

Centre Number						Candidate Number				
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Candidate Signature										



Level 2 Certificate in Further Mathematics  
June 2014

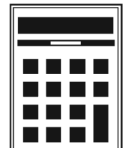
# Further Mathematics

# 8360/2

## Level 2

**Paper 2 Calculator**

**Friday 20 June 2014 9.00 am to 11.00 am**

<p><b>For this paper you must have:</b></p> <ul style="list-style-type: none"> <li>• a calculator</li> <li>• mathematical instruments.</li> </ul>	
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**Time allowed**

- 2 hours

**Instructions**

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

**Information**

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 105.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.
- The use of a calculator is expected but calculators with a facility for symbolic algebra must **not** be used.

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16 – 17	
18 – 19	
20 – 21	
22 – 23	
24 – 25	
26 – 27	
28	
<b>TOTAL</b>	

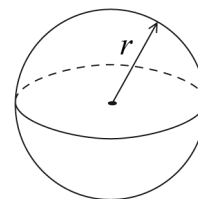


J U N 1 4 8 3 6 0 2 0 1

## Formulae Sheet

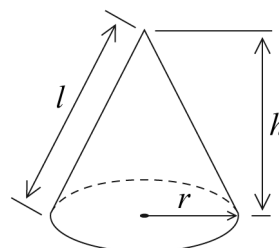
**Volume of sphere**  $= \frac{4}{3}\pi r^3$

**Surface area of sphere**  $= 4\pi r^2$



**Volume of cone**  $= \frac{1}{3}\pi r^2 h$

**Curved surface area of cone**  $= \pi r l$



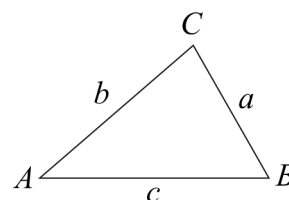
**In any triangle ABC**

**Area of triangle**  $= \frac{1}{2}ab \sin C$

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

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

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$



**The Quadratic Equation**

The solutions of  $ax^2 + bx + c = 0$ , where  $a \neq 0$ , are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

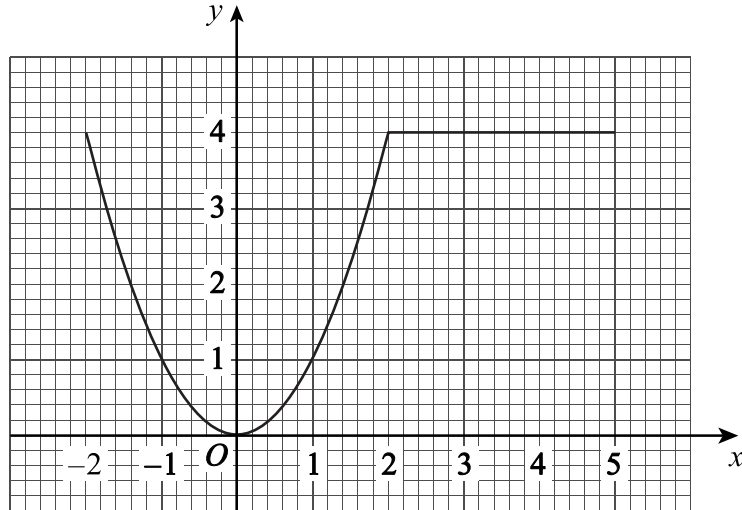
**Trigonometric Identities**

$$\tan \theta \equiv \frac{\sin \theta}{\cos \theta} \quad \sin^2 \theta + \cos^2 \theta \equiv 1$$



Answer **all** questions in the spaces provided.

- 1** The graph of  $y = f(x)$  for the full domain is shown.  
The graph consists of a quadratic curve and a straight line.



Complete the boxes to describe  $f(x)$ .

