

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

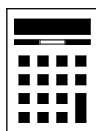
Morning

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	

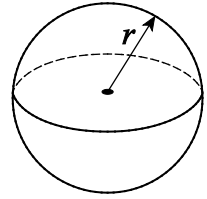


J U N 1 7 8 3 6 0 2 0 1

Formulae Sheet

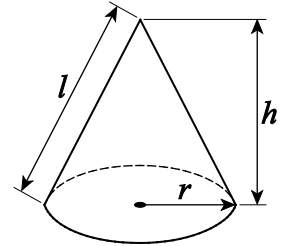
Volume of sphere $= \frac{4}{3} \pi r^3$

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



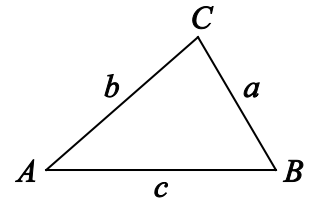
Volume of cone $= \frac{1}{3} \pi r^2 h$

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 (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



- 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]

$p =$ _____ $q =$ _____ $r =$ _____

- 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]

$a =$ _____ $b =$ _____

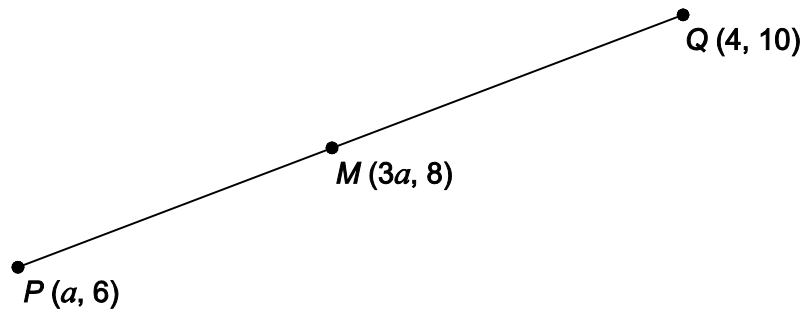


4

Solve $\frac{56}{\sqrt[3]{x}} = 4$ **[2 marks]**

 $x =$ _____**Turn over for the next question****Turn over ►**

5

 M is the midpoint of PQ .Not drawn
accuratelyWork out the value of a .**[3 marks]**

Answer _____



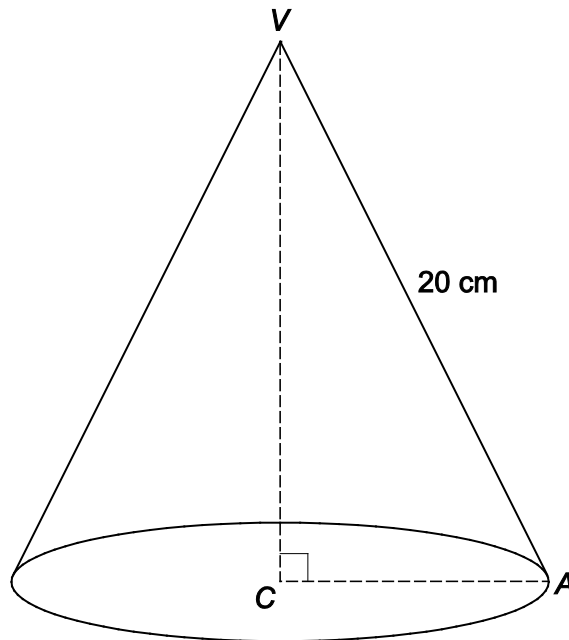
6

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.

