

Please write clearly in block capitals.

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Level 2 Certificate FURTHER MATHEMATICS

Paper 1 Non-Calculator

Tuesday 19 June 2018

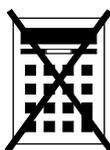
Morning

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- mathematical instruments.
- You must **not** use a calculator.



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 70.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

For Examiner's Use

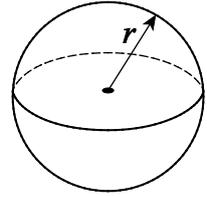
Pages	Mark
3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
TOTAL	



Formulae Sheet

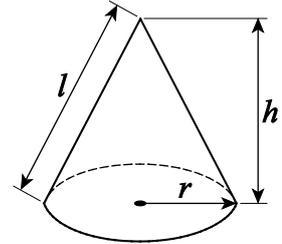
Volume of sphere $= \frac{4}{3} \pi r^3$

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



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

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



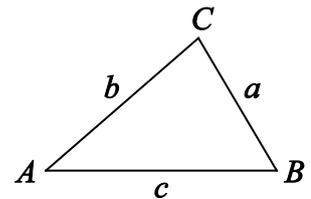
In any triangle ABC

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 $y = \frac{x^6}{2} + \frac{x^4}{4}$

Work out $\frac{dy}{dx}$

Simplify your answer.

[2 marks]

Answer _____

Turn over for the next question

Turn over ►



- 2** P is the point $(-12, b)$
 Q is the point $(a, 4)$
 R is the point $(6, -2)$
 Q is the midpoint of PR .

Work out the values of a and b .

[3 marks]

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



3 $\mathbf{A} = \begin{pmatrix} 2 & 4 \\ 3 & -1 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} -2 & 6 \\ 2 & 1 \end{pmatrix}$

Work out \mathbf{AB} .

[2 marks]

Answer _____

Turn over for the next question

Turn over ►



- 5 In the expansion and simplification of $(x - 3)(x^2 + 5x + k)$ the coefficient of x^2 is equal to the coefficient of x .

k is a constant.

Work out the value of k .

[3 marks]

Answer _____

Turn over for the next question

7

Turn over ►



6 A circle has centre $(-1, 2)$ and radius 5

Which of these is the equation of the circle?

Tick **one** box.

[1 mark]

$$(x + 1)^2 + (y - 2)^2 = 5$$

$$(x - 1)^2 + (y + 2)^2 = 5$$

$$(x + 1)^2 + (y - 2)^2 = 25$$

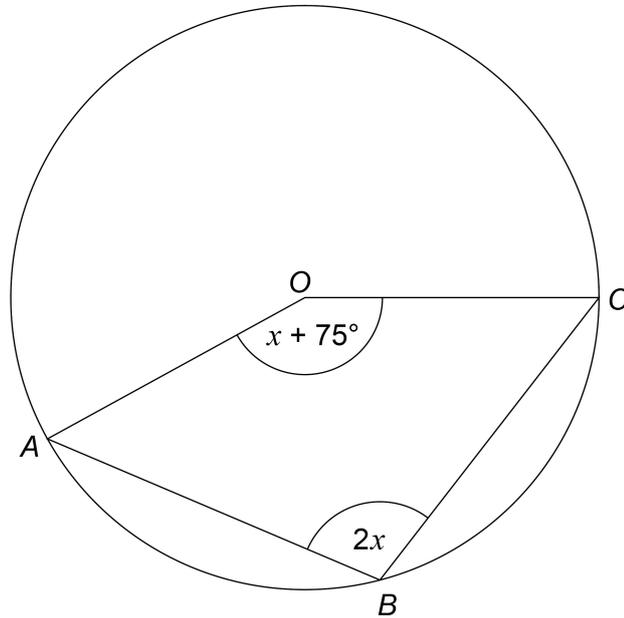
$$(x - 1)^2 + (y + 2)^2 = 25$$



7 Points A , B and C lie on a circle, centre O .

$$\text{Angle } AOC = x + 75^\circ$$

$$\text{Angle } ABC = 2x$$



Not drawn
accurately

Work out the value of x .

[3 marks]

Answer _____ degrees

Turn over for the next question

Turn over ►



- 8 Write $(1 + 2\sqrt{5})(4 - \sqrt{5})$ in the form $a + b\sqrt{5}$ where a and b are integers.

[2 marks]

Answer _____

- 9 $f(x) = 14 - x^2$ for all real values of x .

Solve $f(2x) = 5$

You **must** show your working.

[4 marks]

Answer _____



10 Rearrange $\frac{1}{xy} = 4 - \frac{3}{y}$ to make x the subject.

[3 marks]

Answer _____

Turn over for the next question

Turn over ►



11

A curve has equation $y = 2x^2 + 3x - 9$

At a point P on the curve, the tangent is parallel to the line $y = 4 - 5x$

Work out the coordinates of P .

