Write your name here

| Surname | Other names |
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**Edexcel**
**International GCSE**

| Centre Number | Candidate Number |
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# Mathematics B

## Paper 2

Wednesday 16 May 2012 – Morning
**Time: 2 hours 30 minutes**

Paper Reference
**4MB0/02**

**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.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Calculators may be used.**

## 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.
- Without sufficient working, correct answers may be awarded no marks.

*Turn over* ▶

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6/6/6/3

P 4 0 6 6 2 A 0 1 3 2

PEARSON

**Answer ALL ELEVEN questions.**

**Write your answers in the spaces provided.**

**You must write down all stages in your working.**

**1** $\mathscr{E} = \{ x : 1 \leqslant x \leqslant 10 \text{ and } x \text{ is an integer} \}$ ,

$A = \{ x : 1 < x < 10 \}$ ,
$B = \{ x : 3 < x \leqslant 5 \}$ ,
$C = \{ x : x \text{ is an even integer} \}$ .

Find the elements in

(a) $A'$

**(1)**

(b) $B \cap C$

**(1)**

(c) $(A \cap C) \cup B$

**(2)**

**Question 1 continued**

**(Total for Question 1 is 4 marks)**

**2** A number of shepherds walked their sheep to the local market for sale. In total there were 104 heads. Letting $x$ be the number of shepherds and $y$ be the number of sheep,

(a) write down an equation in $x$ and $y$.

**(1)**

In total there were 404 legs. You may assume that each sheep has four legs and each shepherd has two legs.

(b) Write down a second equation in $x$ and $y$.

**(1)**

(c) Solve your two equations to find the number of shepherds and the number of sheep walking to the market.

**(3)**

**Question 2 continued**

**(Total for Question 2 is 5 marks)**

**3** (a) Calculate the size, in degrees, of an exterior angle of a regular pentagon.

**(2)**

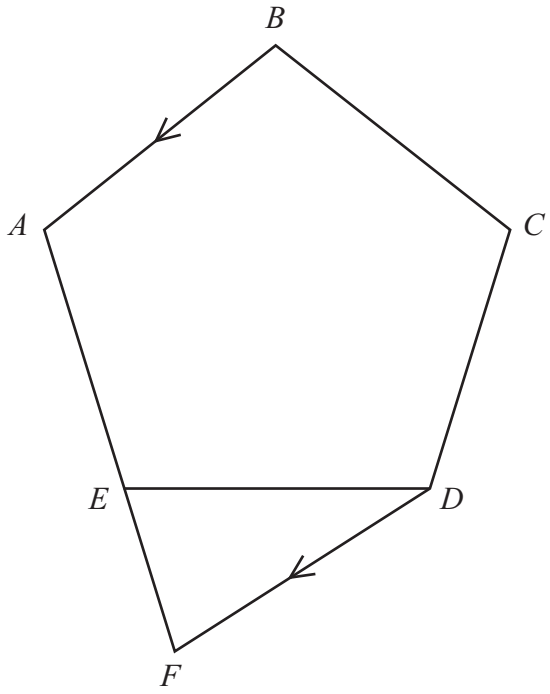


Diagram **NOT** accurately drawn

**Figure 1**

In Figure 1, *ABCDE* is a regular pentagon. *AE* is extended to the point *F* such that *DF* is parallel to *BA*.

(b) Show, giving reasons, that triangle *DEF* is isosceles.

**(4)**

**Question 3 continued**

**(Total for Question 3 is 6 marks)**

**4** One day a cinema showed the following four films

*The Taking of Algebra 123*
*The Binary Knot*
*Carry On Subtracting*
*The Long Division*

