Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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	
TOTAL	

AQA

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

For this paper you must have:
- a calculator
- mathematical instruments.

Time allowed
- 2 hours

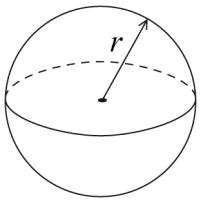
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this 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.

Formulae Sheet

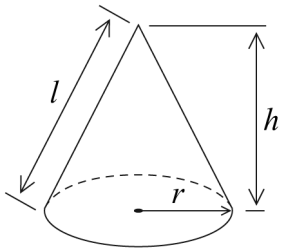
Volume of sphere $= \frac{4}{3}\pi r^3$

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



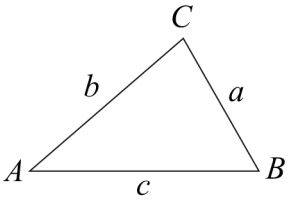
Volume of cone $= \frac{1}{3}\pi r^2 h$

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



In any triangle ABC

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



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

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

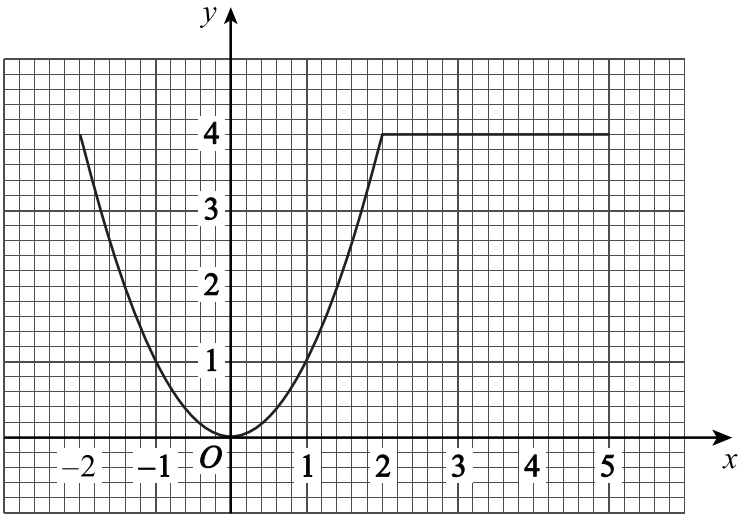
$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

Trigonometric Identities

$\tan\theta \equiv \dfrac{\sin\theta}{\cos\theta}$ $\qquad \sin^2\theta + \cos^2\theta \equiv 1$

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]