You **must** show your working.

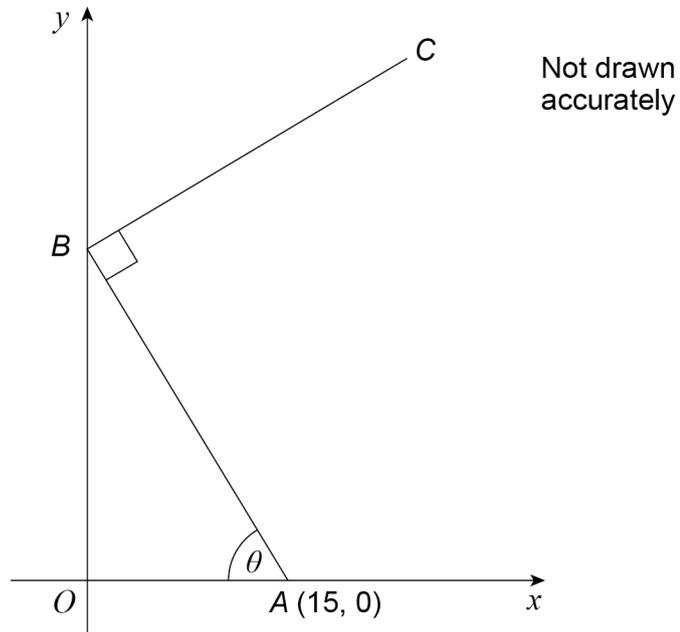
[4 marks]

Answer (_____ , _____)



12

In the diagram,

 A is the point $(15, 0)$ and B lies on the y -axis.Angle $ABC = 90^\circ$ and $\tan \theta = \frac{5}{3}$ Work out the equation of the line BC .**[4 marks]**

Answer _____

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

14 Work out the value of $\left(3^{\frac{1}{2}} + 3^{\frac{3}{2}}\right)^2$

You **must** show your working.

[3 marks]