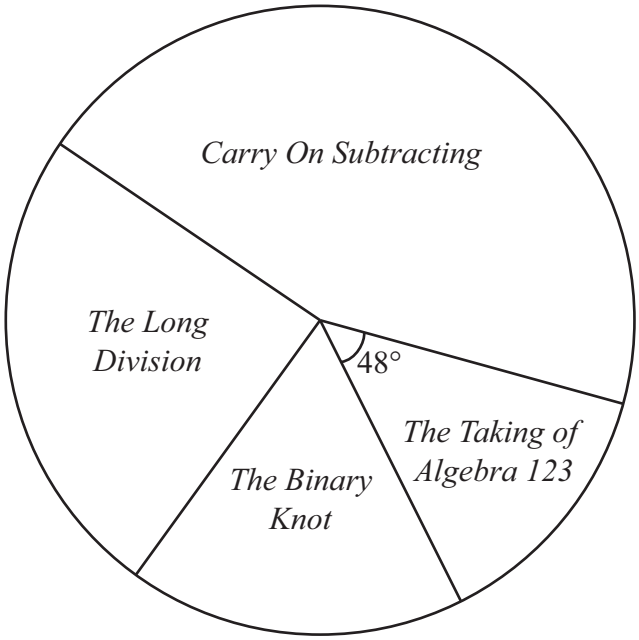


Diagram **NOT** accurately drawn

**Figure 2**

The pie chart in Figure 2 shows information about the number of people who watched each film that day.

The angle of the sector for the film *The Taking of Algebra 123* is 48° and 80 people watched this film.

(a) Calculate the total number of people who watched these four films.

**(2)**

The number of people who watched *The Binary Knot* was 115

(b) Calculate the angle of the sector for this film.

**(2)**

The ratio of the number of people who watched *Carry on Subtracting* to the number of people who watched *The Long Division* was 2 : 1

(c) Calculate the number people who watched *Carry on Subtracting*.

**(2)**

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**Question 4 continued**

**(Total for Question 4 is 6 marks)**

**5** Iftekhar travels to work each day either by bus or by train. The probability that he takes the bus is 4/5. If he takes the bus, the probability that he buys a newspaper is 3/4. If he takes the train, the probability that he buys a newspaper is 2/3.

(a) Draw a tree diagram to represent this information.

**(4)**

(b) Calculate the probability that one particular day, Iftekhar will **not** buy a newspaper.

**(3)**

**Question 5 continued**

**(Total for Question 5 is 7 marks)**

**6**

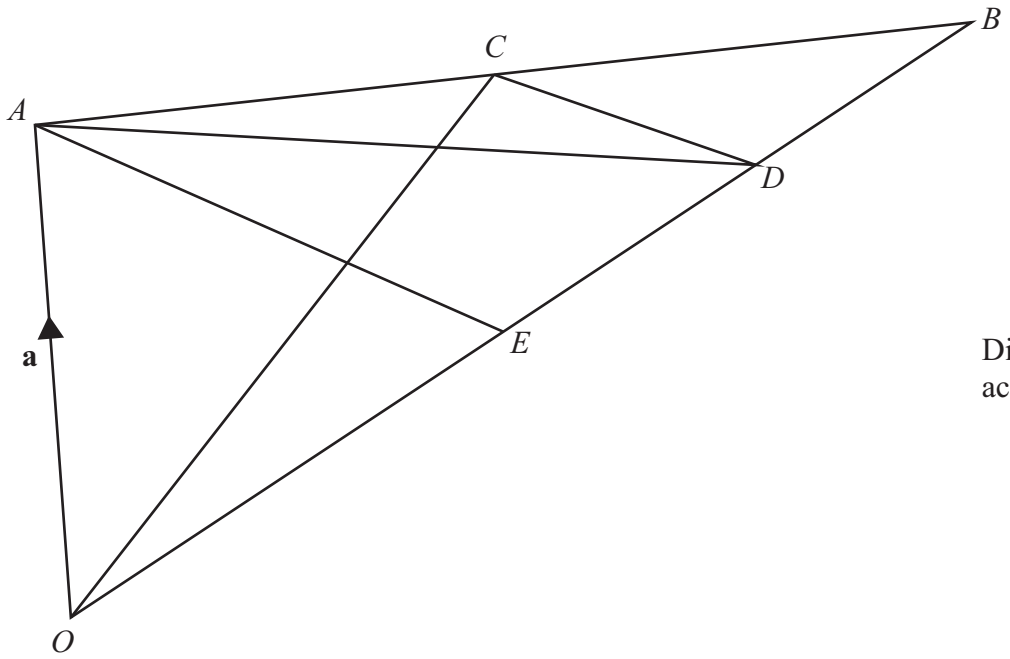


Diagram **NOT** accurately drawn

**Figure 3**

In Figure 3, $\overrightarrow{OA}$ = **a** and $\overrightarrow{OB}$ = **b**.

