



Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

Level 2 Certificate

FURTHER MATHEMATICS

Paper 2 Calculator

Monday 19 June 2017

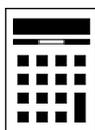
Morning

Time allowed: 2 hours

Materials

For this paper you must have:

- a calculator
- mathematical instruments.



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 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

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 – 29	
30	
TOTAL	

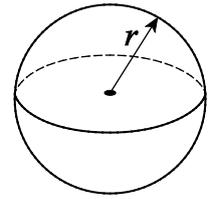


J U N 1 7 8 3 6 0 2 0 1

Formulae Sheet

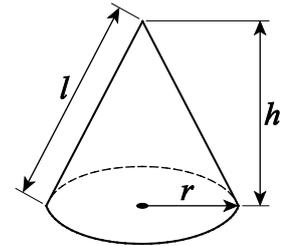
$$\text{Volume of sphere} = \frac{4}{3} \pi r^3$$

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



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

$$\text{Curved surface area of cone} = \pi r l$$



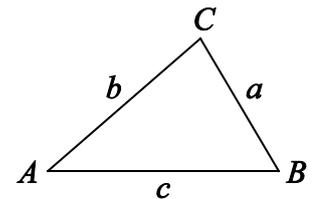
In any triangle ABC

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

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

$$\text{Cosine rule} \quad a^2 = b^2 + c^2 - 2bc \cos A$$

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



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 (a) The n th term of a sequence is $\frac{3-5n}{2}$

Work out the difference between the 20th term and the 8th term.

[2 marks]

Answer _____

1 (b) The n th term of another sequence is $\frac{3n}{1-2n}$

Write down the limiting value of the sequence as $n \rightarrow \infty$

[1 mark]

Answer _____

Turn over for the next question



$$2 \quad \mathbf{A} = \begin{pmatrix} 4 & -1 \\ 3 & -2 \end{pmatrix} \quad \mathbf{B} = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$$

2 (a) Work out \mathbf{A}^2

[2 marks]

Answer _____

2 (b) $k\mathbf{B} = \begin{pmatrix} 11-3k \\ 11-6k \end{pmatrix}$ where k is a constant.

Work out the value of k .

[2 marks]

Answer _____



2 (c) Give a reason why it is **not** possible to work out **BA**

[1 mark]

Turn over for the next question

5

Turn over ►



3 (a) p , q and r are all integers greater than 1

$$pqr = 1365$$

Work out one possible set of values for p , q and r .

[2 marks]

$$p = \underline{\hspace{2cm}} \quad q = \underline{\hspace{2cm}} \quad r = \underline{\hspace{2cm}}$$

3 (b) a and b are both **square** numbers greater than 1

$ab - 11b$ is also a **square** number.

By factorising $ab - 11b$, work out one possible pair of values for a and b .
You **must** show your working.

[2 marks]

$$a = \underline{\hspace{2cm}} \quad b = \underline{\hspace{2cm}}$$



4 Solve $\frac{56}{\sqrt[3]{x}} = 4$

[2 marks]