Answer _____

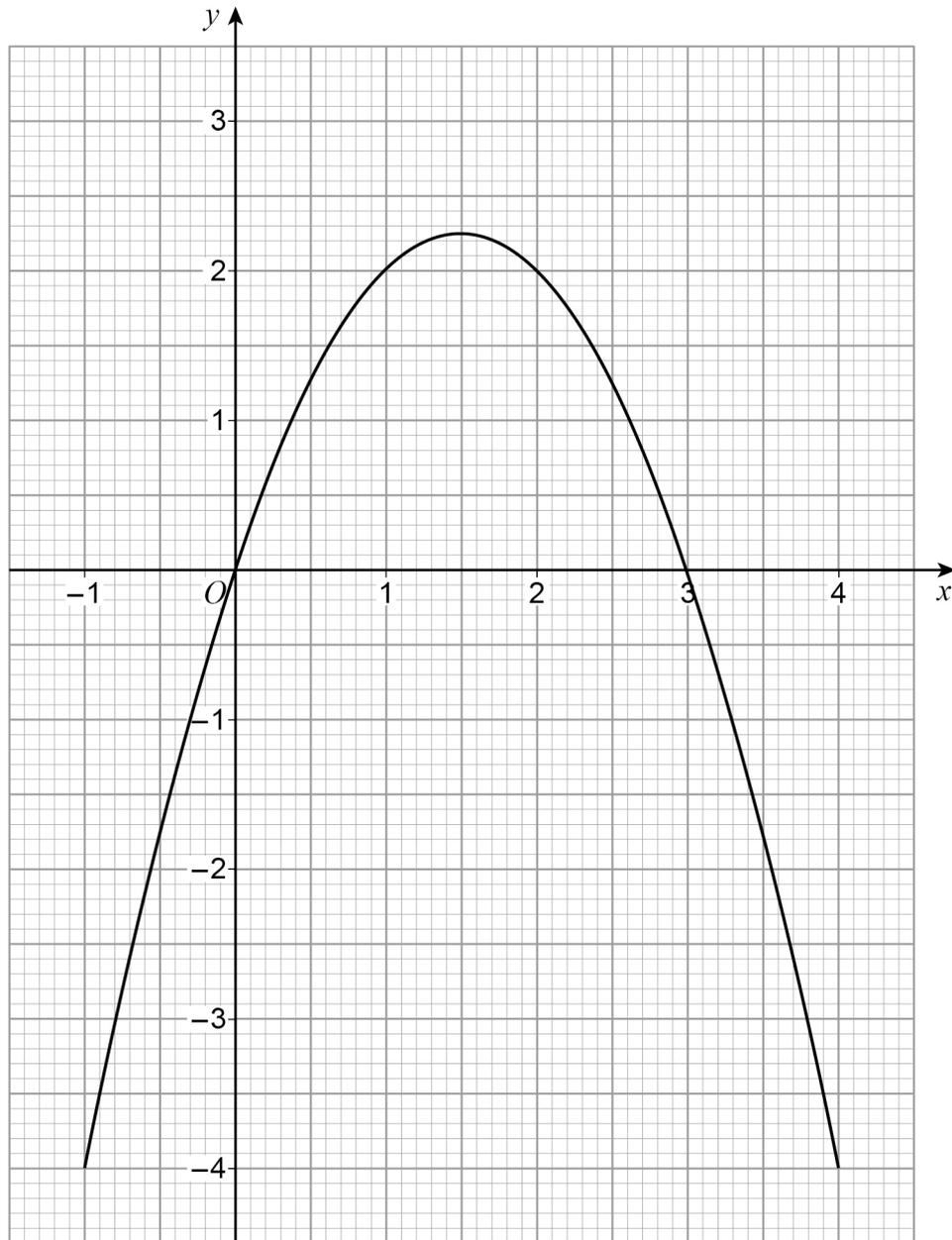
Turn over for the next question

9

Turn over ►



15

Here is the graph of $y = 3x - x^2$ for values of x from -1 to 4 

By drawing a suitable **linear** graph on the grid, work out approximate solutions to

$$x^2 - 4x + 2 = 0$$

[4 marks]

Answer _____

Turn over for the next question

4

Turn over ►



16

$y = f(x)$ is a cubic curve with a maximum and a minimum stationary point.

$$\frac{dy}{dx} = x^2 + 2x - 3$$

The y -coordinate of the minimum point is $2\frac{1}{3}$

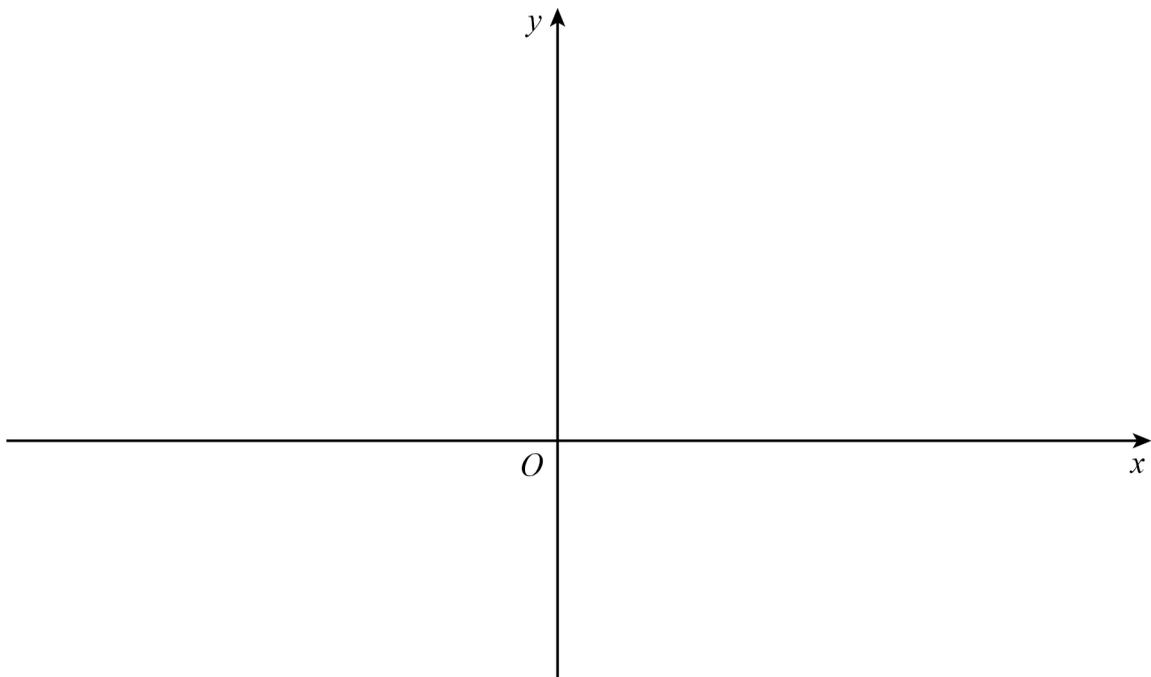
The y -coordinate of the maximum point is 13

$(0, 4)$ is a point on the curve.

The tangent at $(0, 4)$ has a negative gradient.

Sketch the curve on the grid below.

Show the coordinates of the stationary points.