The point $C$ is the midpoint of $AB$.

(a) Find, in terms of **a** and **b**, simplifying your answer

(i) $\overrightarrow{AB}$ ,

(ii) $\overrightarrow{OC}$ .

**(3)**

The point $D$ is on $OB$ such that $OD : DB = 3 : 1$

(b) Find, in terms of **a** and **b**, and simplifying your answer, $\overrightarrow{CD}$.

**(3)**

The point $E$ is on $OB$ such that $\Delta BCD$ is similar to $\Delta BAE$.

(c) Find, in terms of **a** and **b**, $\overrightarrow{AE}$ .

**(2)**

(d) Write down the ratio of $OE : EB$ in the form $m : n$ where $m$ and $n$ are integers.

**(1)**

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**Question 6 continued**

**(Total for Question 6 is 9 marks)**

**7** In 2010 Neucamp Productions employed 3750 people. Of these 36% were clerical staff.

(a) Calculate the number of clerical staff employed in 2010

**(2)**

The other employees of Neucamp Productions are either skilled manual workers or unskilled manual workers. The ratio of the number of skilled manual workers to the number of unskilled manual workers was 3 : 2 in 2010

(b) Calculate the number of skilled manual workers employed in 2010

**(2)**

In 2011 the number of skilled manual workers was 25% less than the number of skilled manual workers in 2010
The numbers of clerical staff and unskilled manual workers remained the same in 2011 as in 2010

(c) Calculate the number of skilled manual workers employed in 2011

**(2)**

The total number of people employed by Neucamp Productions in 2011 was 75% of the total number employed by Neucamp Productions in 2009

(d) Calculate the total number of people employed by Neucamp Productions in 2009

**(3)**

**Question 7 continued**

**(Total for Question 7 is 9 marks)**

**8** The points $(1, -1)$, $(4, -2)$ and $(3, -5)$ are the vertices of triangle $A$.

(a) On the grid, draw and label triangle $A$.

**(1)**

Triangle $A$ is transformed to triangle $B$ under the transformation with matrix $\mathbf{N}$ where

$$\mathbf{N} = \begin{pmatrix} -2 & -1 \\ \frac{3}{2} & \frac{1}{2} \end{pmatrix}$$

(b) Find the coordinates of the vertices of $B$.

**(2)**

(c) On the grid, draw and label $B$.

**(1)**

Triangle $B$ is transformed to triangle $C$ under the transformation with matrix $\mathbf{M}$ where

$$\mathbf{M} = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$$

(d) Find the coordinates of the vertices of $C$.