$f(x) =$ ☐ $\quad -2 \leqslant x \leqslant 2$

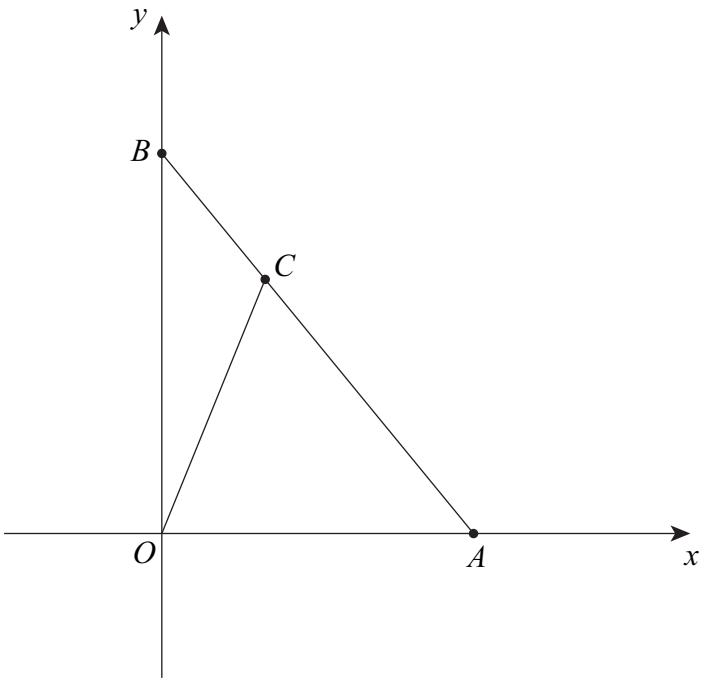
$=$ ☐ $\quad 2 < x \leqslant$ ☐

Turn over for the next question

3

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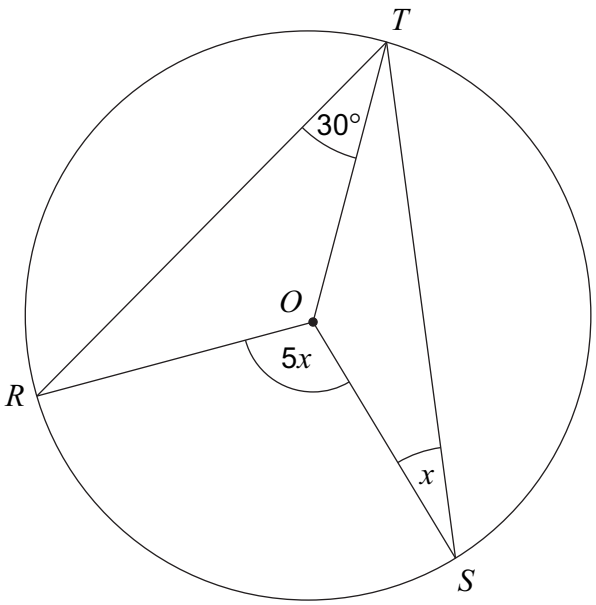
Answer (..... , ...)

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



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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

9

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 .....

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

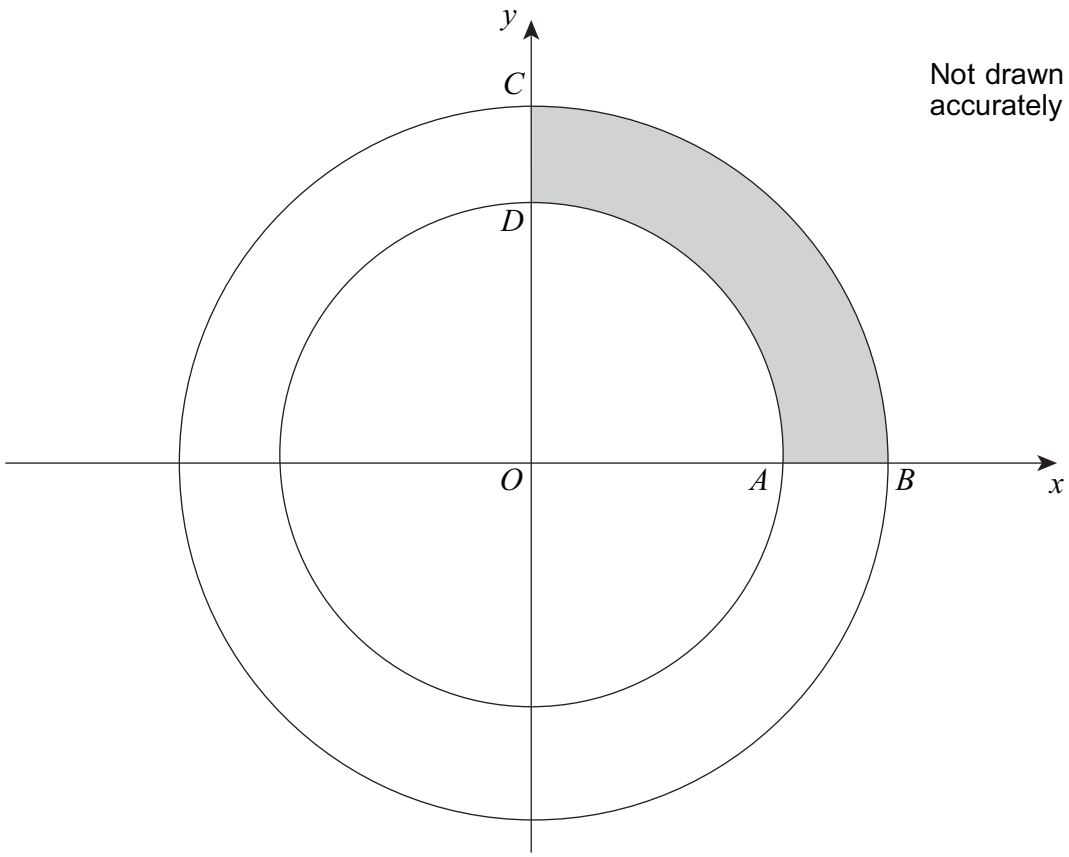
[4 marks]

$c =$ .....

Turn over for the next question

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

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



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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]

$y =$ .....