[4 marks]

17 (a) Use the factor theorem to show that $(x - 2)$ is a factor of $x^3 + 8x^2 + 5x - 50$ [1 mark]

17 (b) Hence, factorise fully $x^3 + 8x^2 + 5x - 50$ [3 marks]

Answer _____

Turn over for the next question



18

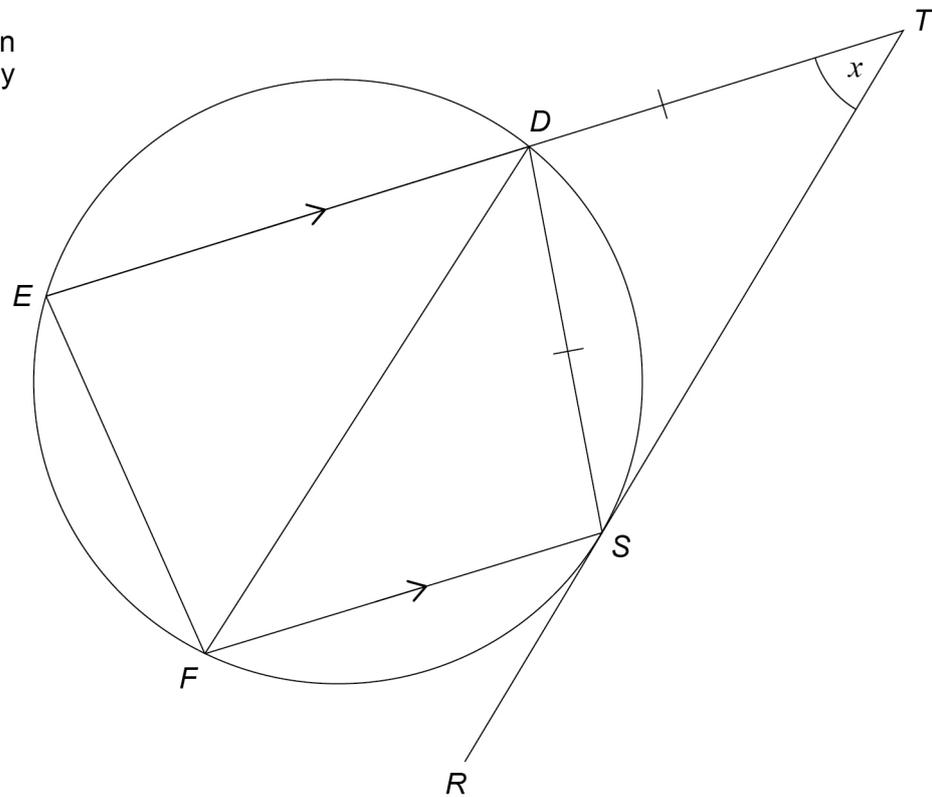
D, E, F and S are points on a circle.

RST is a tangent.

The straight line EDT is parallel to FS .

$DS = DT$

Not drawn
accurately



Prove that FD is parallel to RST .

Use angle DTS as x to help you.

[5 marks]

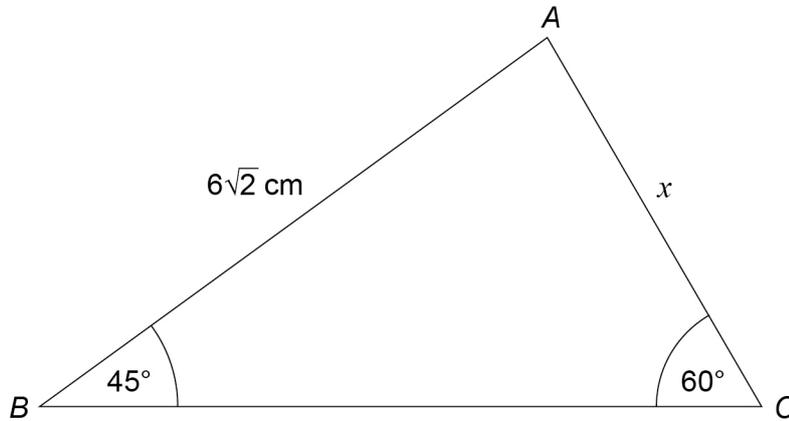


19 Write $2x^2 - 16x + 13$ in the form $a(x + b)^2 + c$ where a , b and c are integers. **[4 marks]**

Answer _____



20

In triangle ABC , $AB = 6\sqrt{2}$ cm, angle $ABC = 45^\circ$ and angle $ACB = 60^\circ$ Not drawn
accuratelyWork out the value of x .Give your answer in the form $a\sqrt{b}$, where a and b are integers.You **must** show your working.**[5 marks]**

Answer _____ cm

END OF QUESTIONS

There are no questions printed on this page

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