

5MB3H/01

# Edexcel GCSE

Mathematics B (Modular) – 2MB01

Paper 3H (Calculator)

## Higher Tier

Practice Paper C

Time: 1 hour 45 minutes



**You must have:**

Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser. Tracing paper may be used.

### Instructions

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- Use **black** ink or ball-point pen.
- Answer **all** questions.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*
- **Calculators may be used.**
- If your calculator does not have a  $\pi$  button, take the value of  $\pi$  to be 3.142 unless the question instructs otherwise.

### Information

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- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets  
– *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (\*) are ones where the quality of your written communication will be assessed  
– *you should take particular care on these questions with your spelling, punctuation and grammar, as well as the clarity of expression.*

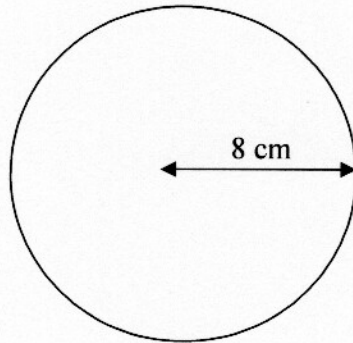
### Advice

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- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Answer ALL questions.  
Write your answers in the spaces provided.  
You must write down all stages in your working.

1. Here is a circle.



The radius of the circle is 8 cm.

(a) Work out the circumference of the circle.

$$2\pi r = 2 \times \pi \times 8 = 50.2654$$

$$= 50.27 \dots \text{cm}$$

(to 4 sig. figures) (2)

(b) Work out the area of the circle.

$$\pi r^2 = 201.06 \text{ cm}^2$$

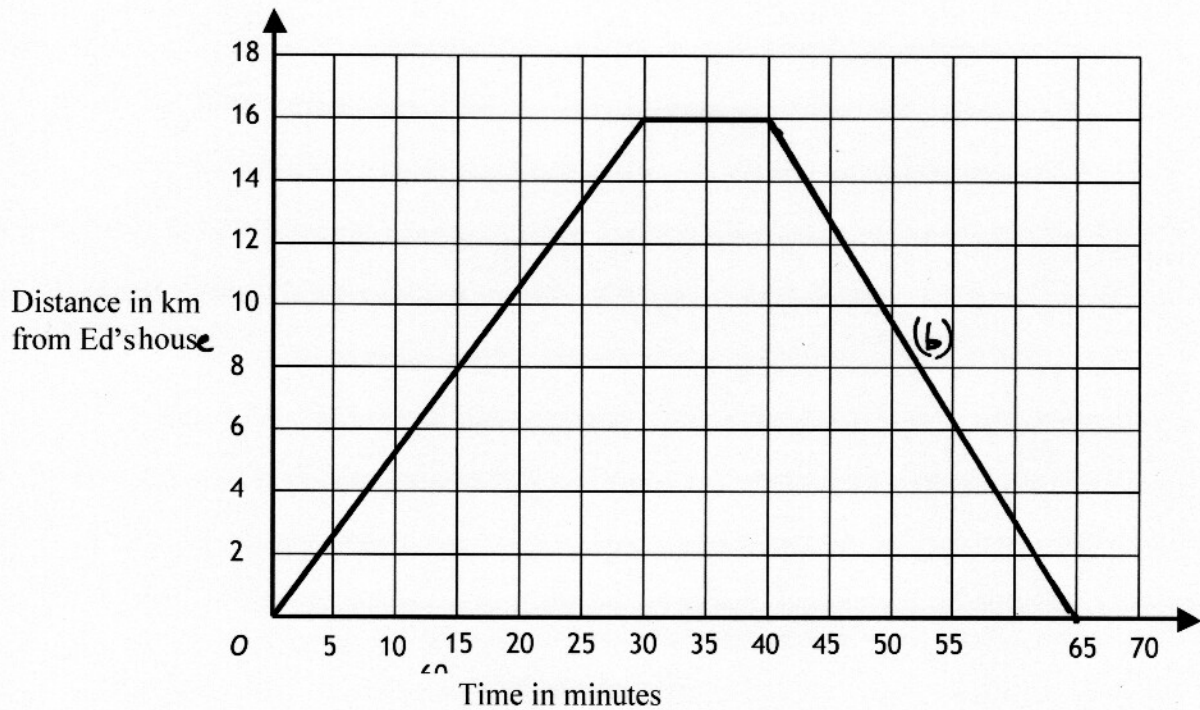
$$201.06 \dots \text{cm}^2$$

(2)

(Total for Question 1 is 4 marks)

2. Ed went from his home to the shops and then home again.

Here is part of a travel graph for Ed's journey.



