

Centre Number						Candidate Number				
Surname										
Other Names										
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>For this paper you must have:</p> <ul style="list-style-type: none"> • a calculator • mathematical instruments. 	
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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	
TOTAL	

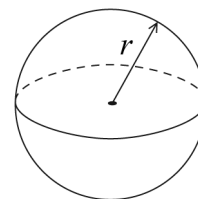


J U N 1 4 8 3 6 0 2 0 1

Formulae Sheet

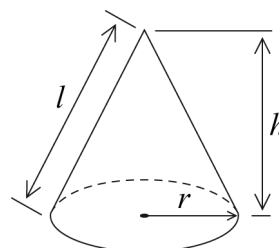
Volume of sphere $= \frac{4}{3}\pi r^3$

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



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

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



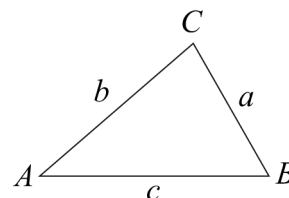
In any triangle ABC

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

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

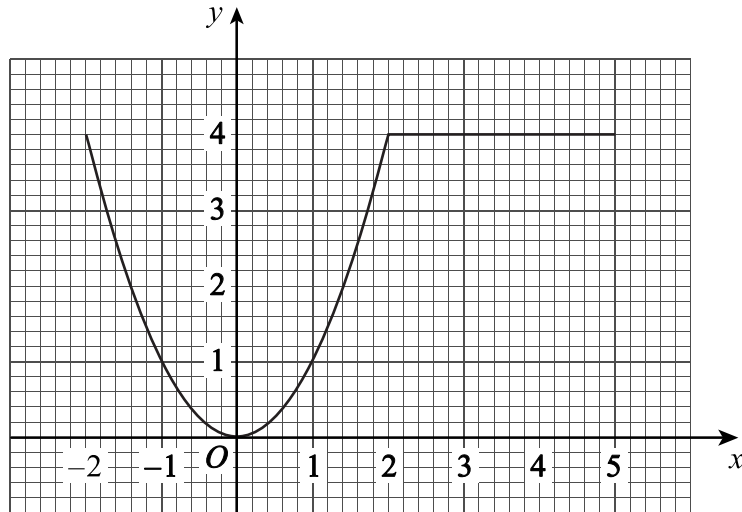
Trigonometric Identities

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



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]

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

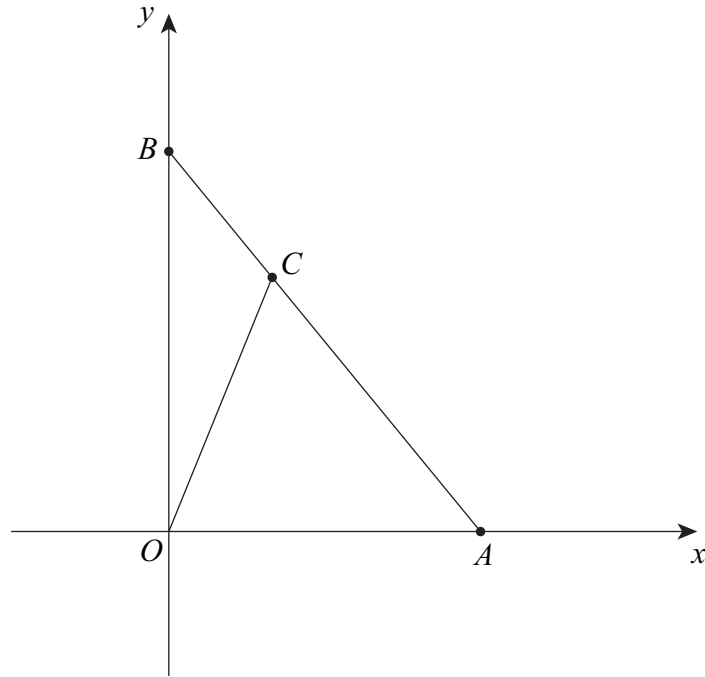
$$= \boxed{} \quad 2 < x \leq \boxed{}$$

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.



Work out the coordinates of C .

