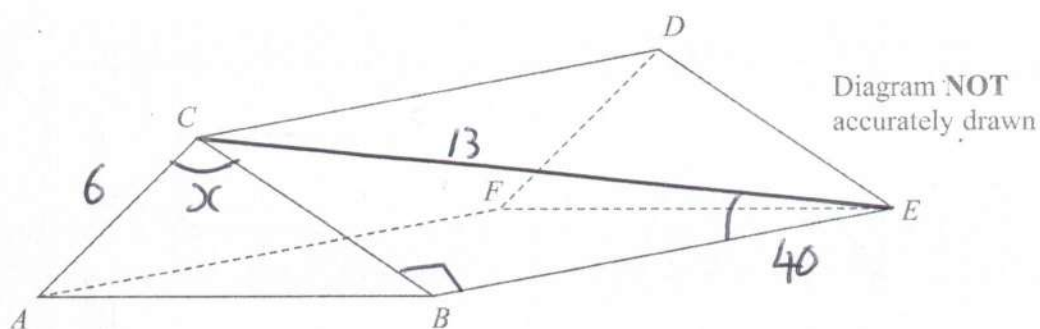
$$2r^2h - \frac{1}{4}r^2h = 4r^3$$

$$\frac{7}{4}h = 4r$$

$$\frac{7}{16}h = r$$



- 21 The diagram shows the prism $ABCDEF$ with cross section triangle ABC .

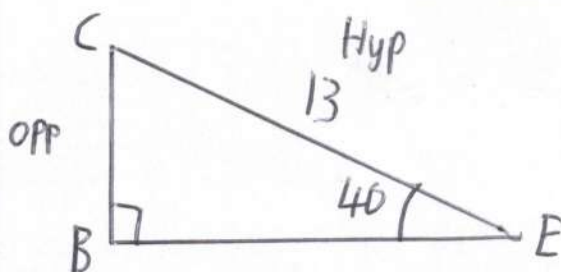


Angle $BEC = 40^\circ$ and angle ACB is obtuse.
 $AC = 6$ cm and $CE = 13$ cm

The area of triangle ABC is 22 cm²

Calculate the length of AB .

Give your answer correct to one decimal place.