- (a) Work out the average speed for the first 30 minutes of Ed's journey.  
Give your answer in km per hour.

$$\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{16 \text{ km}}{0.5 \text{ h}} = 32 \text{ km/h}$$

.....32..... km per hour  
(2)

Ed was at the shops for 10 minutes.  
He then went home.

His journey home took 25 minutes.

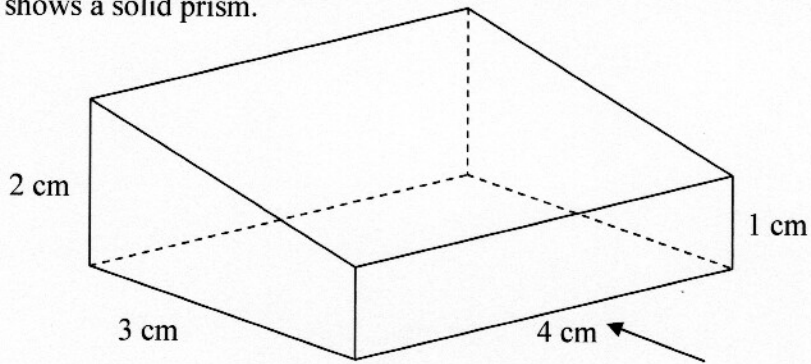
- (b) Complete the travel graph.

$$(40 + 25 = 65 \text{ min on } x\text{-axis})$$

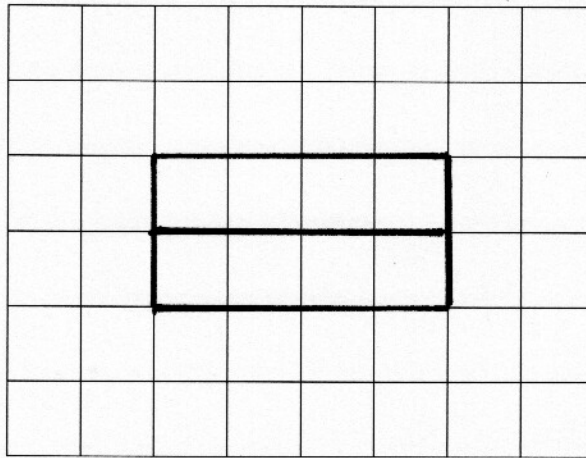
(1)

(Total for Question 2 is 3 Marks)

3. The diagram shows a solid prism.

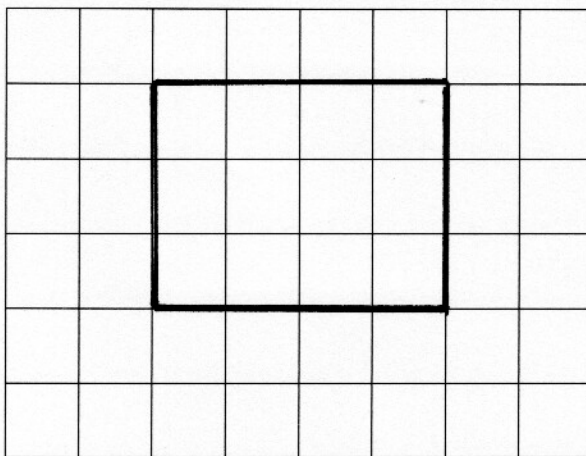


(a) On the grid below, draw the front elevation of the prism from the direction of the arrow.



(2)

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



(2)

(Total for Question 3 is 4 marks)