**[3 marks]**

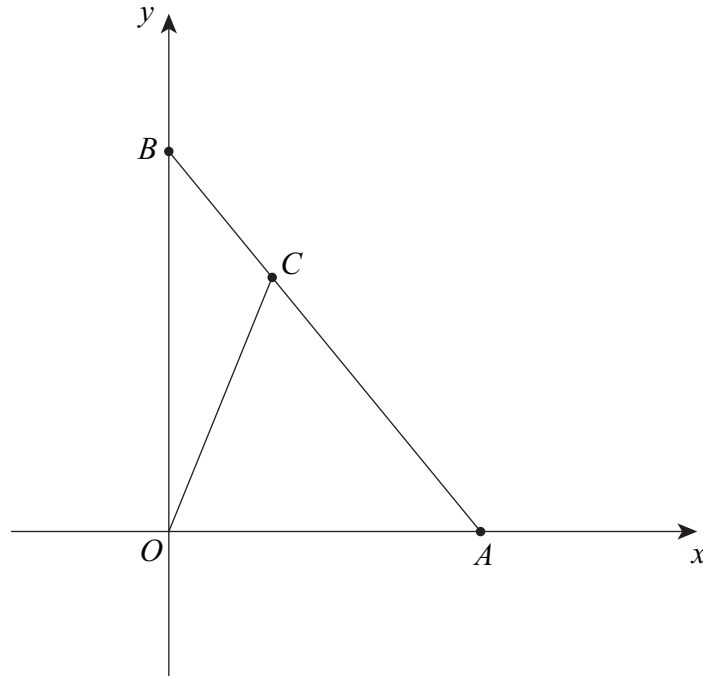
$$f(x) = \boxed{\phantom{000000}} \quad -2 \leq x \leq 2$$

$$= \boxed{\phantom{000000}} \quad 2 < x \leq \boxed{\phantom{000000}}$$

**Turn over for the next question**



- 2 The equation of line  $AB$  is  $y = 12 - 2x$   
The area of triangle  $OCA$  is 24 square units.



Not drawn  
accurately

Work out the coordinates of  $C$ .

[5 marks]

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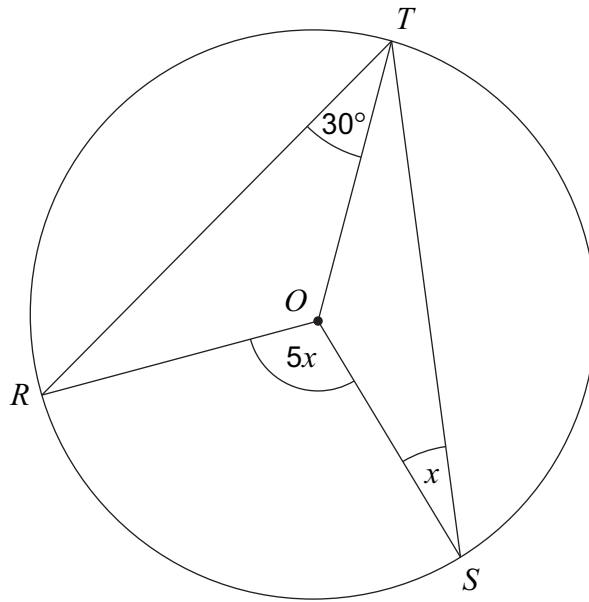
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Answer ( ..... , ..... )



**3**  $R, S$  and  $T$  are on the circumference of a circle, centre  $O$ .



Not drawn  
accurately

**3 (a)** Give a reason why angle  $OTS = x$

[1 mark]

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**3 (b)** Work out the value of  $x$ .

[3 marks]

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 .....

Answer..... degrees

**Turn over for the next question**



4 (a) Expand  $x^2(x - 2)$

[2 marks]

Answer .....

4 (b) A curve has equation  $y = x^2(x - 2)$

Work out the gradient of the curve at the point (3, 9).

[3 marks]

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Answer .....

4 (c) Line  $L$  is the tangent to the curve  $y = x^2(x - 2)$  at the point (3, 9).

Work out the equation of  $L$ .

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

[2 marks]

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Answer .....