[5 marks]

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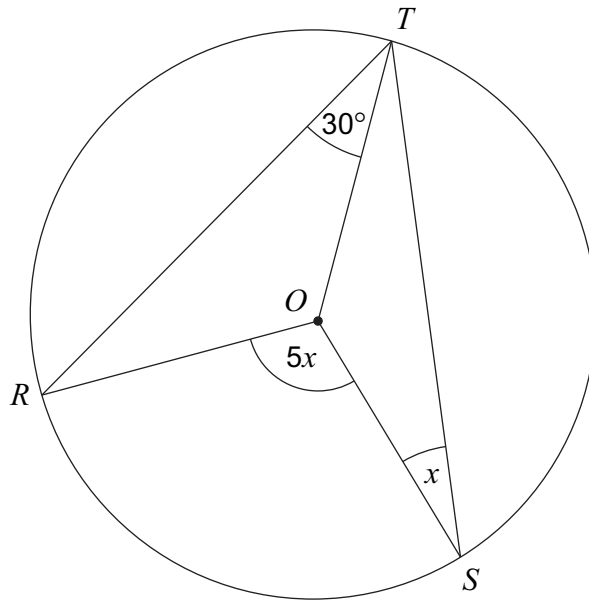
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Answer (..... ,)



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



5

Solve

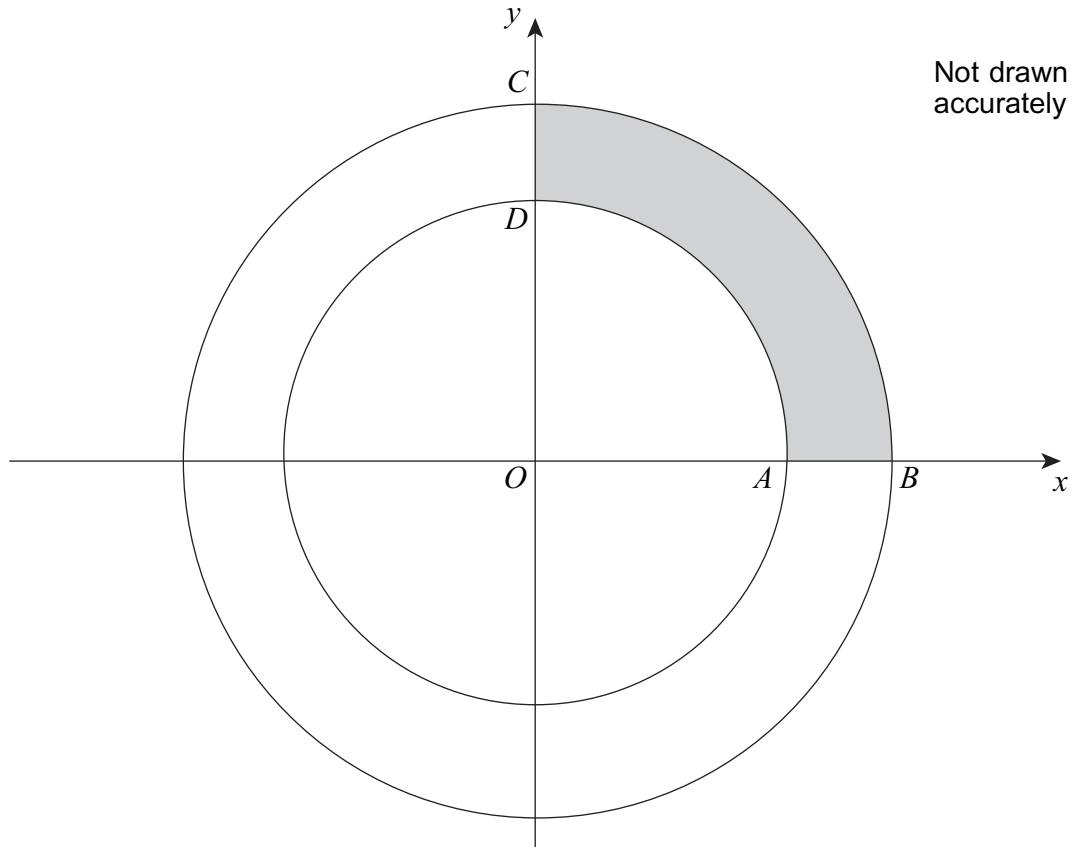
$$\frac{4c + 3}{2} + \frac{c - 8}{5} = 1$$

[4 marks]