$x =$ _____

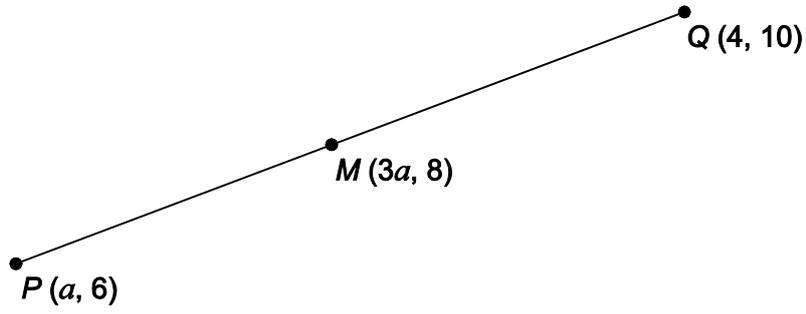
Turn over for the next question

6

Turn over ►



5 M is the midpoint of PQ .



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accurately

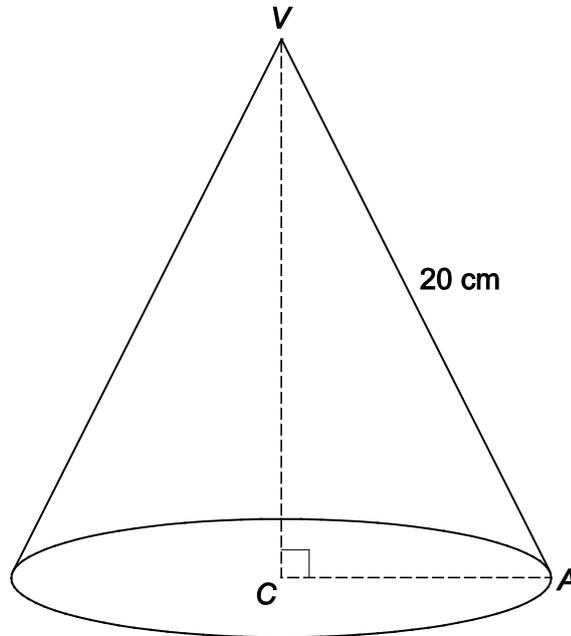
Work out the value of a .

[3 marks]

Answer _____



- 6 A cone has vertex V .
 C is the centre of the base.
The slant height, VA , is 20 cm
The angle between VA and VC is 38°



Work out the radius of the base.

[3 marks]

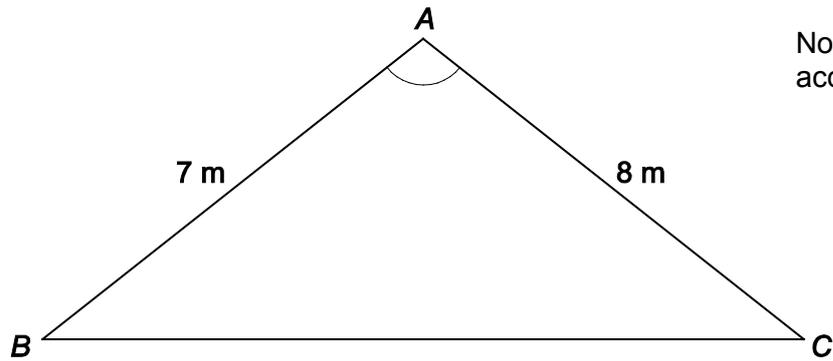
Answer _____ cm

6

Turn over ►



8 The perimeter of a triangular flower bed, ABC , is marked out using 27 metres of rope.



Work out the size of angle BAC .

[4 marks]

Answer _____ degrees

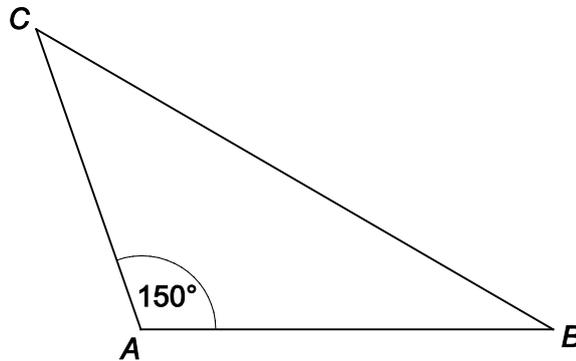
Turn over for the next question



10

ABC is an isosceles triangle with $AB = AC$

The area of ABC is 57.76 cm^2



Not drawn
accurately

Work out the length of AB .

[3 marks]