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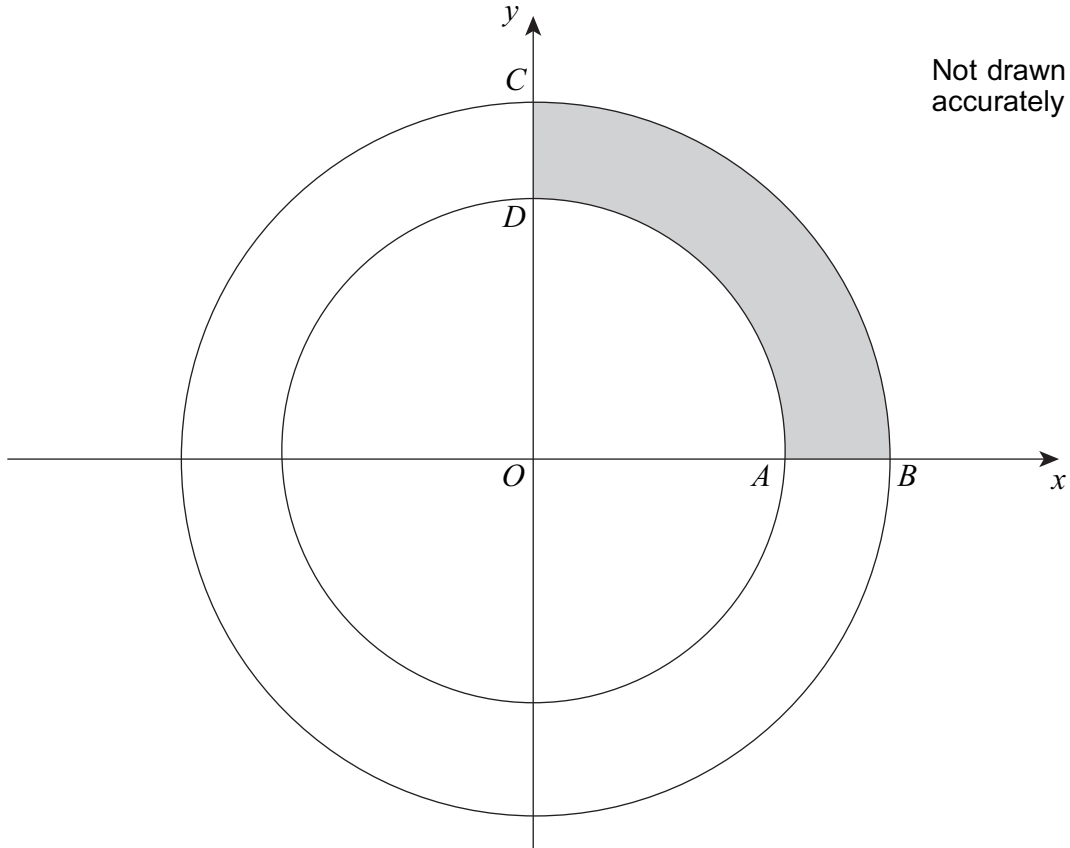
Solve

$$\frac{4c + 3}{2} + \frac{c - 8}{5} = 1$$

**[4 marks]** $c = \dots\dots\dots$ **Turn over for the next question**

6 Two circles, each with centre  $O$ , are shown.  
The equations of the circles are

$$x^2 + y^2 = 289 \quad \text{and} \quad x^2 + y^2 = 121$$



Work out the **perimeter** of the shaded section  $ABCD$ .

**[5 marks]**

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Answer .....





7 (a) Simplify  $\sqrt{x^5 \times x^9}$

Give your answer in the form  $x^p$  where  $p$  is an integer.

[2 marks]

Answer .....

7 (b) Solve  $y^{-3} = 125$

[2 marks]

$y =$  .....