 $c = \dots\dots\dots$ **Turn over for the next question****Turn over ►**

- 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



8

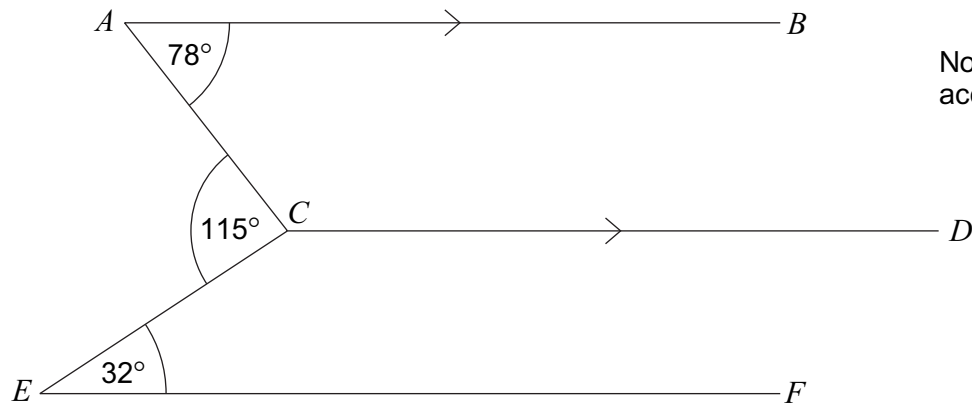
$$\mathbf{M} = \begin{pmatrix} -2 & -1 \\ 3 & 1 \end{pmatrix}$$

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

[4 marks]



9



Not drawn accurately

AB is parallel to CD .

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

[3 marks]

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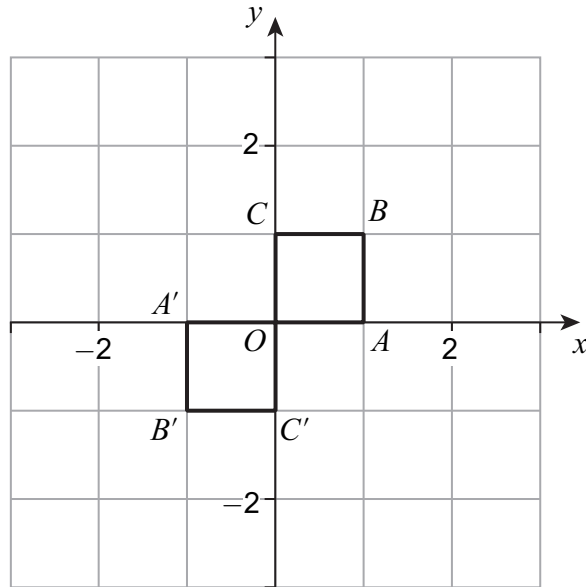
Turn over for the next question



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]

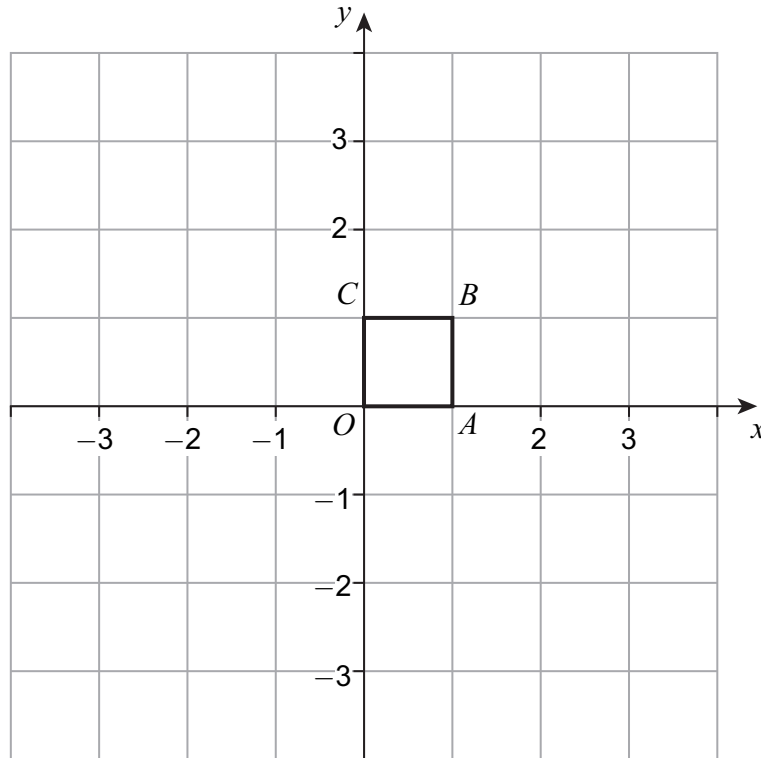
Answer



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]