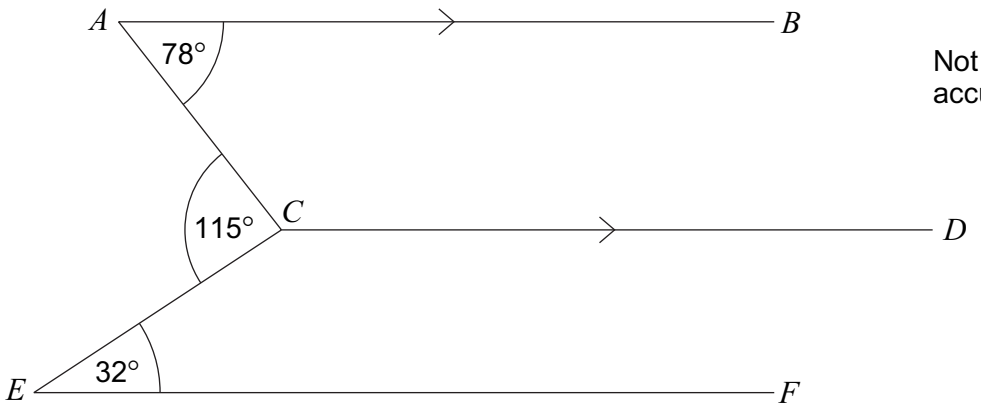
Turn over for the next question

8 $\mathbf{M} = \begin{pmatrix} -2 & -1 \\ 3 & 1 \end{pmatrix}$

Show that $\mathbf{M}^3 = \mathbf{I}$

[4 marks]

9



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AB is parallel to CD.

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

[3 marks]

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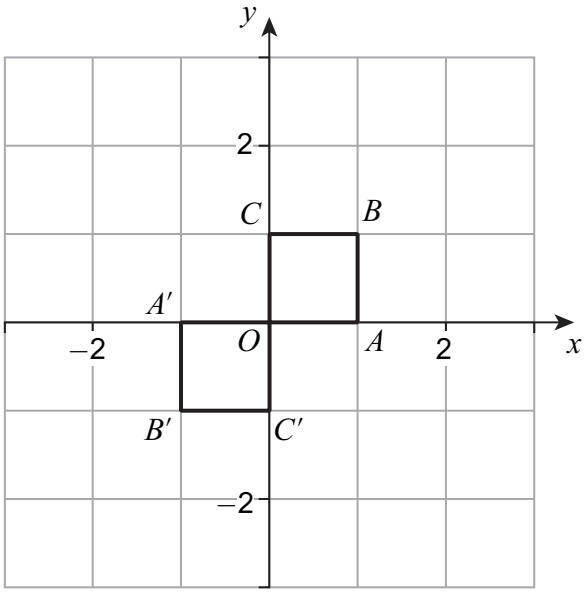
Turn over for the next question

7

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 **M**.



Work out matrix **M**.

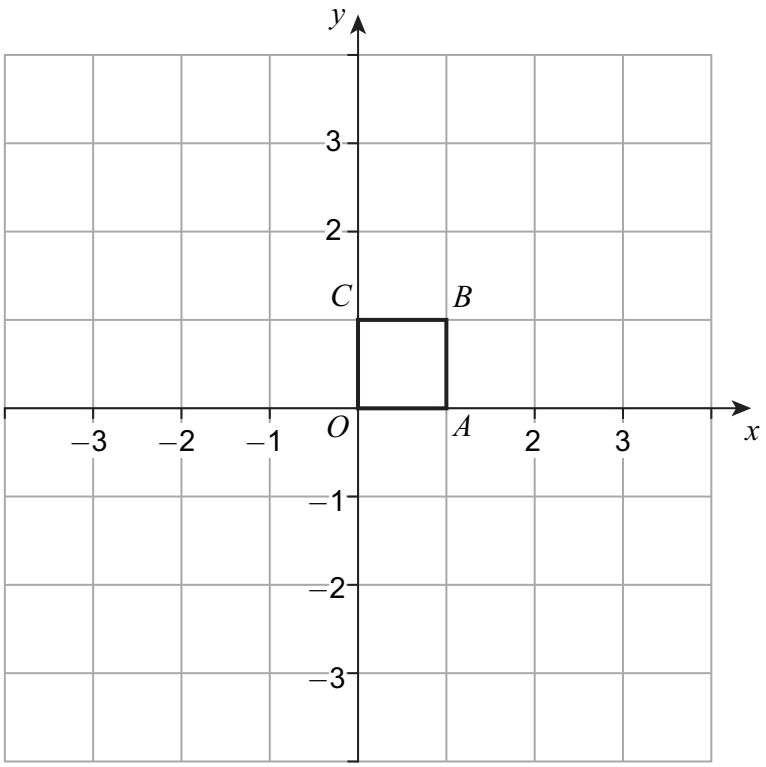
[2 marks]

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

5

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

[3 marks]

Answer .....