*ANS<sup>2</sup> + ANS - 3  
or TABLE mode*

4. (a) Complete the table of values for  $y = x^2 + x - 3$

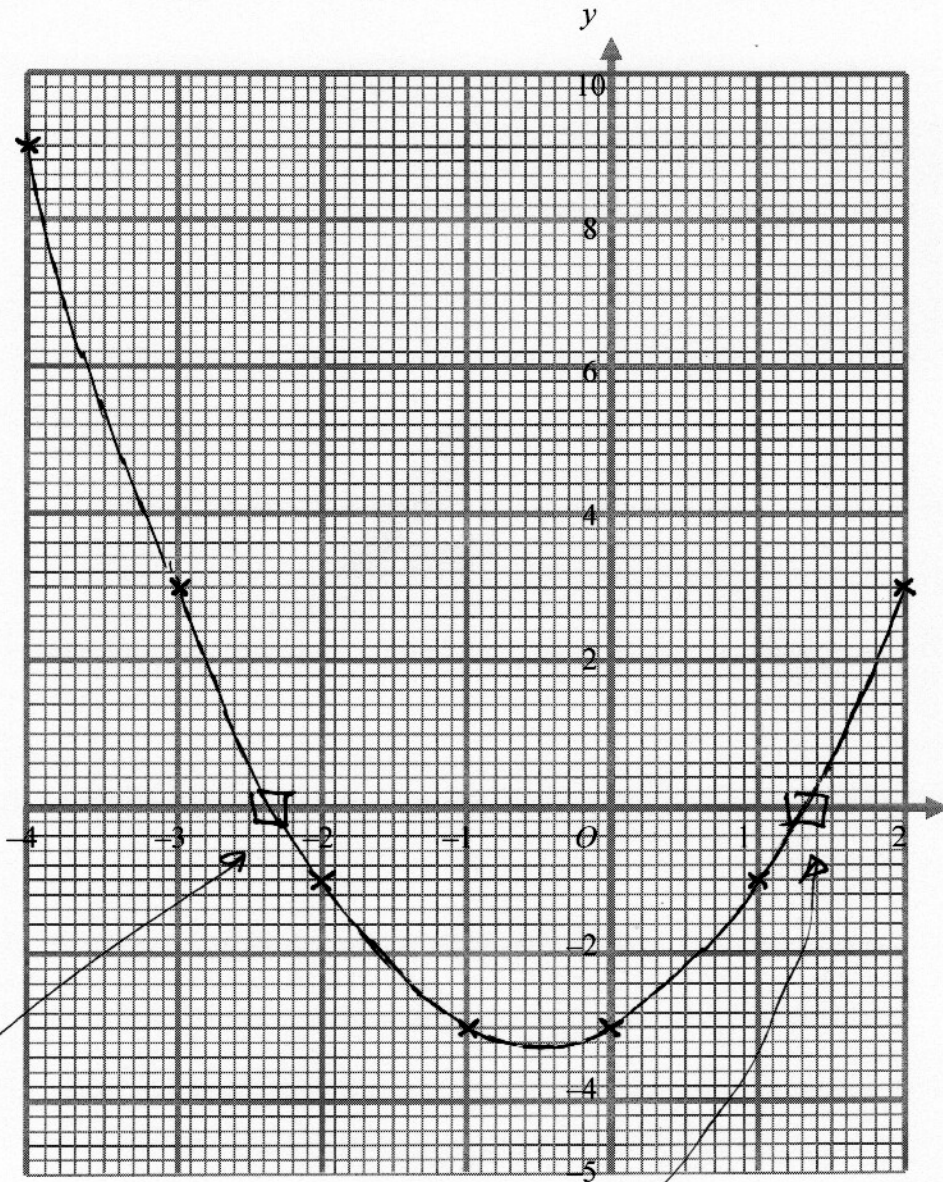
x	-4	-3	-2	-1	0	1	2
y	9	3	-1	-3	-3	-1	3

*Quadratic → check they are symmetrical.*

*← | →*

(2)

(b) On the grid below, draw the graph of  $y = x^2 + x - 3$  for values of  $x$  from  $-4$  to  $2$



(2)

(c) Use your graph to find estimates for the solutions of  $x^2 + x - 3 = 0$

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

$$\left. \begin{array}{l} y = x^2 + x - 3 \\ x^2 + x - 3 = 0 \end{array} \right\} \therefore y = 0$$

$$-2.36, 1.32 \dots$$

(2)

*[exact -2.3028, 1.3028*

(Total for Question 4 is 6 marks)

*from formula - check!]*

5.

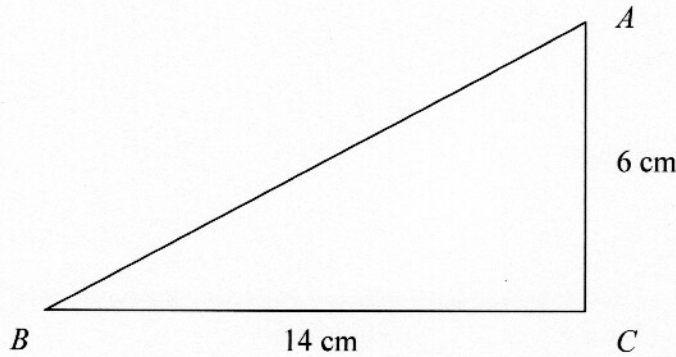


Diagram NOT accurately drawn

Calculate the length of  $AB$ .  
Give your answer correct to 2 decimal places.

$$\sqrt{14^2 + 6^2} = 15.23155$$

$$= 15.23 \text{ cm to 2dp.}$$

15.23..... cm

(Total for Question 5 is 3 marks)

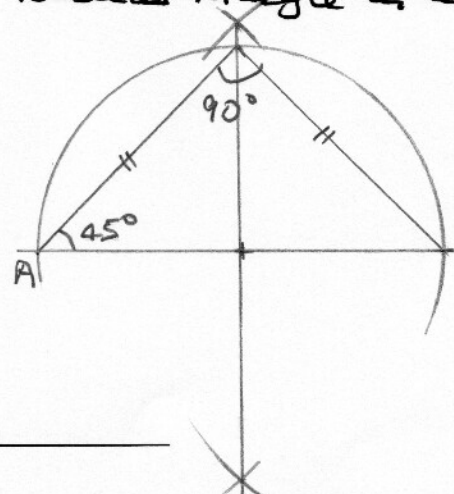
6. Use ruler and compasses **construct** an angle of  $45^\circ$  at  $A$   
You must show **all** construction lines.