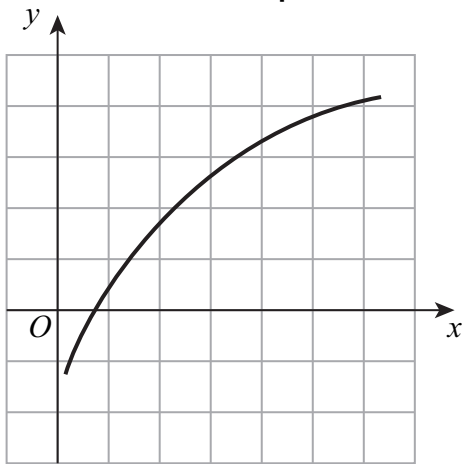
Answer



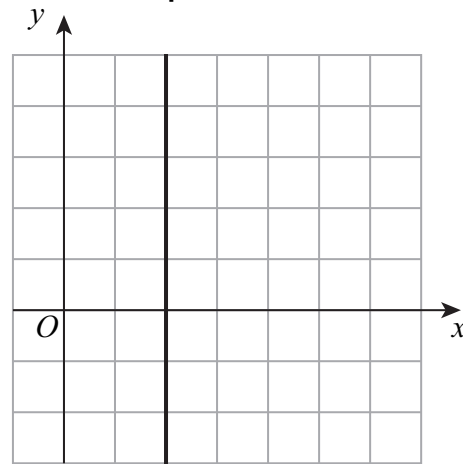
13

Here are five graphs.