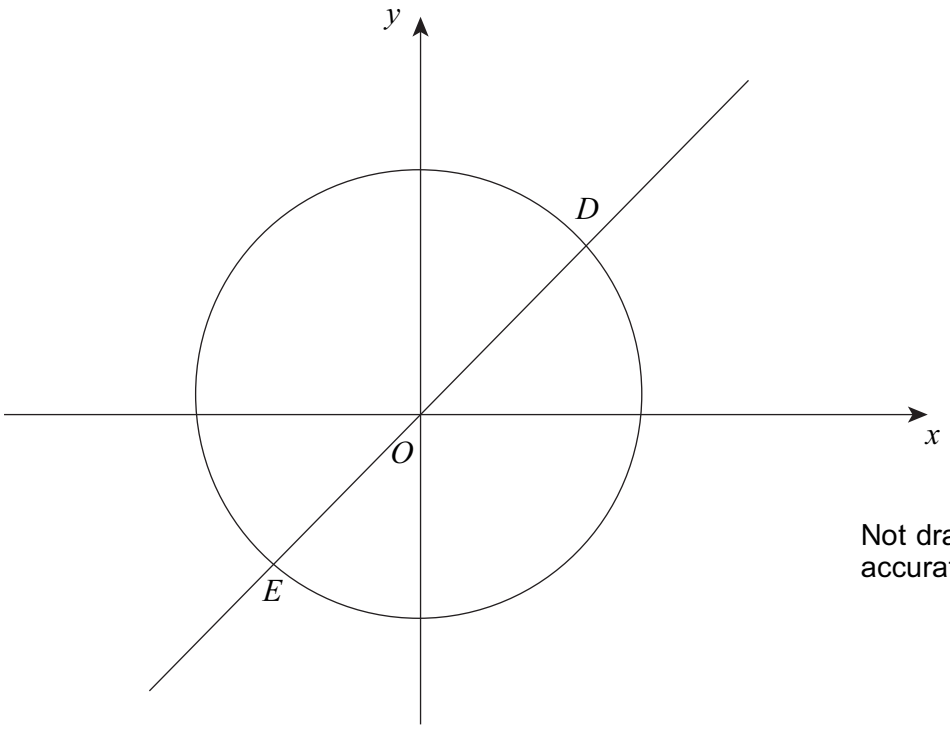
11 (b) Write as a single fraction $\frac{5}{m+1} + \frac{6}{m-4}$

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.



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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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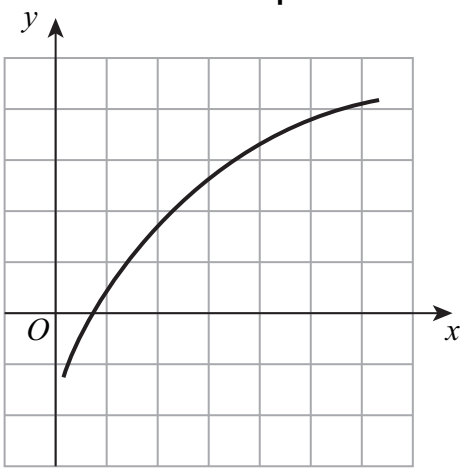
$D\left(\text{.....}, \text{.....}\right)$ $E\left(\text{.....}, \text{.....}\right)$