$$BC = 13 \times \sin 40$$

$$= 8.356...$$

$$\text{Area } ABC = \frac{1}{2} \times 6 \times 8.356 \times \sin x = 22$$

$$x = \sin^{-1}(0.8782...) = 61.431...$$

not obtuse so $x = 180 - 61.4 = 118.6$

$$AB^2 = 6^2 + 8.356^2 - (2 \times 6 \times 8.356 \times \cos 118.6)$$

$$AB = \sqrt{153.82} = 12.402...$$

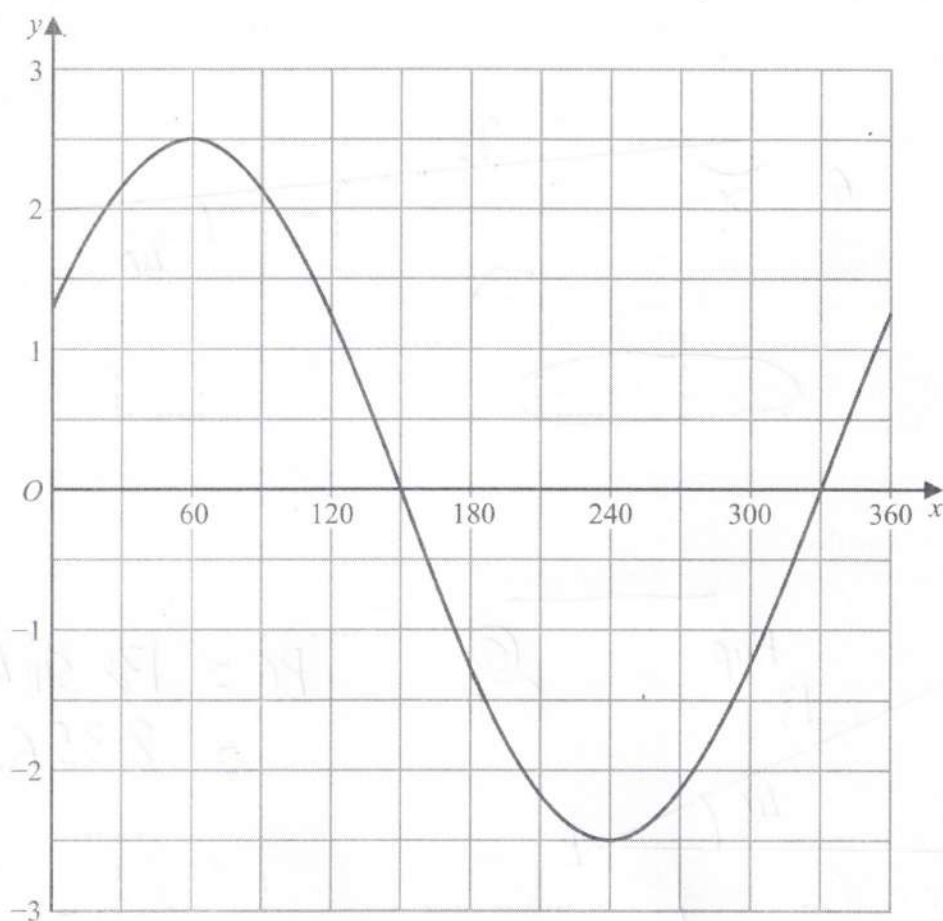
12.4

cm

(Total for Question 21 is 6 marks)



22 The graph of $y = a \cos(x + b)^\circ$ for $0 \leq x \leq 360$ is drawn on the grid.



(a) Find the value of a and the value of b .

$\begin{array}{c} 2.5 \\ \uparrow \\ \times 2.5 \\ \downarrow \\ -2.5 \end{array}$

$\rightarrow 60^\circ$

$a = 2.5$
 $b = -60$
 (2)

Another curve C has equation $y = f(x)$

The coordinates of the minimum point of C are $(4, 5)$

(b) Write down the coordinates of the minimum point of the curve with equation

(i) $y = f(2x)$

$\leftarrow \times \frac{1}{2} \rightarrow$

$(2, 5)$

(ii) $y = f(x) - 7$

$\downarrow 7$

$(4, -2)$
(2)

(Total for Question 22 is 4 marks)



P 5 8 4 4 3 A 0 2 3 2 4

- 23 A particle moves along a straight line.

The fixed point O lies on this line.

The displacement of the particle from O at time t seconds, $t \geq 0$, is s metres where

$$s = t^3 + 4t^2 - 5t + 7$$

At time T seconds the velocity of P is V m/s where $V \geq -5$

Find an expression for T in terms of V .

Give your expression in the form $\frac{-4 + \sqrt{k + mV}}{3}$ where k and m are integers to be found.

$$V = \frac{ds}{dt} = 3t^2 + 8t - 5$$

$$\text{so } V = 3T^2 + 8T - 5$$

$$V = 3\left[T^2 + \frac{8T}{3}\right] - 5$$

$$V = 3\left[\left(T + \frac{4}{3}\right)^2 - \frac{16}{9}\right] - 5$$

$$V = 3\left(T + \frac{4}{3}\right)^2 - \frac{48}{9} - 5$$

$$V + \frac{31}{3} = 3\left(T + \frac{4}{3}\right)^2$$

$$+ \sqrt{\frac{3V + 31}{9}} = T + \frac{4}{3}$$

$$\frac{-4 + \sqrt{31 + 3V}}{3}$$

$T =$

(Total for Question 23 is 6 marks)

TOTAL FOR PAPER IS 100 MARKS