Answer _____ cm

Turn over for the next question

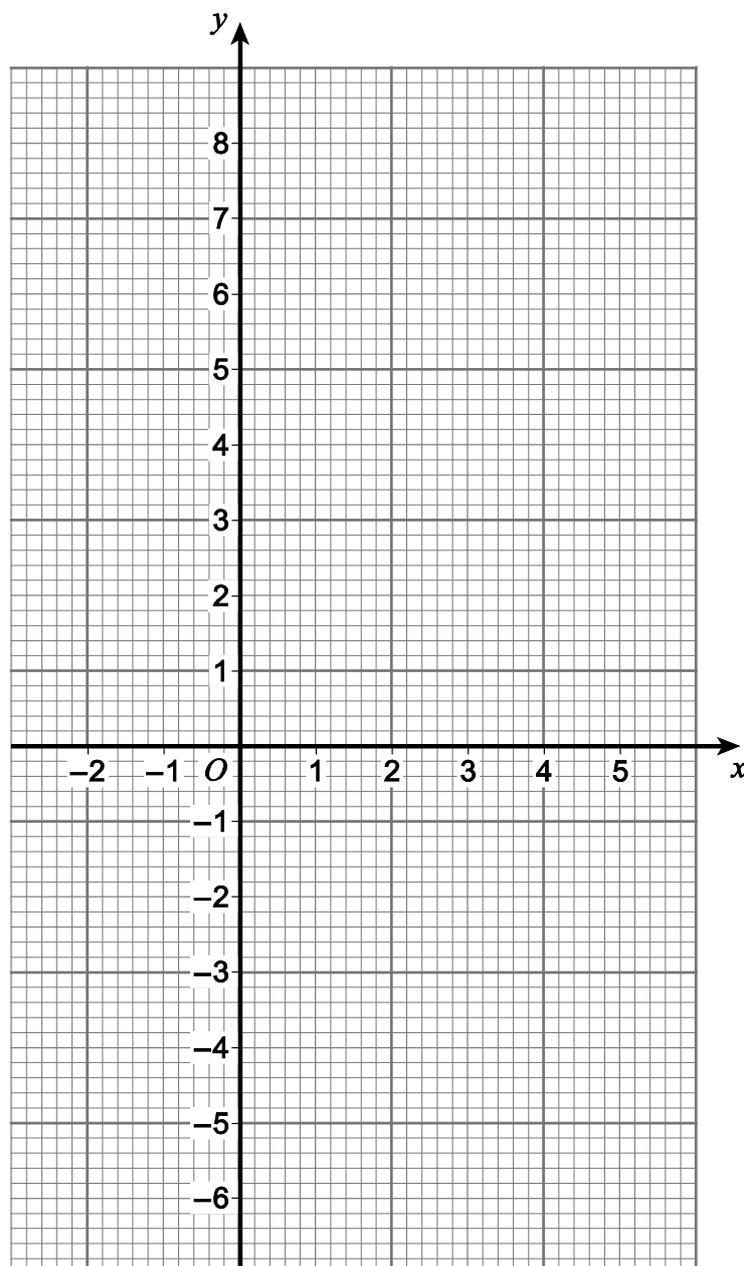


11 A function $f(x)$ is defined as

$$\begin{aligned} f(x) &= 3 - 2x & -2 \leq x < 0 \\ &= (1 + x)(3 - x) & 0 \leq x < 4 \\ &= 5x - 25 & 4 \leq x \leq 5 \end{aligned}$$

11 (a) Draw the graph of $y = f(x)$ on the axes below.

[4 marks]



11 (b) State the range of $f(x)$

[2 marks]

Answer _____

12 (a) Factorise fully $75 - 3x^2$

[2 marks]

Answer _____

12 (b) Simplify fully $(3n + 1)^2 - (3n - 1)^2$

[2 marks]

Answer _____

10

Turn over ►

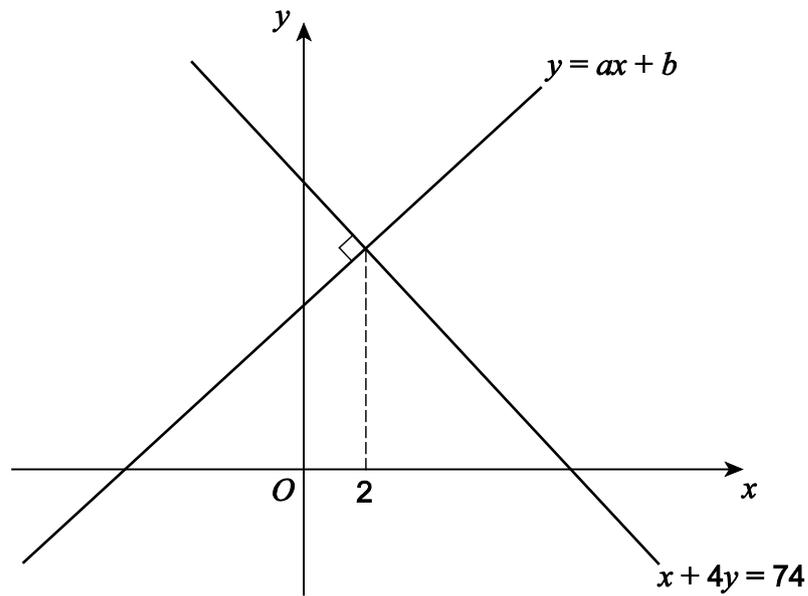


13 Simplify fully $\frac{8a}{3a+6} \times \frac{5a+10}{3a^2} \div \frac{4}{15a^3}$ [3 marks]

Answer _____



- 14** The line $y = ax + b$ is perpendicular to the line $x + 4y = 74$
The lines intersect at the point where $x = 2$



Not drawn
accurately

Work out the values of a and b .