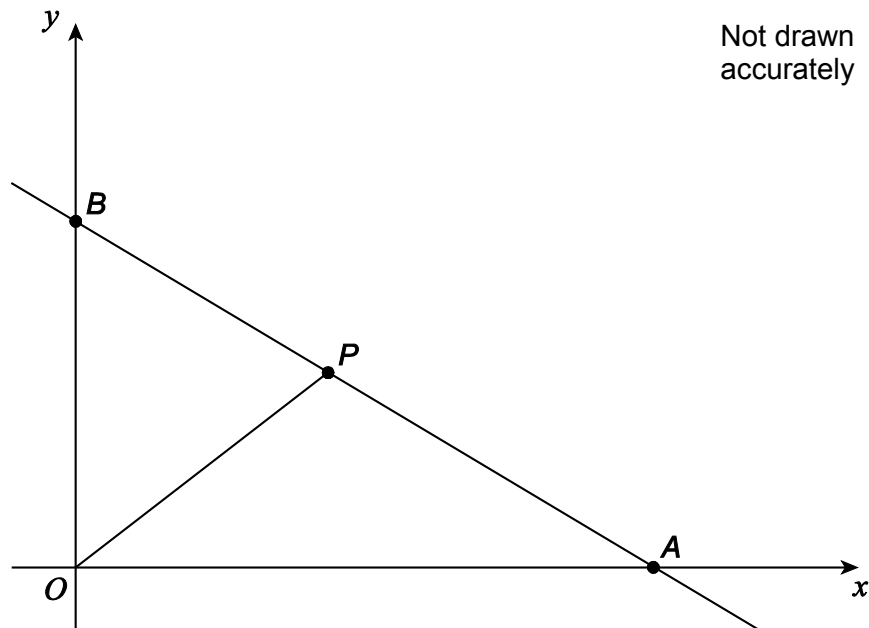
[3 marks]

Answer _____ cm



7 The equation of the line through B , P and A is $4x + 5y = 40$

$$BP : PA = 2 : 3$$



Work out the area of triangle OBP .

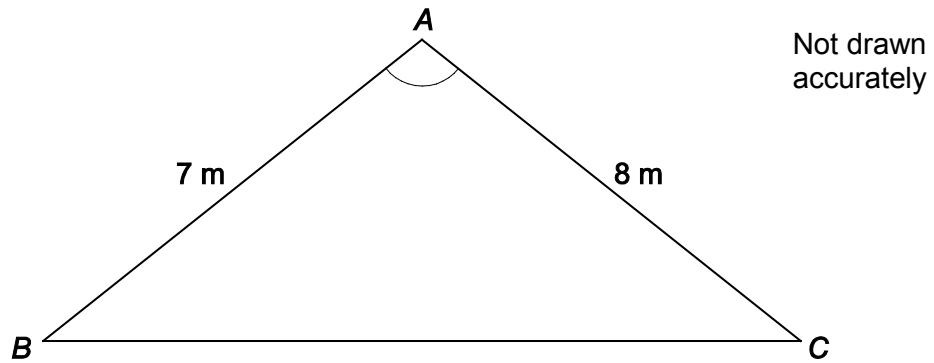
[4 marks]

Answer _____ square units



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



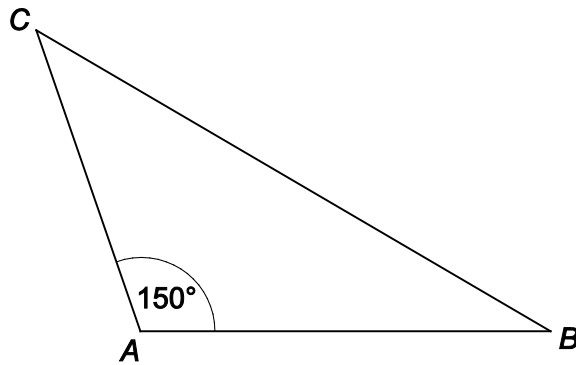
9 $-11 < 5x \leq 5$ and $6x + 7 \leq 4x + 4$

Show that there is **exactly** one integer that x can be.

[5 marks]



10

 ABC is an isosceles triangle with $AB = AC$ The area of ABC is 57.76 cm^2 Not drawn
accuratelyWork out the length of AB .**[3 marks]**