**(2)**

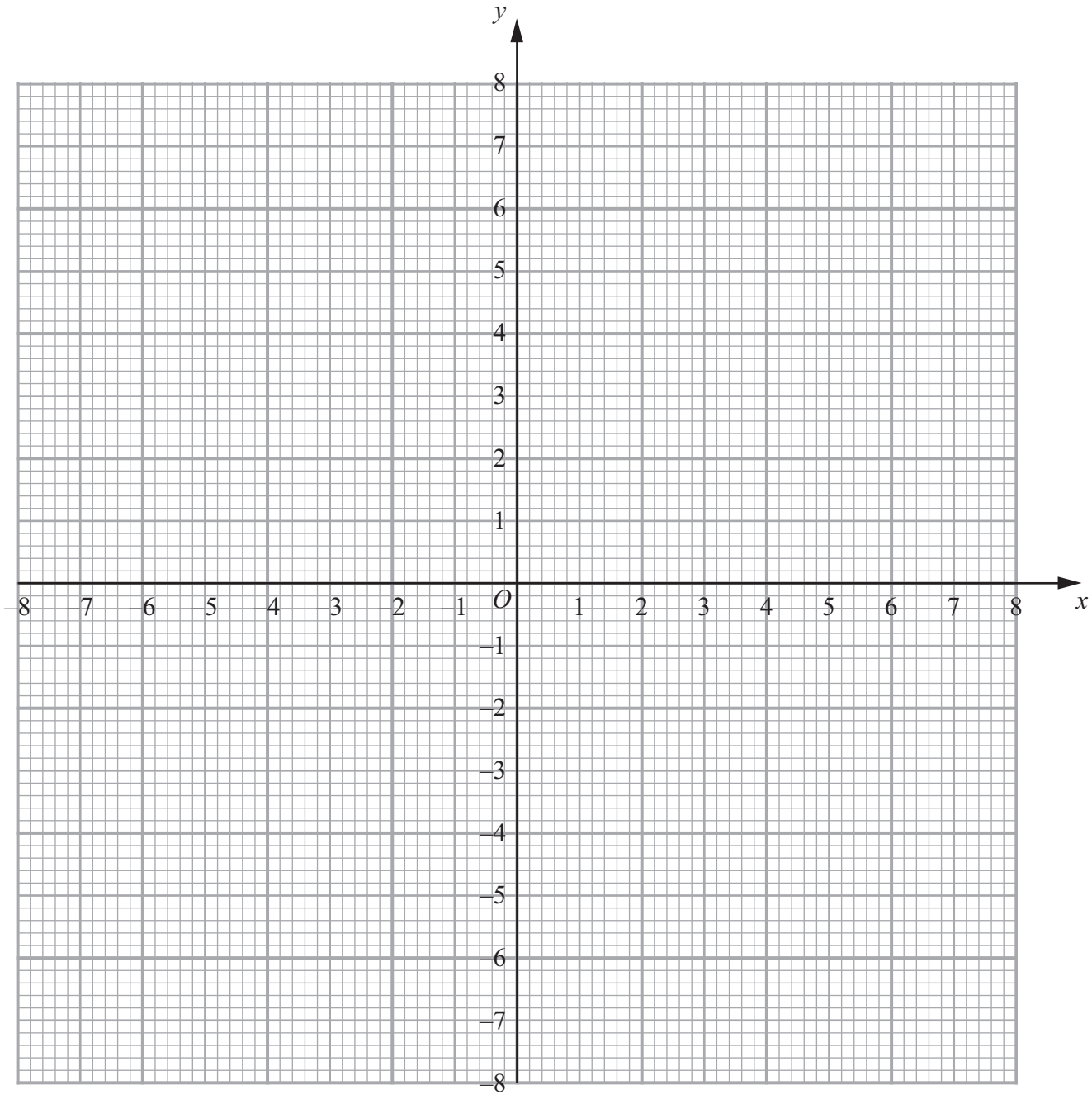
(e) On the grid, draw and label $C$.

**(1)**

(f) Describe fully the single transformation which maps triangle $C$ onto triangle $A$.

**(2)**

**Question 8 continued**



**Question 8 continued**

**Question 8 continued**

**(Total for Question 8 is 9 marks)**

**9** $\mathrm{f}: x \mapsto x^2 - 3x - 6$

$\mathrm{g}: x \mapsto 2 + \dfrac{4}{x}$

(a) Find

(i) f(–4)

(ii) $\mathrm{fg}\left(\dfrac{1}{3}\right)$

**(3)**

(b) State the value of $x$ which must be excluded from any domain of g.

**(1)**

(c) Find the values of $x$ for which $\mathrm{gf}(x) = 0$

**(5)**

(d) Find $\mathrm{g}^{-1}$. Give your answer in the form $\mathrm{g}^{-1}: x \mapsto$ ….

**(4)**

**Question 9 continued**

**Question 9 continued**

**Question 9 continued**

**(Total for Question 9 is 13 marks)**

**10**

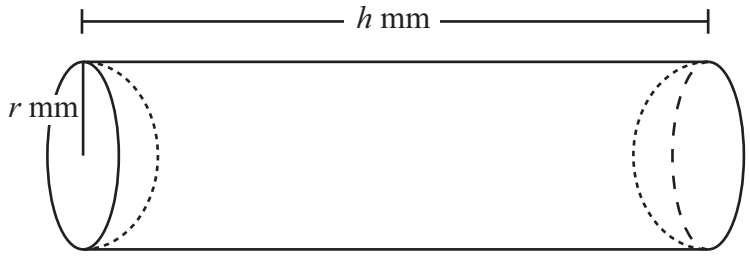



**Figure 4**

A solid $S$ is made by removing a hemisphere of radius $r$ mm from each end of a solid right circular cylinder of radius $r$ mm and length $h$ mm as shown in Figure 4. The volume of the solid $S$ is $V$ mm$^3$.