[5 marks]

$a =$ _____ $b =$ _____

8

Turn over ►



15 Rearrange $w = \frac{8x - y}{y}$ to make y the subject.

[3 marks]

Answer _____



16 (a) $a = 3^{2b}$

Circle the correct expression for $\frac{1}{a}$ **[1 mark]**

3^{2b-1}

3^{-2b}

-3^{2b}

$\left(\frac{1}{3}\right)^{-2b}$

16 (b) $y = 5^x$

Circle the correct expression for $25y$ **[1 mark]**

5^{x+2}

25^x

5^{2x}

125^x

16 (c) $w = 2^m$

Circle the correct expression for w^3 **[1 mark]**

8^{3m}

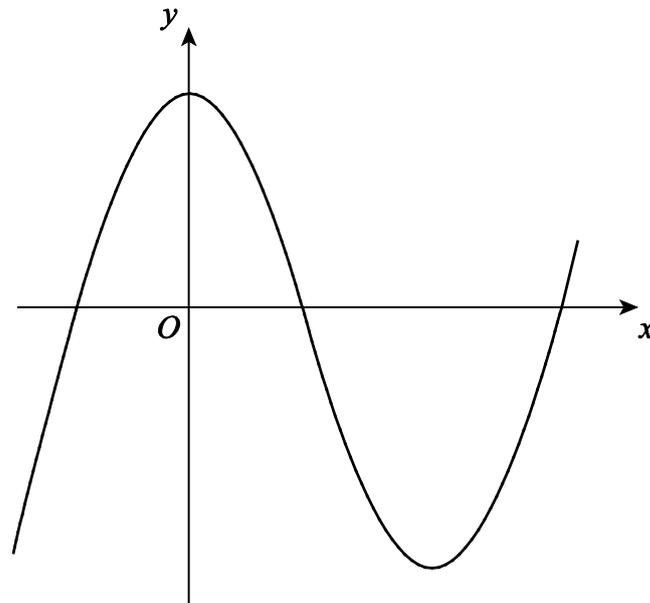
6^m

2^{m+3}

2^{3m}

Turn over for the next question**Turn over ►**

- 17 Here is a sketch of $y = x^3 - 6x^2 + 7$



Not drawn
accurately

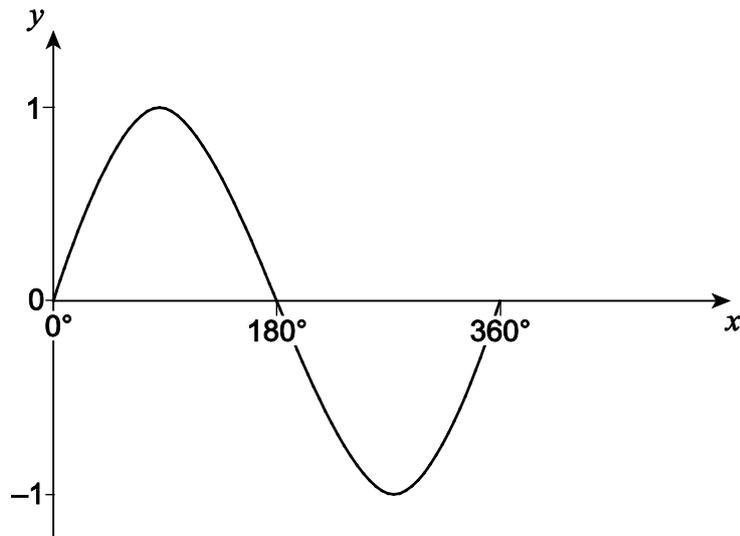
- 17 (a) Use differentiation to work out the coordinates of the stationary point that is a minimum. You **must** show your working.

[4 marks]

Answer (_____ , _____)



19 Here is a sketch of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$



Not drawn
accurately

α is an acute angle measured in degrees.

$\sin \alpha = k$ where k is a constant.

Write the answers to each of the following in terms of k , without involving trigonometric functions.

19 (a) $\sin(180^\circ - \alpha)$

[1 mark]

Answer _____

19 (b) $\sin(360^\circ - \alpha)$

[1 mark]

Answer _____

19 (c) $\cos \alpha$

[2 marks]