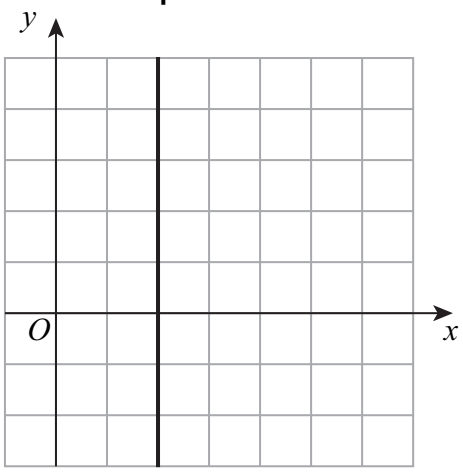
12

13 Here are five graphs.

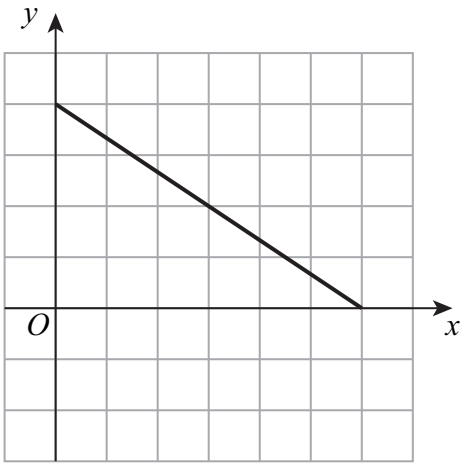
Graph *A*



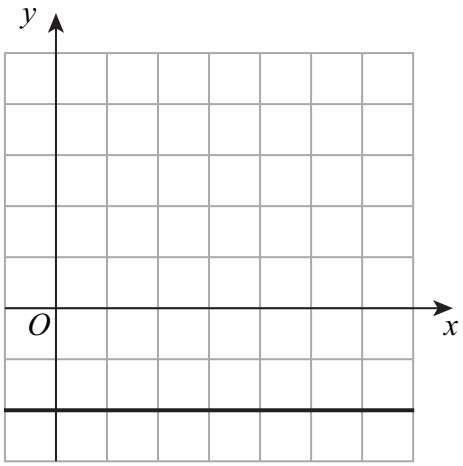
Graph *B*



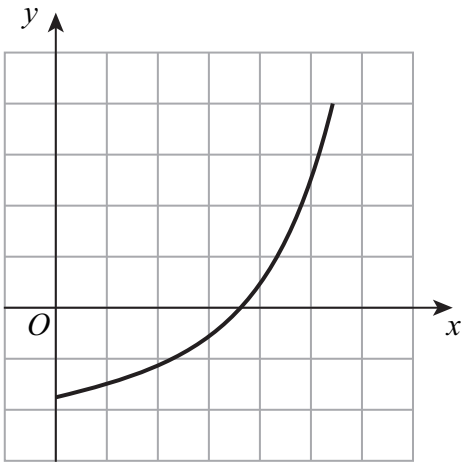
Graph *C*



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

3

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

[4 marks]

Answer .....

15 (a) The nth 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 nth 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

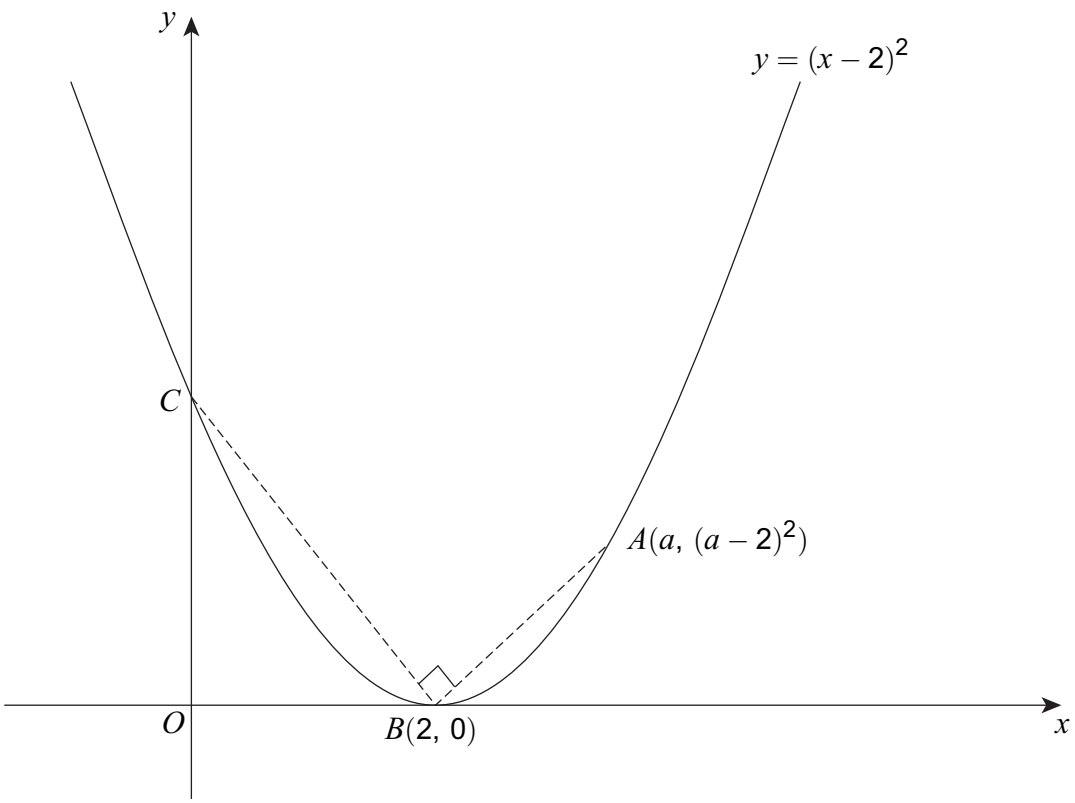
9

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

[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°.
- 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