Answer _____ cm

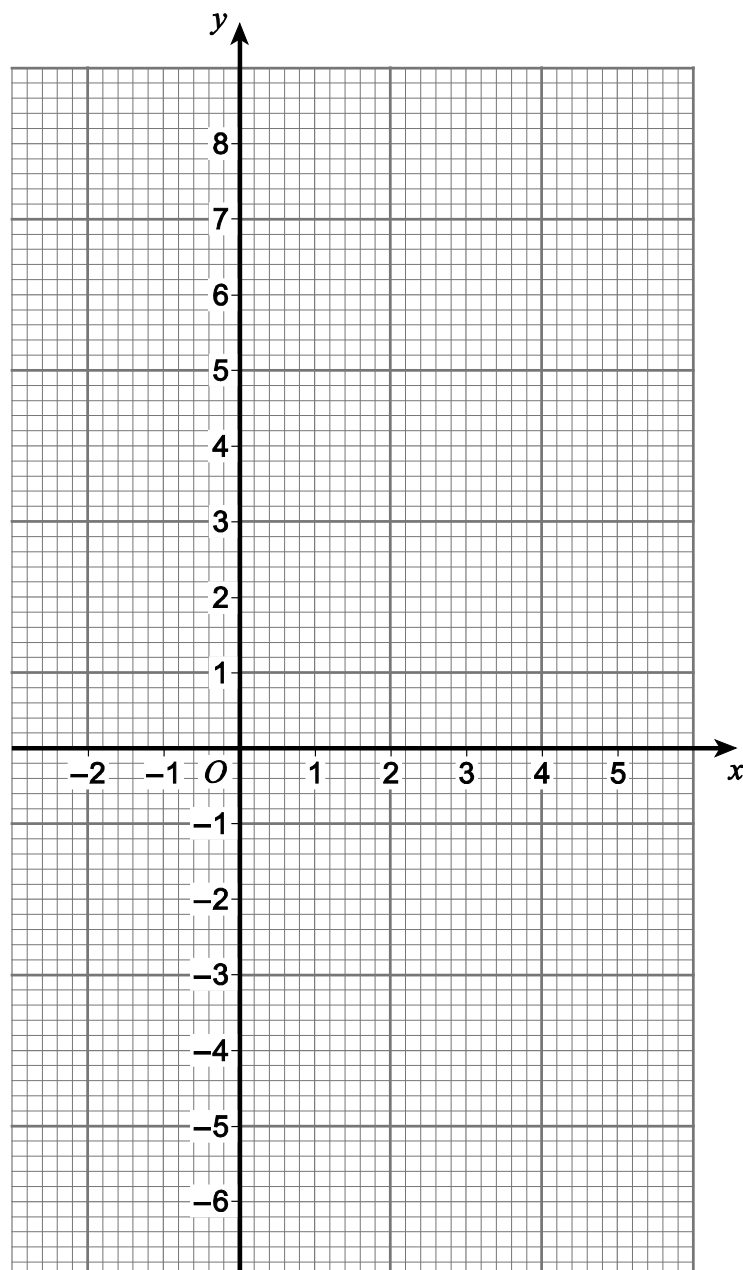
Turn over for the next question

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 _____



13

Simplify fully

$$\frac{8a}{3a+6} \times \frac{5a+10}{3a^2} \div \frac{4}{15a^3}$$

[3 marks]

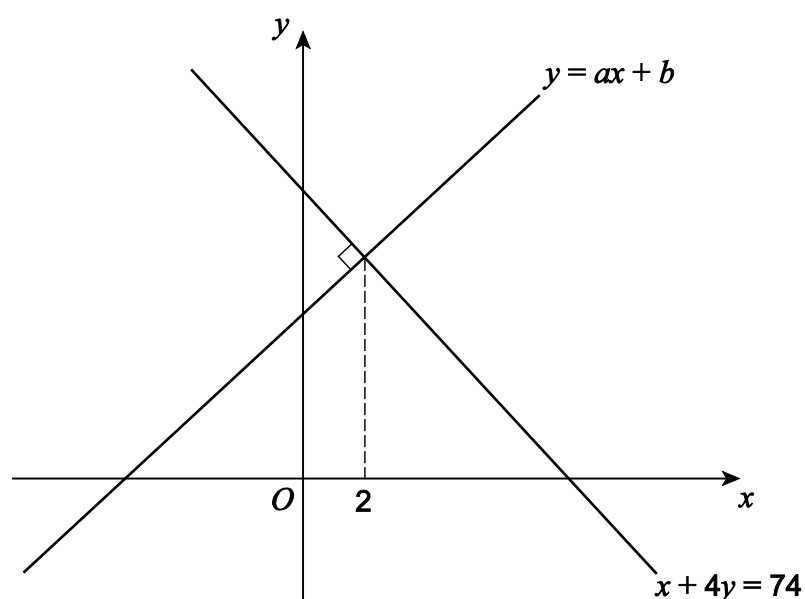
Answer _____



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]