Either: Construct a perpendicular, then halve the angle. OR

Construct a  $45-90-45^\circ$  isosceles triangle in a circle.

Construction of perpendicular & perpendicular bisector.

bisect the  $90^\circ$  angle.



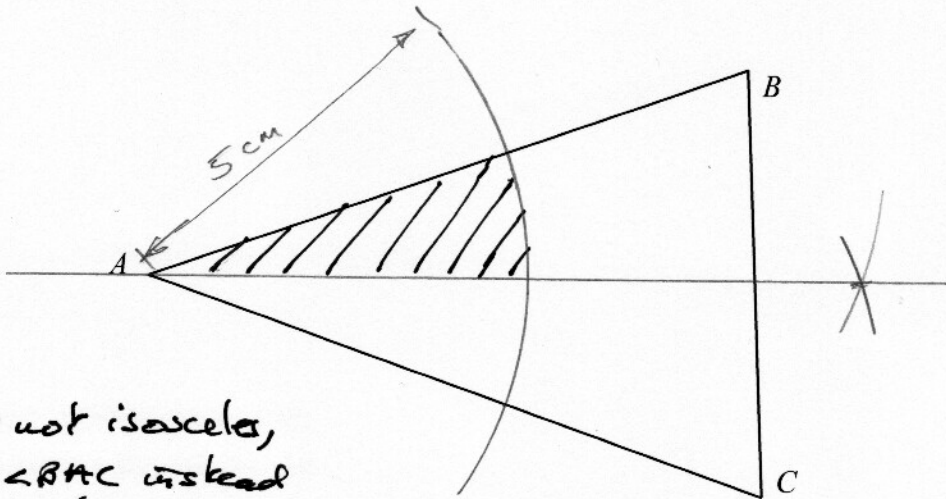
(Total for Question 6 is 3 marks)

7. The diagram represents a triangular garden  $ABC$ .  
The scale of the diagram is 1 cm represents 1 m.

A tree is to be planted in the garden so that it is

nearer to  $AB$  than to  $AC$ ,  
within 5 m of point  $A$ .

On the diagram, shade the region where the tree may be planted.



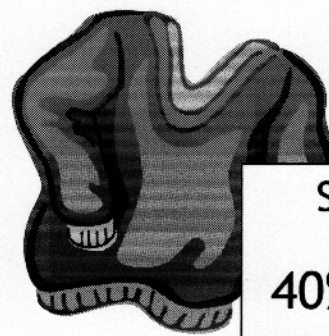
nb This is not isosceles,  
so bisect  $\angle BAC$  instead  
of bisecting length  $BC$ .

(Total 3 marks)

- \*8. Susie buys a jumper in a sale.  
The original cost of the jumper was £28.50

Work out the sale price of the jumper.

It is reduced by 40%, so  
she pays 60% of the original cost.  
 $0.6 \times \pounds 28.50 = \pounds 17.10$



Sale  
40% off

(Total for Question 8 is 3 marks)

9.

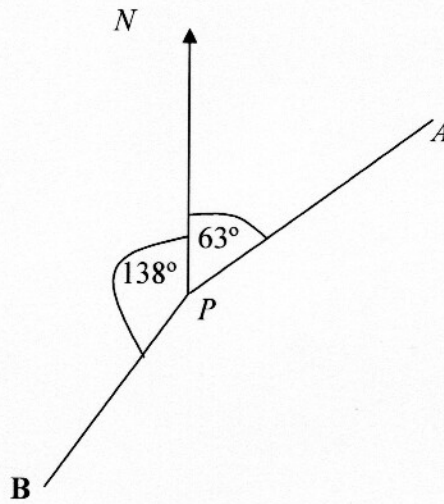


Diagram NOT accurately drawn

Work out the bearing of

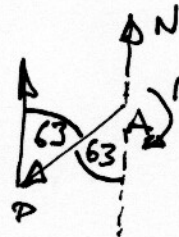
(i) B from P,

$$360 - 138 = 222^\circ$$



(ii) P from A.