Turn over for the next question

Turn over ►

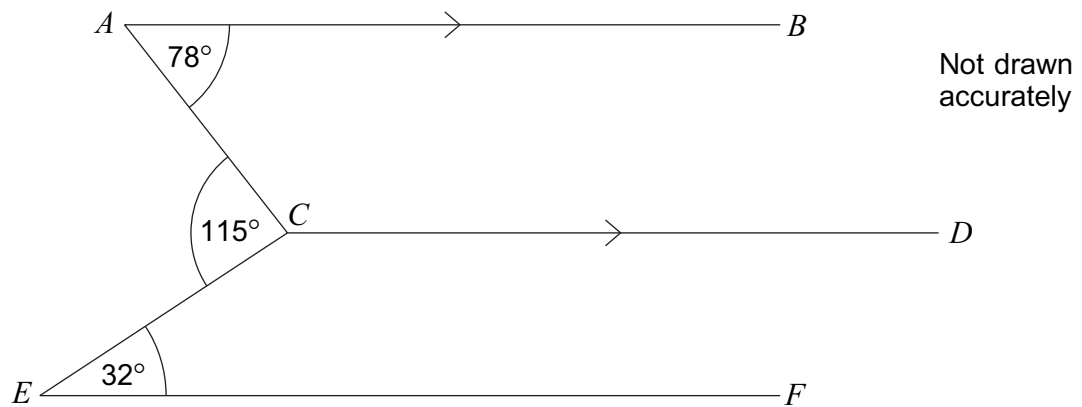


8

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

Show that  $\mathbf{M}^3 = \mathbf{I}$ **[4 marks]**

9



$AB$  is parallel to  $CD$ .

Is  $EF$  parallel to  $CD$ ?  
You **must** show your working.

[3 marks]

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Turn over for the next question

Turn over ►

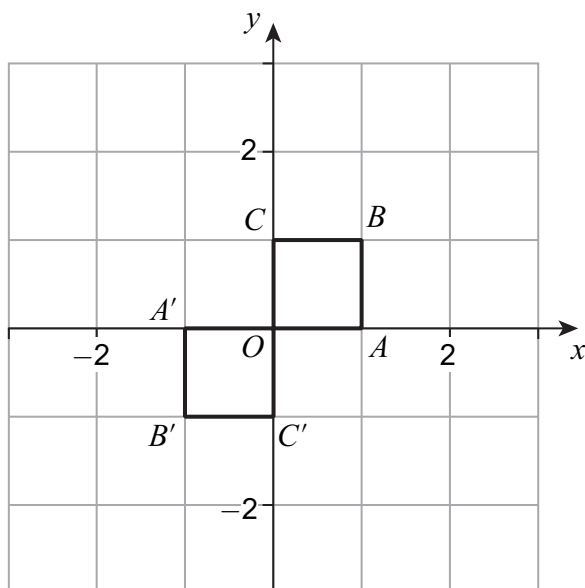
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**10** The unit square  $OABC$  has vertices

$$O(0, 0) \quad A(1, 0) \quad B(1, 1) \quad C(0, 1)$$

**10 (a)**  $OABC$  is mapped to  $OA'B'C'$  under transformation matrix  $\mathbf{M}$ .



Work out matrix  $\mathbf{M}$ .

**[2 marks]**

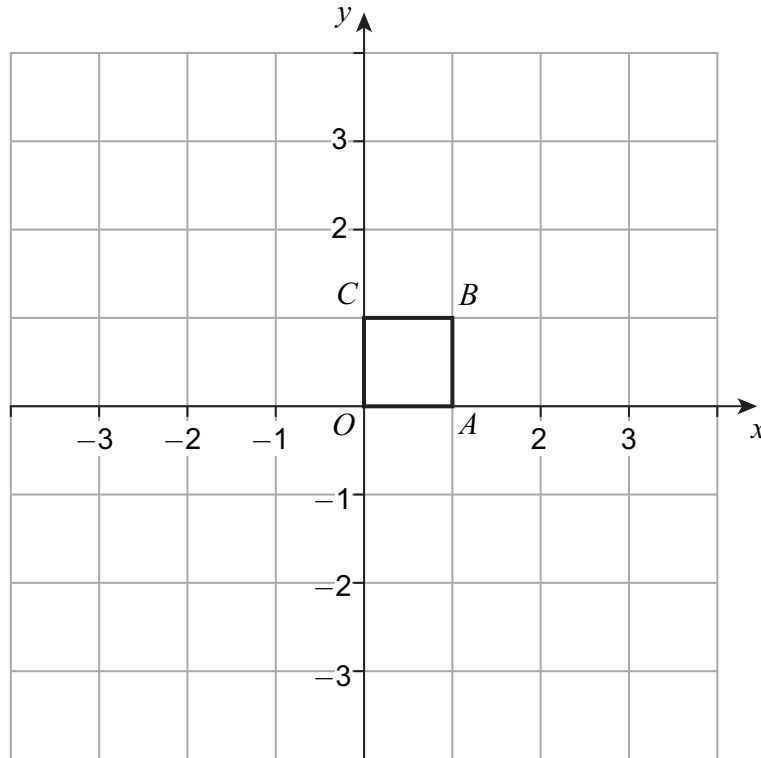
Answer .....