(a) Find an expression for $V$ in terms of $r$ and $h$.

**(1)**

The sum of the length of the cylinder and its diameter is 20 mm.

(b) Write down a formula for $h$ in terms of $r$.

**(1)**

(c) Hence show that $V = \frac{10\pi}{3}\left(6r^2 - r^3\right)$

**(2)**

**Question 10 continued**

**Question 10 continued**

(d) For $y = 6r^2 - r^3$, complete the table.

| $r$ | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| $6r^2$ | 0 | 6 | | 54 | | | 216 |
| $-r^3$ | 0 | –1 | | –27 | | | –216 |
| $y$ | 0 | 5 | | 27 | | | 0 |

**(3)**

(e) On the grid, plot the points from your completed table and join them to form a smooth curve.

**(3)**

(f) By drawing a suitable straight line on your grid, find the value of $y$ when $r = 3.3$

**(2)**

Given that $V = 180$,

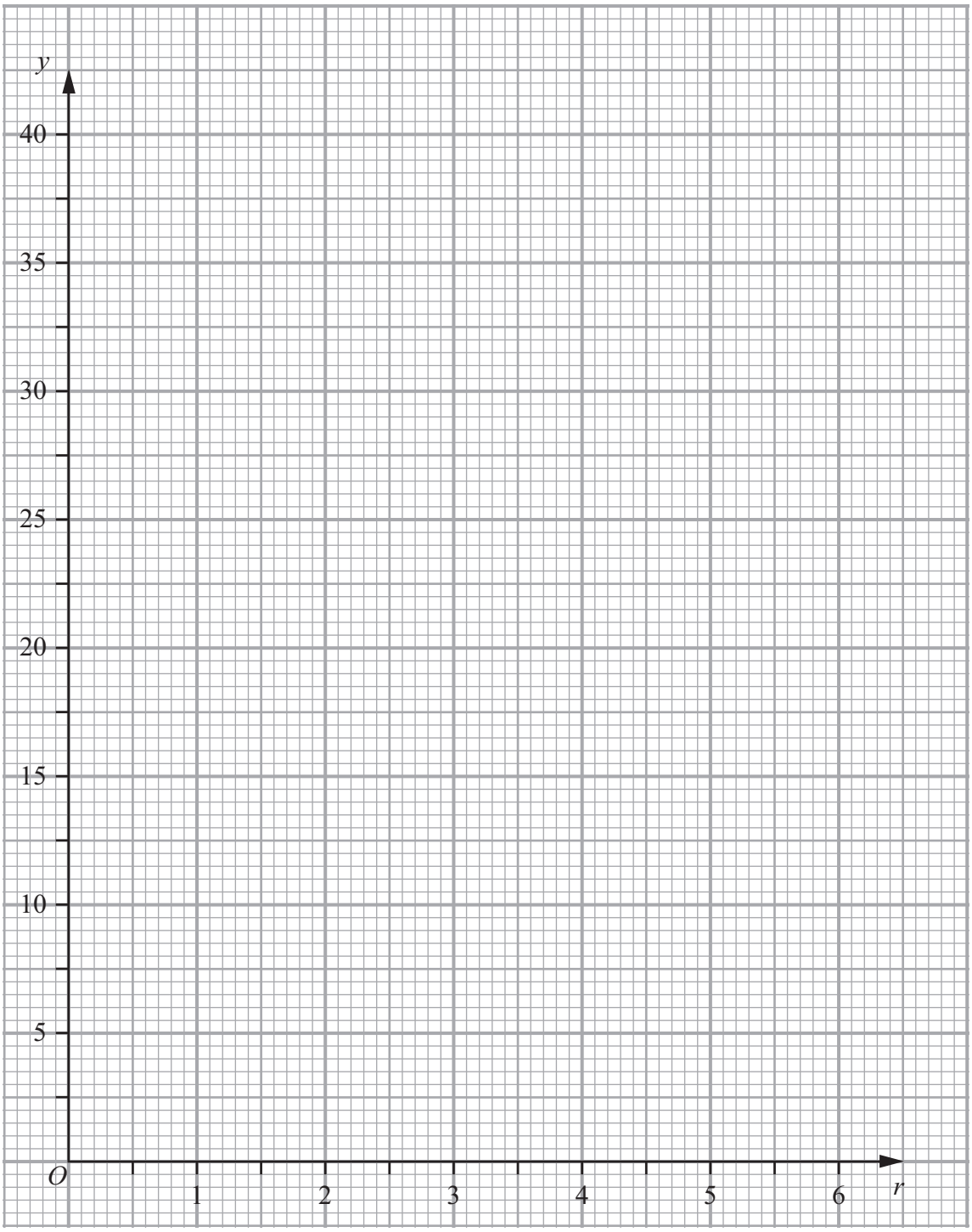
(g) use your graph to find, to one decimal place, the two possible values of $r$.