Alternate angles:



$$180 + 63 = 243$$

.....  
222.....°

.....  
243.....°

(Total for Question 7 is 4 marks)

10. (a) Solve

$$3x - 5 = 7x + 30$$

$$\begin{aligned} &\swarrow \searrow \\ 7x + 30 &= 3x - 5 \\ 4x + 30 &= -5 \\ 4x &= -35 \end{aligned}$$

$$\rightarrow x = \frac{-35}{4} = -8.75$$

.....  
-8.75.....  
(2)

(b) Solve

$$\frac{20 - 2x}{5} = 2x + 3$$

$$\textcircled{\times 5} \quad 20 - 2x = 10x + 15$$

$$20 = 12x + 15$$

$$12x = 20 - 15 = 5$$

$$x = \frac{5}{12}$$

.....  
 $\frac{5}{12}$ .....  
(3)

(Total for Question 10 is 5 marks)



11. (a)  $-2 < x \leq 1$   
 $x$  is an integer.

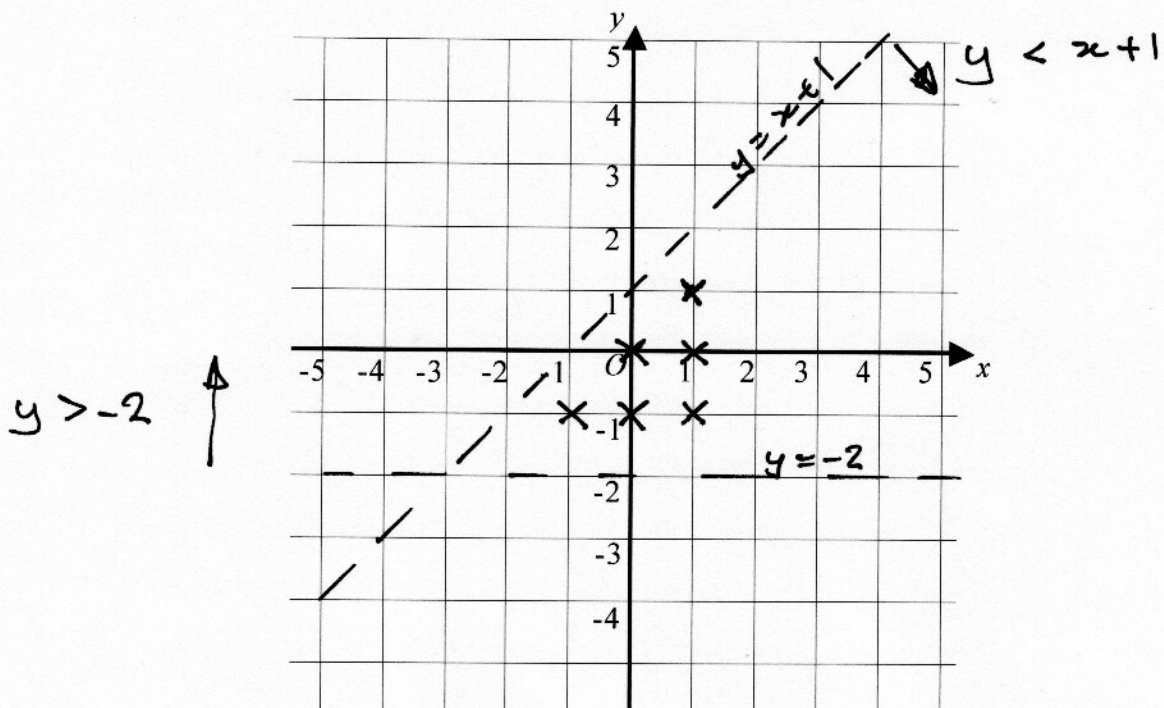
Write down all the possible values of  $x$ .

$-1, 0, 1$ ..... (2)

- (b)  $-2 < x \leq 1$       $y > -2$       $y < x + 1$

$x$  and  $y$  are integers.

On the grid below mark with a cross ( $\times$ ), each of the six points which satisfies **all** these 3 inequalities.



(3)

(Total for Question 11 is 5 marks)

12. A spaceship travelled for  $6 \times 10^2$  hours at a speed of  $8 \times 10^4$  km/h.

- (a) Calculate the distance travelled by the spaceship.  
Give your answer in standard form.

$$\begin{aligned} \text{Distance} &= \text{speed} \times \text{time} \\ &= 8 \times 10^4 \times 6 \times 10^2 \\ &= 48 \times 10^6 \quad (\text{use ENG button} \\ &\quad \text{not s. form!}) \\ &= 4.8 \times 10^7 \quad \dots\dots\dots \text{km} \end{aligned}$$

(3)

One month an aircraft travelled  $2.4 \times 10^5$  km.  
The next month the aircraft travelled  $3.7 \times 10^4$  km.