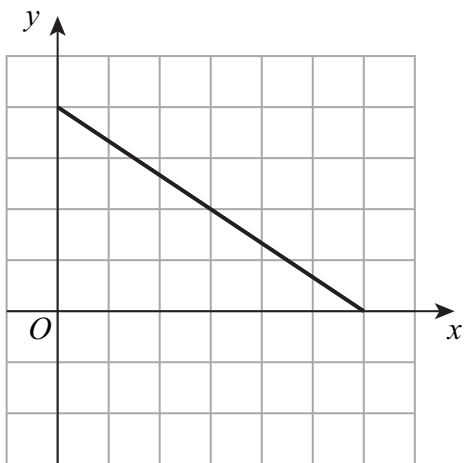
Graph A



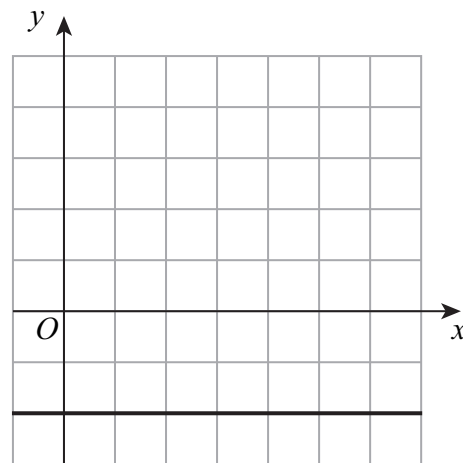
Graph B



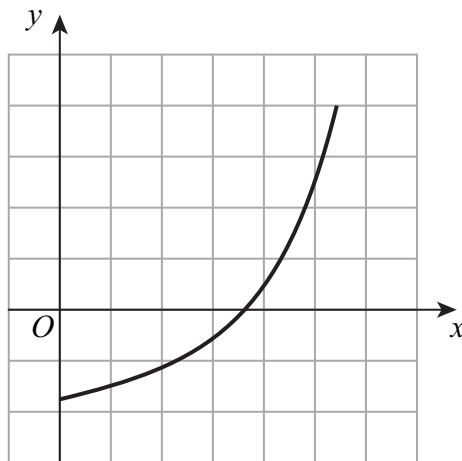
Graph C



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

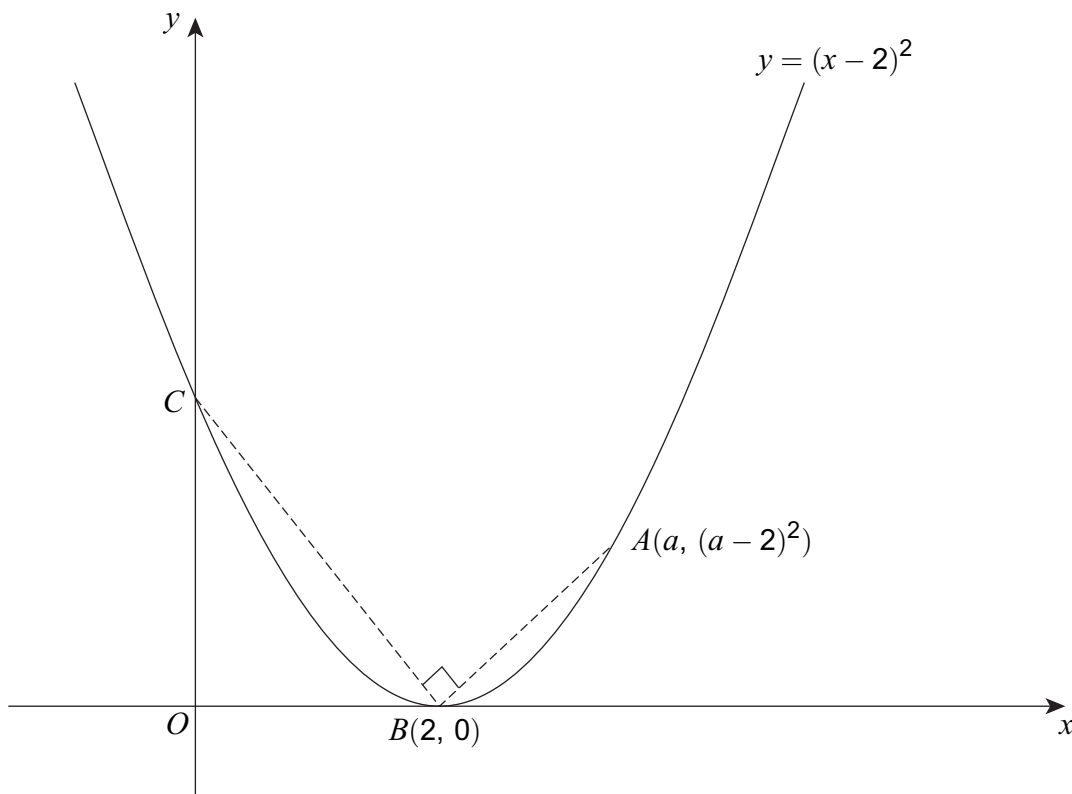


16 (a) Simplify $\frac{(a-2)^2}{a-2}$

[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° .
- 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



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]

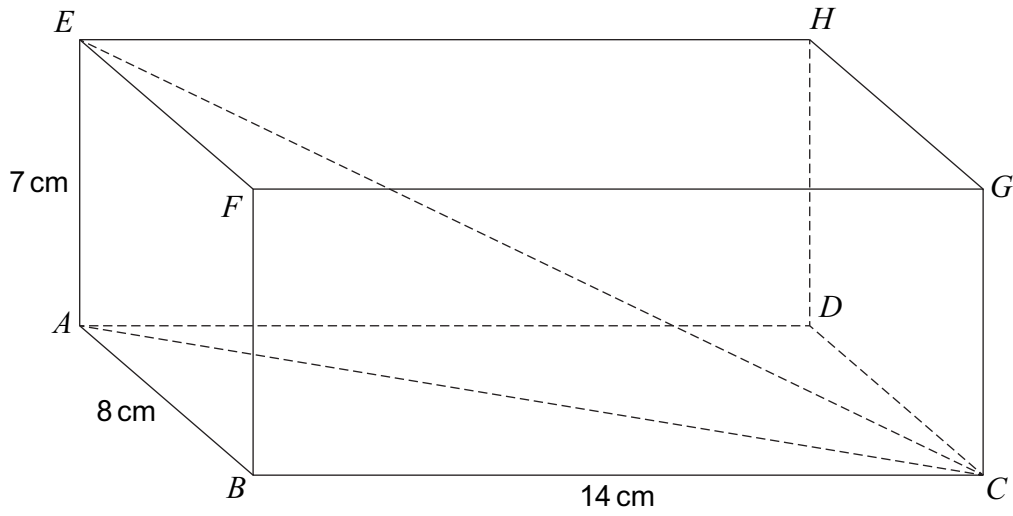
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Answer



18

$ABCDEFGH$ is a cuboid.



Work out the angle between EC and $ABCD$.

[3 marks]

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Answer..... degrees



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

Turn over ►



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