[illegible]
$$a = \underline{\hspace{2cm}} \qquad b = \underline{\hspace{2cm}}$$


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}

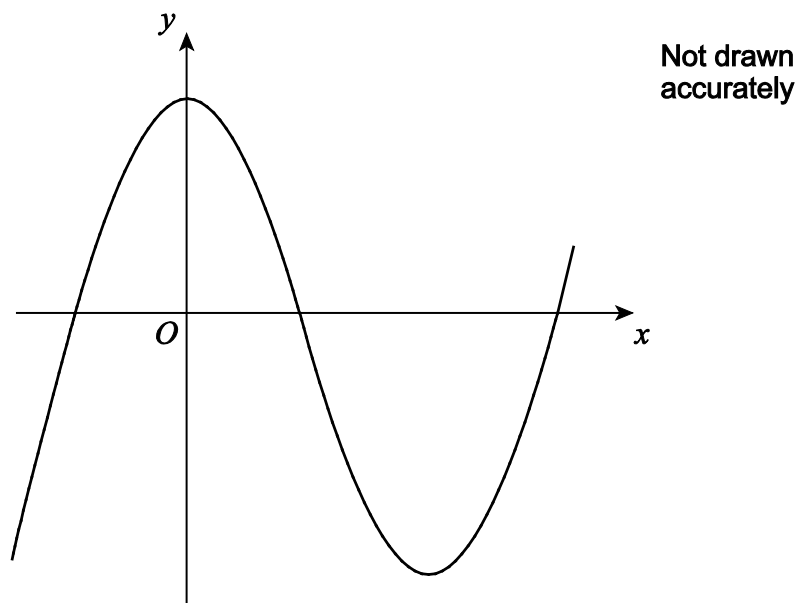
2^{3m}

Turn over for the next question

Turn over ►



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



- 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 (_____ , _____)



- Show that $x = -1$ is one root of $x^3 - 6x^2 + 7 = 0$

- Give your answers to 2 decimal places.
You **must** show your working.

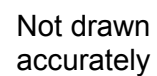
This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on the right side, suggesting it's resting on a surface.

Answer

Turn over ►



The diagram shows a rectangle with a diagonal drawn.
The given expressions for the measurements are in centimetres.



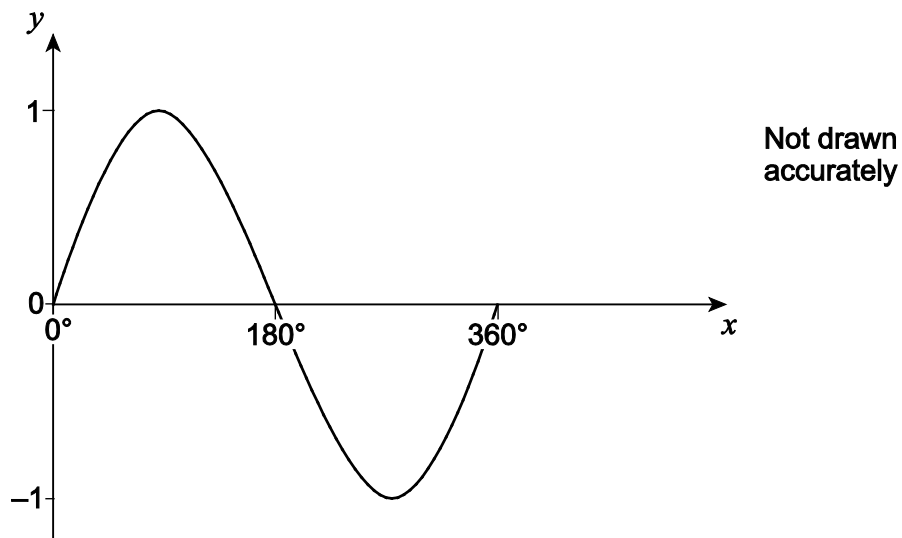
[4 marks]