- (b) Calculate the total distance travelled by the aircraft in the two months.  
Give your answer as an ordinary number.

$$\begin{aligned} 2.4 \times 10^5 + 3.7 \times 10^4 &= 240000 \\ &\quad + 37000 \\ &= 277000 \end{aligned}$$

$\dots\dots\dots 277000 \dots\dots\dots$  km  
(2)

(Total for Question 12 is 5 marks)

13. Gwen invests a sum of money in a savings account for 5 years at 4% compound interest.

By what number must multiply her original investment by to find the total amount of money she would have in the savings account at the end of 5 years.

$$1.04^5 = 1.216653$$

$$1.04^5 (= 1.217) \dots\dots\dots$$

(Total for Question 13 is 2 marks)

14.

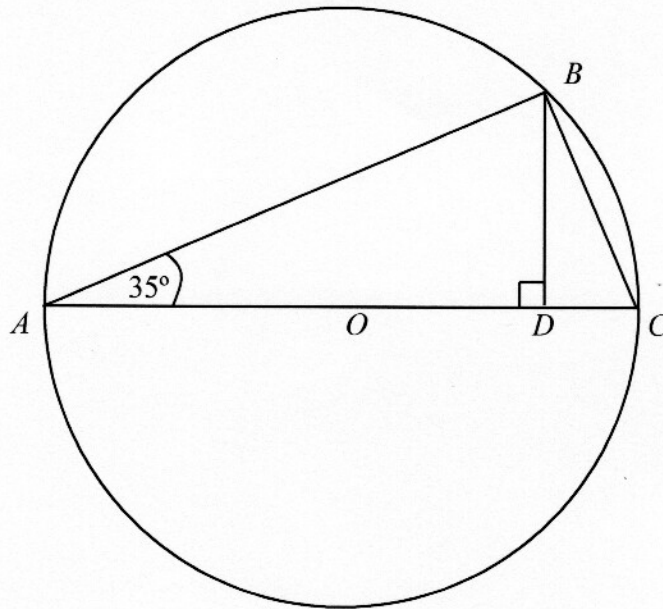


Diagram NOT accurately drawn

The diagram shows a circle, centre  $O$ .

$AC$  is a diameter

Angle  $BAC = 35^\circ$

$D$  is the point on  $AC$  such that angle  $BDA$  is a right angle

- (a) Work out the size of angle  $BCA$ .

$\angle ABC = 90^\circ$  ( $AC$  is a diameter,  $\angle ABC =$  half of  $\angle AOC = \frac{180^\circ}{2}$ ).

Angles in a triangle add to  $180^\circ$

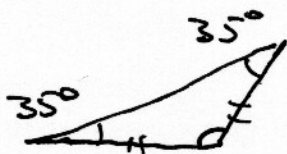
$$\angle BCA + 35 + 90 = 180, \quad \angle BCA = 180 - 125 = 55^\circ$$

(2)

- (b) Calculate the size of angle  $BOA$ .

Triangle  $BOA$  is isosceles ( $OA = OB = \text{radius}$ )

$\therefore$  base angles are equal (both  $35^\circ$ ).



Angles in a triangle add to  $180^\circ$

$$\therefore \angle BOA = 180 - 2 \times 35$$

(2)

$$= 180 - 70 = 110^\circ$$

Total for Question 14 is 4 marks)

or Angle at centre =  $2 \times$  angle at edge,  $2 \times 55 = 110^\circ$   
 ( $\angle BOA = 2 \times \angle BCA$ )

15. Ali installed double glazing in his flat.

According to an energy conservation website he will save 15% on his heating bills.  
His heating bill for January was £55

How much money has he saved?  
Give your answer to the nearest penny.

if he saved 15%, he is paying 85% of his previous bills "B".

$$0.85B = £55, \quad B = \frac{£55}{0.85} = £64.71$$

$$\begin{aligned} \text{His saving is } & £64.71 - £55 \\ & = £9.71 \end{aligned}$$

£ 9.71.....

(Total for Question 15 is 3 marks)

16. Solve

$$\begin{aligned} 5x + 2y &= 8 \\ 2x - 4y &= 8 \end{aligned}$$

"value to get 2y"

$$\begin{array}{r} 5x + 2y = 8 \\ x - 2y = 4 \quad + \\ \hline 6x = 12 \end{array}$$

$$x = \frac{12}{6} = 2$$

$$10 + 2y = 8$$

$$2y = 8 - 10 = -2$$

$$y = -1$$

$$x = 2.....$$

$$y = -1.....$$

(Total for Question 16 is 3 marks)