10 (b)  $OABC$  is mapped to  $OA''B''C''$  under transformation matrix  $\begin{pmatrix} -3 & 0 \\ 0 & -3 \end{pmatrix}$

Draw **and** label  $OA''B''C''$  on the diagram below.

[3 marks]



Turn over for the next question



11 (a) Simplify fully  $\frac{8c^7}{15d^6} \div \frac{6c^2}{5d^3}$

[3 marks]

Answer .....

11 (b) Write as a single fraction  $\frac{5}{m+1} + \frac{6}{m-4}$

Give your answer in its simplest form.

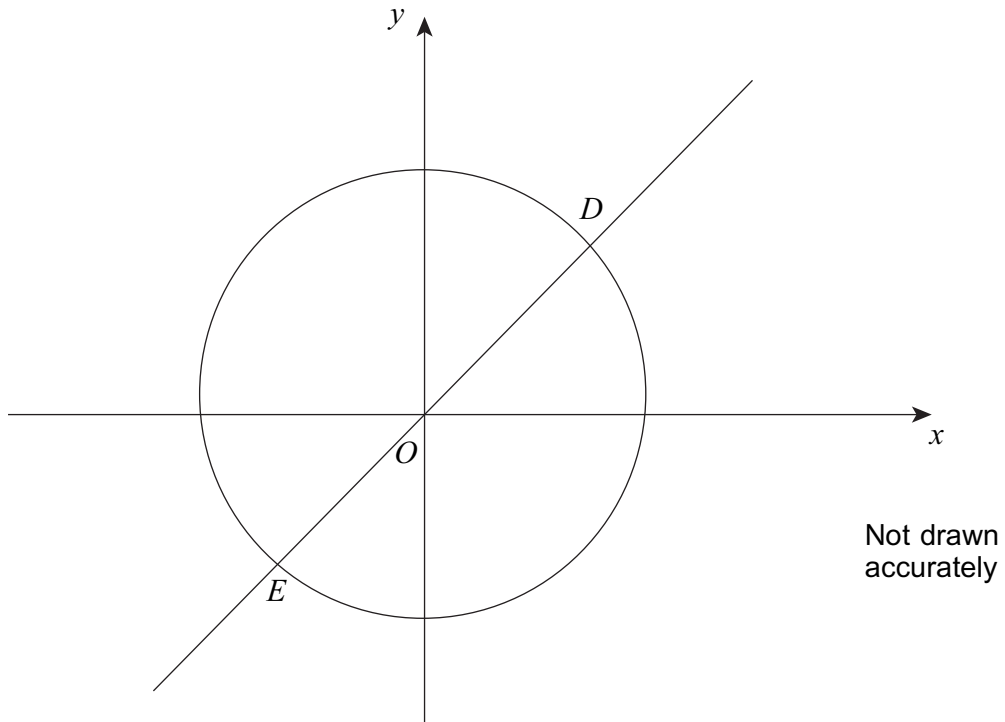
[4 marks]

Answer .....



12

The circle  $x^2 + y^2 = 20$  and the line  $y = 2x$  intersect at points  $D$  and  $E$ .



Work out the coordinates of  $D$  and  $E$ .  
Do **not** use trial and improvement.  
You **must** show your working.

[5 marks]

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$D$  ( ....., ..... )       $E$  ( ....., ..... )