6

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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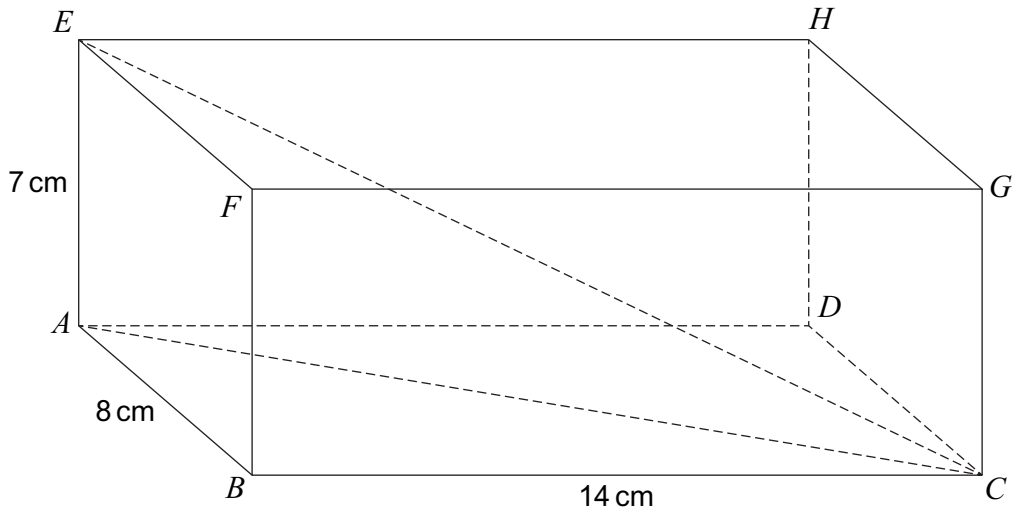
Answer .....

18 $ABCDEFGH$ is a cuboid.



Work out the angle between EC and $ABCD$.

[3 marks]

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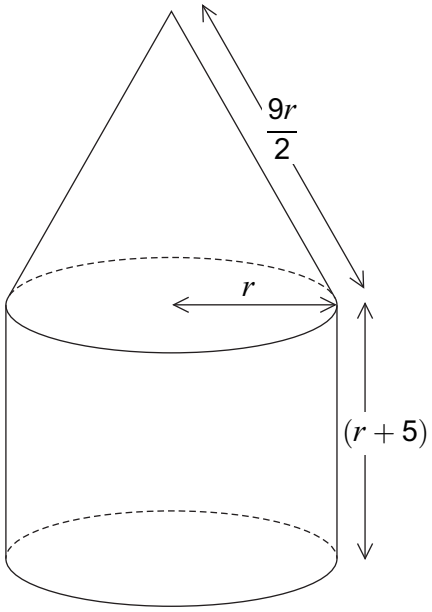
Answer..... degrees

8

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 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 1200π cm^2

Work out the value of r.

[5 marks]

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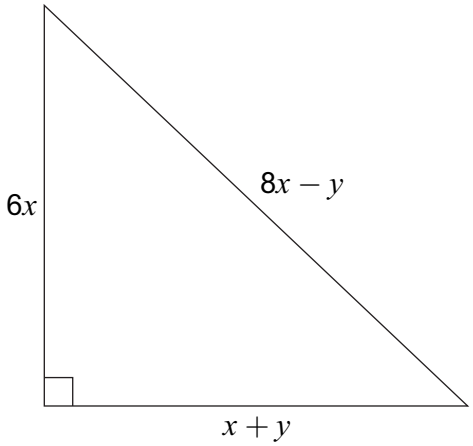
Answer .....

Turn over for the next question

9

20 The diagram shows a right-angled triangle.



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

[6 marks]

21 Solve $16\sin^2 x = 1$ for $0° \leqslant x \leqslant 270°$

[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

3