17. The diagram shows a sector of a circle with a radius of  $x$  cm and centre  $O$ .

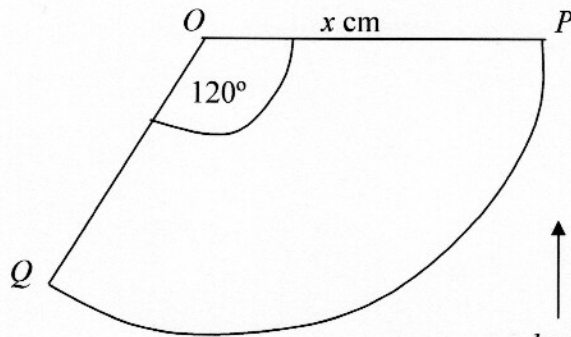
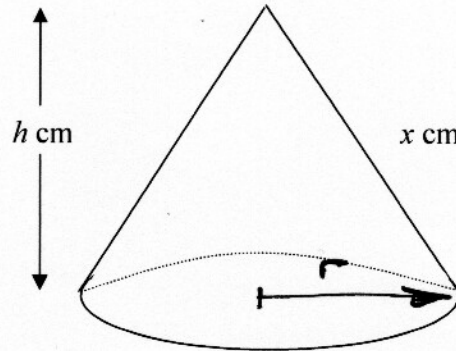


Diagram NOT accurately drawn

$PQ$  is an arc of the circle.  
Angle  $POQ = 120^\circ$



The sector is the net of the curved surface of this cone.  
Arc  $PQ$  forms the circumference of the circle that makes the base of the cone.

The curved surface area of the cone is  $A$  cm<sup>2</sup>.  
The volume of the cone is  $V$  cm<sup>3</sup>.  
The height of the cone is  $h$  cm.

Given that  $V = 3A$  find the value of  $h$ .

$$\begin{aligned} \text{Area of sector} &= (\text{fraction of circle}) \times \pi r^2 \\ &= \left(\frac{120^\circ}{360^\circ}\right) \times \pi x^2 = \frac{1}{3} \pi x^2 \\ &= \text{cone's curved surface area "A"} \end{aligned}$$

$$\therefore V = 3A = \pi x^2$$

$$\text{Arc length of sector, } PQ = \left(\frac{120}{360}\right) 2\pi x = \frac{2}{3} \pi x$$

$$= \text{cone's base circumference} = 2\pi r$$

$$\therefore r = \frac{1}{3} x$$

$$\text{Volume of cone} = \frac{1}{3} \pi r^2 h \quad (\text{formula sheet}) \quad h = 27 \dots$$

$$= \frac{1}{27} \pi x^2 h = \pi x^2 \quad \therefore \frac{1}{27} h = 1, h = 27 \quad (\text{Total for Question 17 is 5 marks})$$

[Mark scheme incorrect!]

hence " $h$  cm" = 27 cm

18. The diagram shows a vertical tower  $DC$  on horizontal ground  $ABC$ .

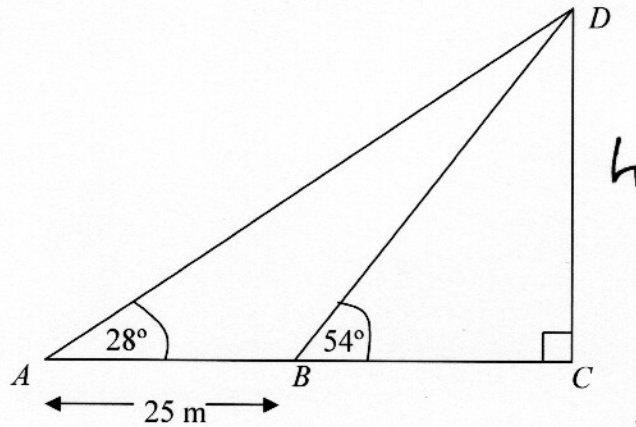


Diagram NOT  
Accurately drawn

$ABC$  is a straight line.

The angle of elevation of  $D$  from  $A$  is  $28^\circ$ .

The angle of elevation of  $D$  from  $B$  is  $54^\circ$ .

$AB = 25$  m.

Calculate the height of the tower.

Give your answer correct to 3 significant figures.

$$AC = \frac{h}{\tan 28}, \quad BC = \frac{h}{\tan 54}$$

$$AC - BC = h \left( \frac{1}{\tan 28} - \frac{1}{\tan 54} \right) = 25 \text{ m}$$

$$\therefore h = \frac{25}{\frac{1}{\tan 28} - \frac{1}{\tan 54}} = 21.66 \text{ m}$$

$$= 21.7 \text{ m to 3 s.f.}$$

OR Use sine rule to find length  $DB$  first:

$26^\circ$  external angle = sum of opposite two internal angles,  
 $54 - 28 = 26^\circ$

$$\frac{a}{\sin A} = \frac{d}{\sin D}, \quad a = \frac{\sin 28 \times 25}{\sin 26} = 26.774 \text{ m.}$$

$$h = a \sin 54 = 21.66 \text{ m}$$

$$21.7 \dots \text{ m}$$

(Total for Question 18 is 5 marks)

Mark scheme incorrect!