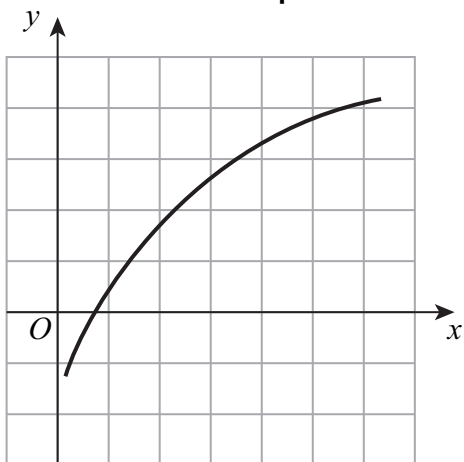
12

Turn over ▶

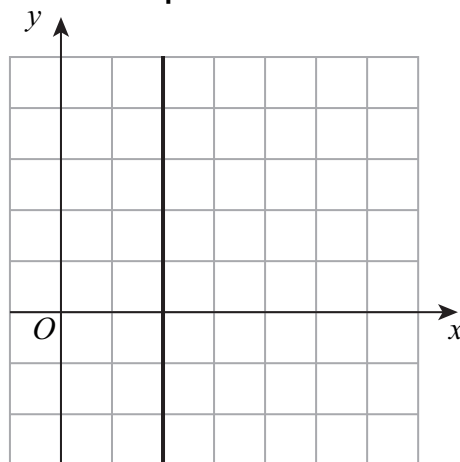


13 Here are five graphs.

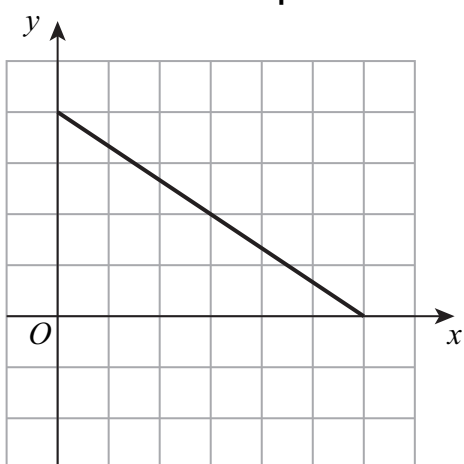
**Graph A**



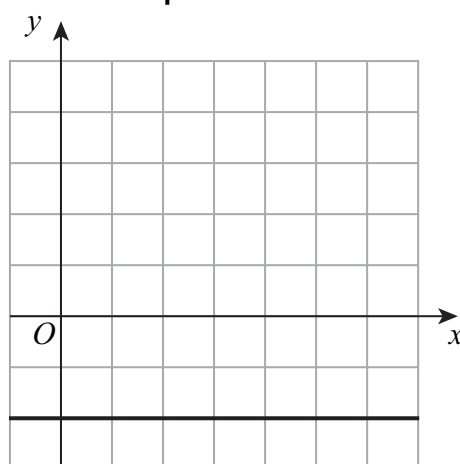
**Graph B**



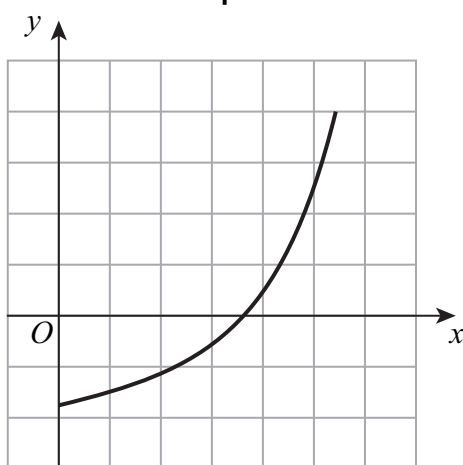
**Graph C**



**Graph D**



**Graph E**





For each of the following statements, decide which graph is being described.  
Circle your answer each time.

**13 (a)** The rate of change of  $y$  with respect to  $x$  is always negative.

[1 mark]

*A*            *B*            *C*            *D*            *E*

**13 (b)** The rate of change of  $y$  with respect to  $x$  is always zero.

[1 mark]

*A*            *B*            *C*            *D*            *E*

**13 (c)** As  $x$  increases, the rate of change of  $y$  with respect to  $x$  decreases.

[1 mark]

*A*            *B*            *C*            *D*            *E*

**Turn over for the next question**



14 Rearrange  $x = \frac{2w + 1}{5 - 3w}$  to make  $w$  the subject.

[4 marks]

Answer .....



**15 (a)** The  $n$ th term of a sequence is  $n^2 + 12n + 27$

By factorising, or otherwise, show that the 20th term can be written as the product of two prime numbers.

**[2 marks]**

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**15 (b)** The  $n$ th term of a different sequence is  $n^2 - 6n + 14$

By completing the square, or otherwise, show that every term is positive.