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Answer _____ cm^2



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



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)** $\cos \alpha$

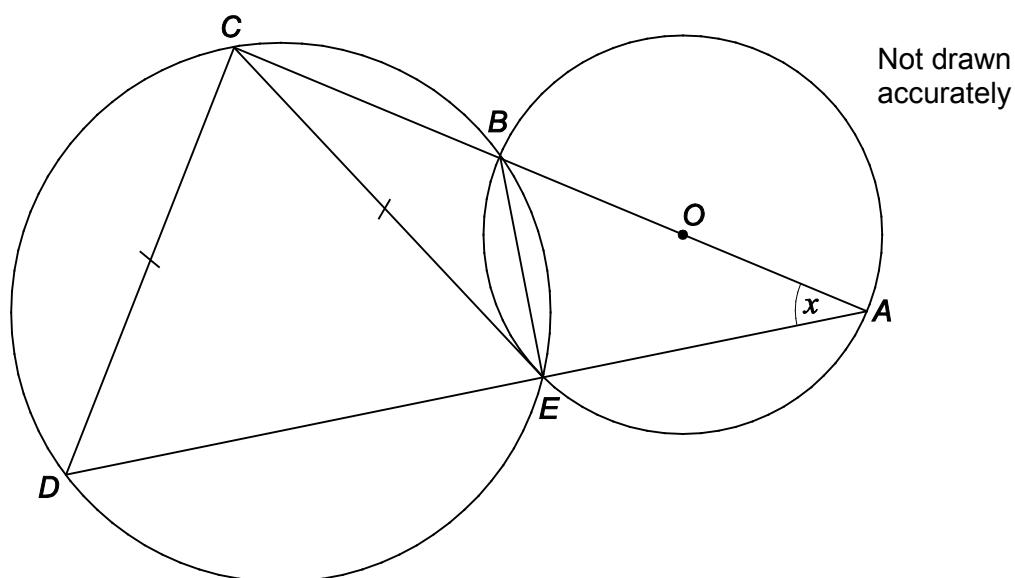
[2 marks]

Answer _____



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]



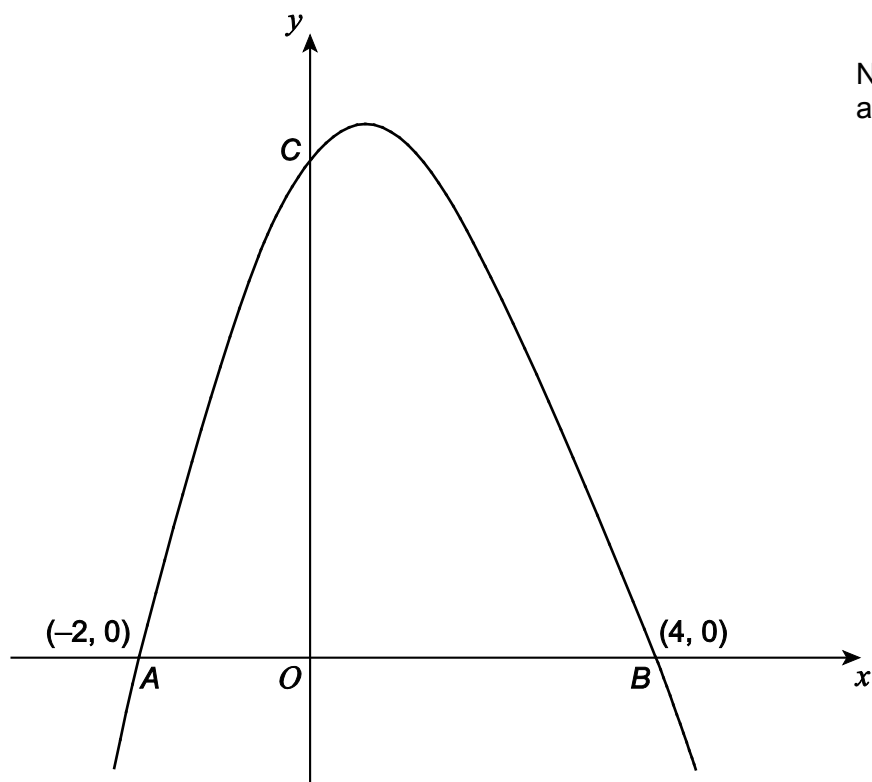
[4 marks]

[illegible]

5

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 .



Not drawn
accurately

21 (a) Work out the coordinates of C .

[1 mark]

Answer (_____ , _____)



[3 marks]

Answer

[5 marks]

[illegible]

[5 marks]

[illegible]

Answer (_____ , _____) and (_____ , _____)



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

Turn over ►

[5 marks]

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Answer

END OF QUESTIONS

5



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