**(4)**

[Volume of sphere $= \frac{4}{3}\pi r^3$

Area of circle $= \pi r^2$ ]

**Question 10 continued**




**(Total for Question 10 is 16 marks)**

**11**

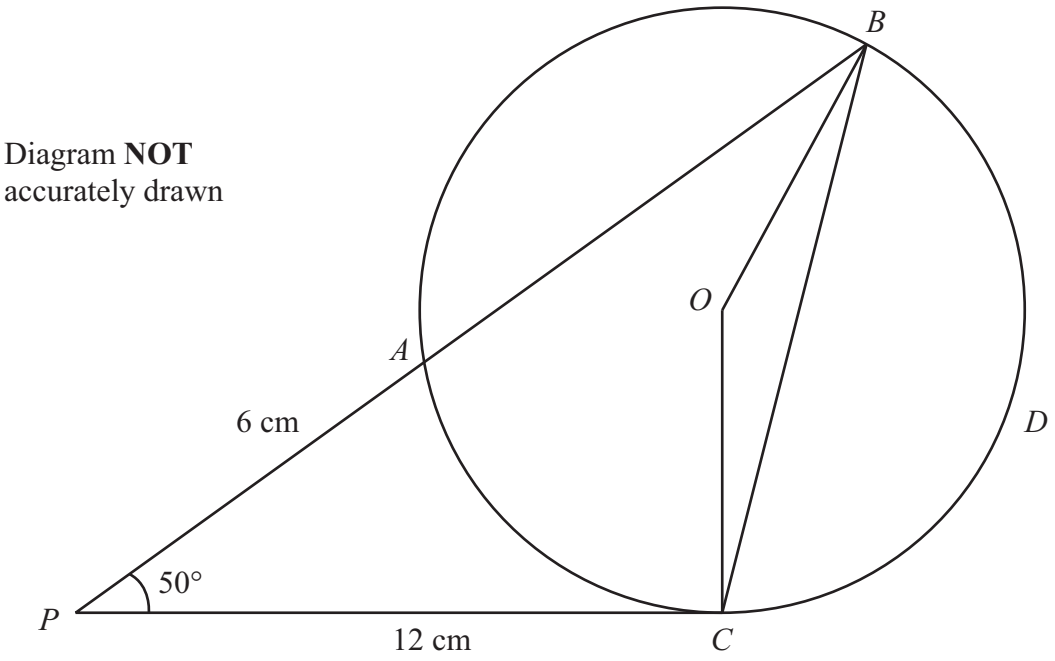



**Figure 5**

In Figure 5, $ABDC$ is a circle with centre $O$. The tangent at $C$ meets $BA$ produced at $P$.

$PA = 6$ cm, $PC = 12$ cm.

(a) Give a reason why $\angle OCP$ is 90°.

**(1)**

(b) Show that $PB = 24$ cm.

**(2)**

Given that $\angle BPC = 50°$ find, giving all your answers to 3 significant figures,

(c) the length, in cm, of $BC$,

**(3)**

(d) the size, in degrees, of $\angle BCO$,

**(4)**

(e) the radius, in cm, of the circle,

**(3)**

(f) the area, in cm$^2$, of the sector $OBDC$.

**(3)**

[Cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$

Sine rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Area of circle = $\pi r^2$]

**Question 11 continued**

**Question 11 continued**

**(Total for Question 11 is 16 marks)**

**TOTAL FOR PAPER IS 100 MARKS**

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