RM version is edited!

19. Solve  $3x^2 + 2x - 1 = 0$

$$ac = -3 = 3x - 1$$

$$(3 + (-1) = 2 = b)$$

$$(3x - 1)(x + \frac{1}{3}) = 0$$

$$(3x - 1)(x + 1) = 0$$

Hence

$$x + 1 = 0 \Rightarrow x = -1$$

or

$$3x - 1 = 0 \Rightarrow x = \frac{1}{3}$$

OR Use  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-2 \pm \sqrt{2^2 - 4 \times 3 \times (-1)}}{6}$

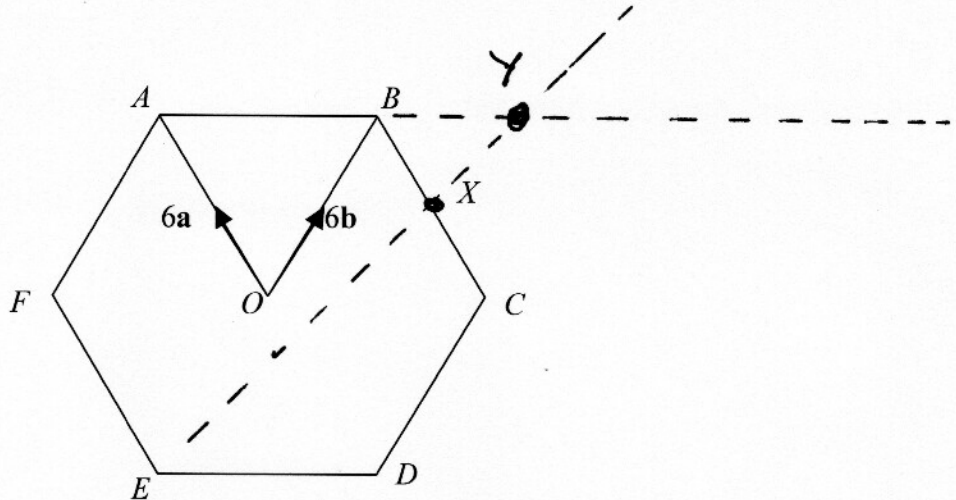
$$= \frac{-1}{3} \pm \frac{\sqrt{4+12}}{6} = \frac{-1}{3} \pm \frac{\sqrt{16}}{6} = \frac{-1}{3} \pm \frac{4}{6}$$

$$= -1 \text{ or } +\frac{1}{3}$$

$$x = -1, x = \frac{1}{3}$$

(Total for Question 19 is 3 marks)

20.



The diagram shows a regular hexagon  $ABCDEF$  with centre  $O$ .

$$OA = 6a \quad OB = 6b$$

(a) Express in terms of  $a$  and/or  $b$

(i)  $\vec{AB}$ ,  $6a + \vec{AB} = 6b$   
 $\vec{AB} = 6b - 6a$  .....  
6b-6a

(ii)  $\vec{EF}$ .  
 $\vec{EF}$  is parallel to  $\vec{OA}$  and same length .....  
6a  
(2)

$X$  is the midpoint of  $BC$ .

(b) Express  $\vec{EX}$  in terms of  $a$  and/or  $b$ .  $\vec{BC} = -6a$   
 $\vec{BX} = \frac{1}{2} \vec{BC} = -3a$   
 $\vec{EX} = \vec{EB} + \vec{BX} = 2(OB) + \vec{BX} = 12b - 3a$  .....  
12b-3a  
(2)

$Y$  is the point on  $AB$  extended, such that  $AB : BY = 3 : 2$

\*(c) Prove that  $E, X$  and  $Y$  lie on the same straight line.

$AB : BY = 3 : 2$  hence  $\vec{BY} = \frac{2}{3} \vec{AB} = 4b - 4a$   
 If  $E, X$  and  $Y$  are collinear,  $\vec{EY}$  will be a multiple of  $\vec{EX}$   
 $\vec{EY} = \vec{EB} + \vec{BY} = 12b + (4b - 4a) = 16b - 4a$   
 Since  $16b - 4a = \frac{4}{3}(12b - 3a)$ ,  
 $\vec{EY} = \frac{4}{3} \vec{EX}$ , so they are collinear. (3)  
(Total 7 marks)

TOTAL FOR PAPER = 80 MARKS