**[3 marks]**

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**Turn over for the next question**

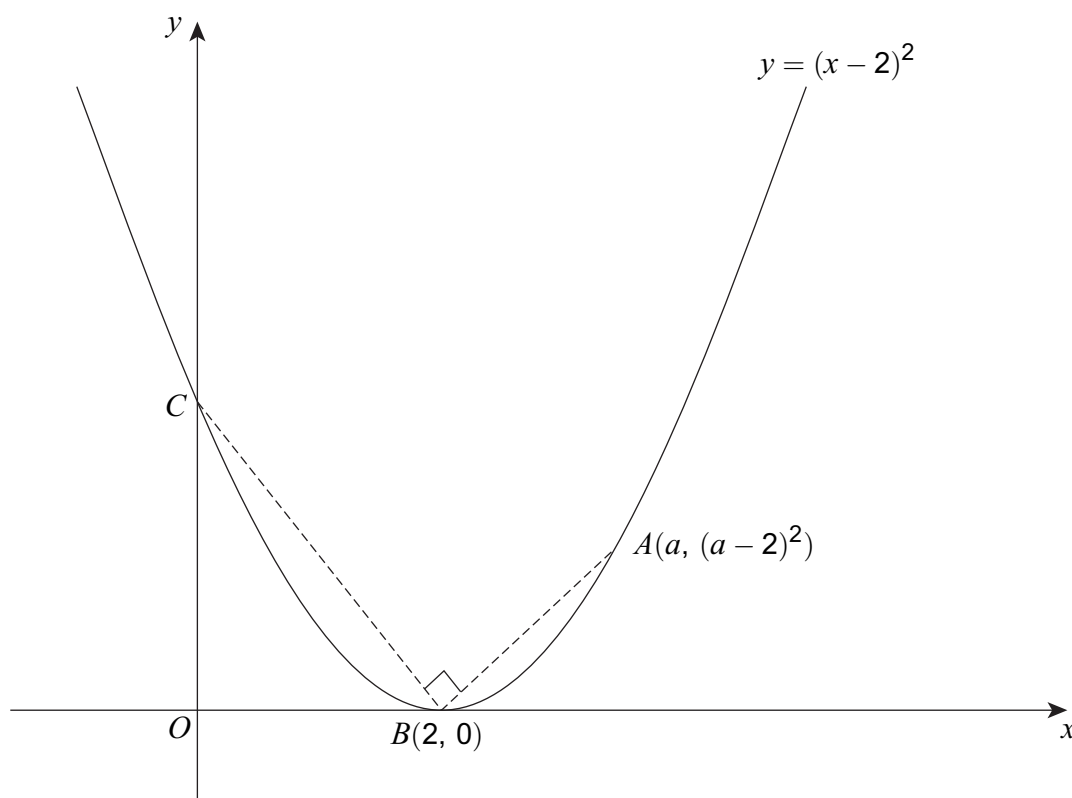


16 (a) Simplify  $\frac{(a-2)^2}{a-2}$

[1 mark]

Answer .....

16 (b) Here is a sketch of the curve  $y = (x-2)^2$



- The curve touches the  $x$ -axis at  $B$  and intersects the  $y$ -axis at  $C$ .
- Angle  $ABC$  is  $90^\circ$ .
- The curve passes through  $A(a, (a-2)^2)$



Work out the value of  $a$ .

[5 marks]

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Answer .....

**Turn over for the next question**

**Turn over** ►

6
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17 (a) Factorise fully  $12c^2d - 9d^2$

[2 marks]

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Answer .....

17 (b) Factorise fully  $(w + 4)^3 - (w + 4)^2(w + 1)$

[3 marks]