Answer _____

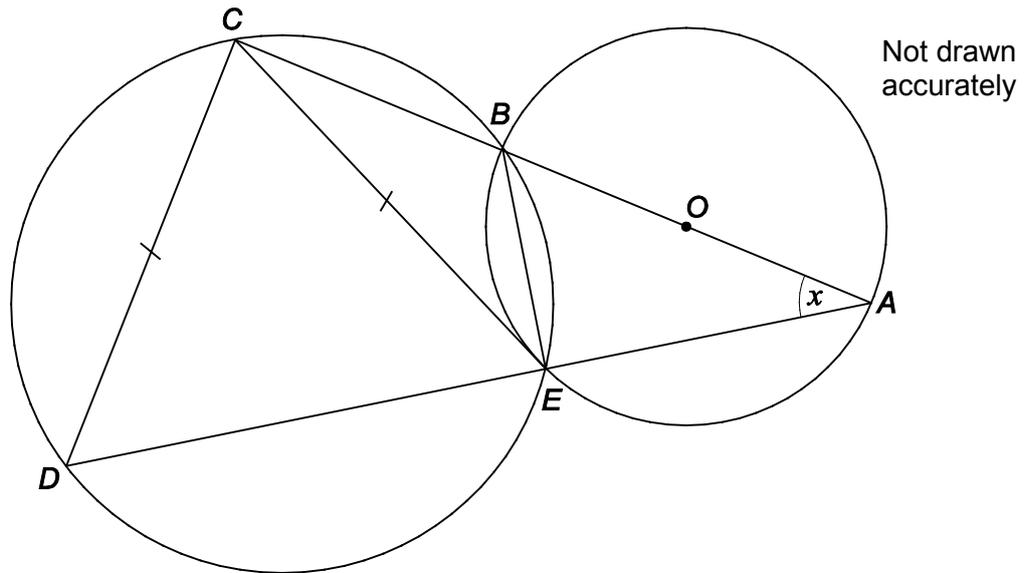
8

Turn over ►



20

Two circles overlap.

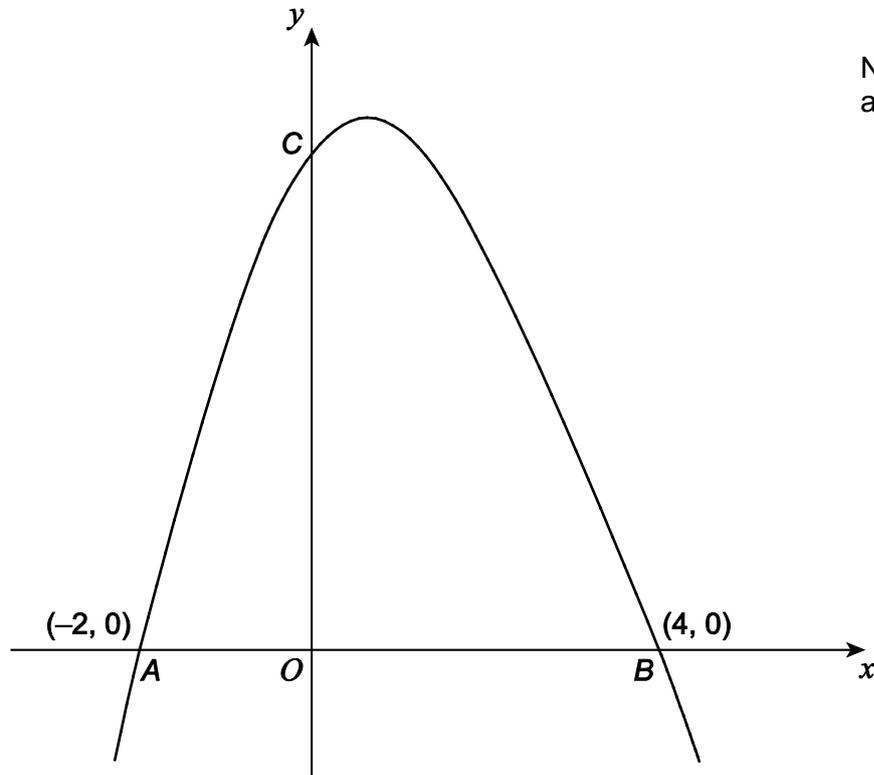
 A, B and E lie on the circle, centre O . B, C, D and E lie on the other circle. $AOBC$ and AED are straight lines. $CD = CE$ angle $BAE = x$ 20 (a) Give a reason why angle $BEA = 90^\circ$

[1 mark]



21 Here is a sketch of $y = (x + 2)(4 - x)$

The graph intersects the axes at $A (-2, 0)$, $B (4, 0)$ and C .



21 (a) Work out the coordinates of C .

[1 mark]

Answer (_____ , _____)



23

In this question, $\tan x \neq 0$ and $\sin x \neq 0$

Show that $\frac{1}{\tan^2 x} - \frac{1}{\sin^2 x}$ is a constant.

[3 marks]

Turn over for the next question

8

Turn over ►



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