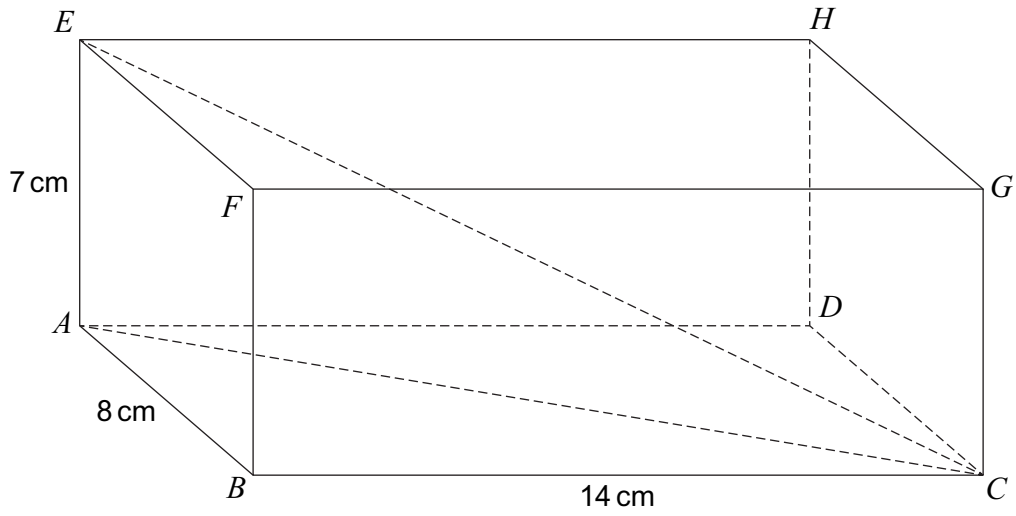
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Answer .....



18

*ABCDEFGH* is a cuboid.



Work out the angle between *EC* and *ABCD*.

[3 marks]

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Answer..... degrees

8
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Turn over ►

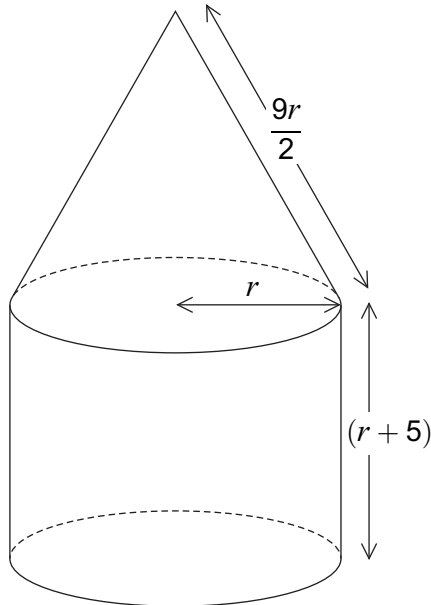


19

On this diagram all lengths are given in centimetres.  
A cylinder and cone are joined together to make a solid.

The cylinder has radius  $r$  and height  $(r + 5)$

The cone has radius  $r$  and slant height  $\frac{9r}{2}$



19 (a)

Show that the **total** surface area of the solid, in  $\text{cm}^2$ , is  $\frac{5\pi r}{2}(3r + 4)$

[4 marks]

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**19 (b)** The total surface area of the solid is  $1200\pi \text{ cm}^2$

Work out the value of  $r$ .

**[5 marks]**

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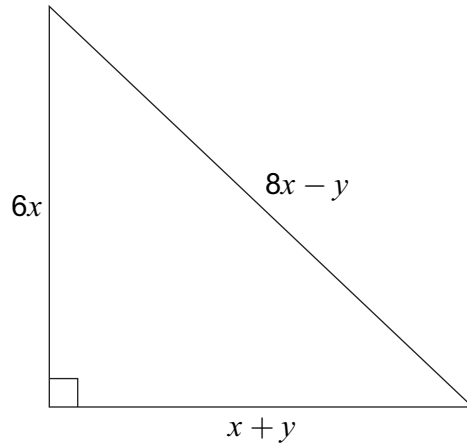
Answer .....

**Turn over for the next question**



20

The diagram shows a right-angled triangle.



Not drawn  
accurately

Prove algebraically that  $x : y = 2 : 3$

[6 marks]

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21 Solve  $16 \sin^2 x = 1$  for  $0^\circ \leq x \leq 270^\circ$

[5 marks]

Answer .....

Turn over for the next question



22

The curve  $y = f(x)$  has  $\frac{dy}{dx} = kx(x - 3)^3$  where  $k$  is a **negative** constant.

There is a stationary point at  $x = 3$

Determine the nature of this stationary point.  
You **must** show your working.

[3 marks]

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Answer .....

**END OF QUESTIONS**

