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## Level 2 Certificate FURTHER MATHEMATICS

Paper 1 Non-Calculator

Friday 14 June 2019

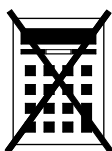
Afternoon

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.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- 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	
<b>TOTAL</b>	

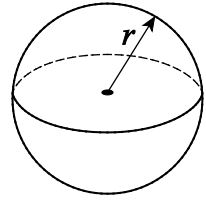


## Formulae Sheet

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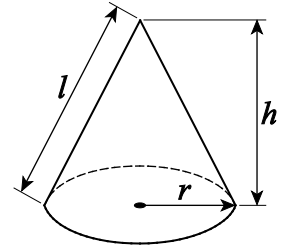
$$\text{Volume of sphere} = \frac{4}{3}\pi r^3$$

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



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

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



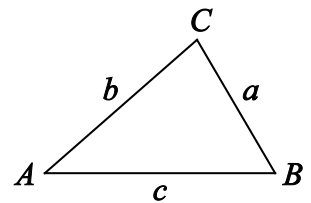
In any triangle  $ABC$

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

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

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

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



### 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.

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**1** A straight line passes through the points  $(-2, 11)$  and  $(1, 2)$

Work out the equation of the line.

Give your answer in the form  $y = mx + c$

**[3 marks]**

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Answer \_\_\_\_\_

**Turn over for the next question**

**Turn over ►**



2 Write  $\frac{5}{6a} + \frac{a}{4}$  as a single fraction.

Give your answer in its simplest form.

[2 marks]

Answer \_\_\_\_\_



- 3 Work out the **smallest** integer value of  $x$  that satisfies the inequality  $8 - 5x < 26$  [2 marks]

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Answer \_\_\_\_\_

- 4  $p(x - 1) + 2(3x + k) \equiv 4(x + 2)$  where  $p$  and  $k$  are integers.

Work out the values of  $p$  and  $k$ .

[4 marks]

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Answer  $p =$  \_\_\_\_\_,  $k =$  \_\_\_\_\_



5 Solve  $\sqrt[3]{(2\sqrt{x} - 10)} = 2$

[3 marks]

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$x =$  \_\_\_\_\_

6 The transformation matrix  $\begin{pmatrix} 2a & b \\ -b & -a \end{pmatrix}$  maps the point (3, 4) onto the point (8, -7)

Work out the values of  $a$  and  $b$ .

[5 marks]

Answer  $a =$  \_\_\_\_\_,  $b =$  \_\_\_\_\_



7 A function is given by

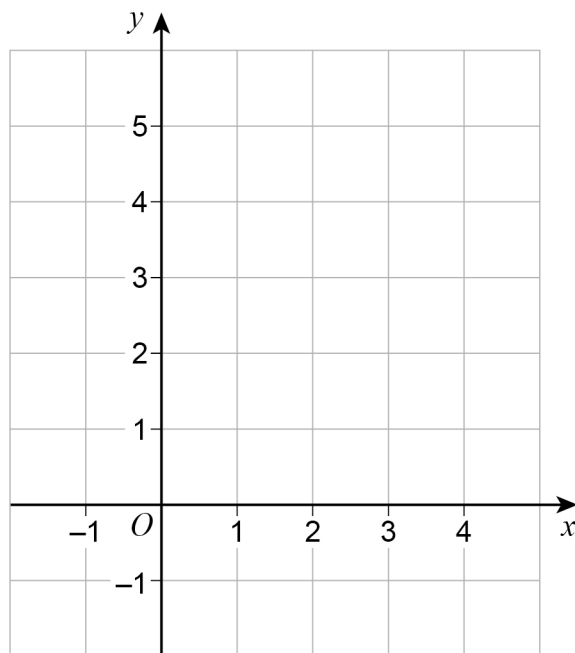
$$f(x) = -2x \quad -1 \leq x < 0$$

$$= x(4 - x) \quad 0 \leq x < 3$$

$$= 2x - 3 \quad 3 \leq x \leq 4$$

Draw the graph of  $y = f(x)$  on the grid.

[4 marks]



8

$ABC$  is a straight line.

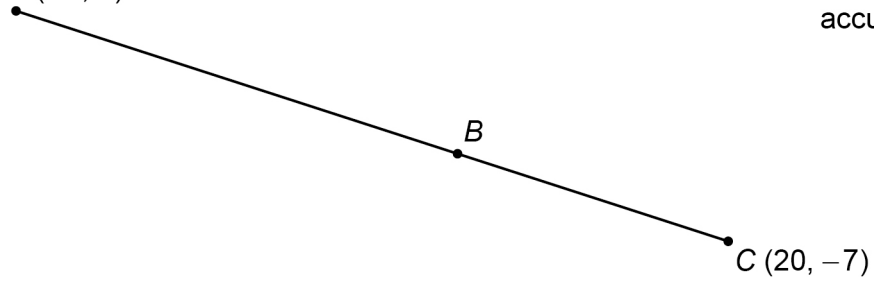
$A$  is the point  $(-4, 5)$

$C$  is the point  $(20, -7)$

$AB : BC = 5 : 3$

$A(-4, 5)$

Not drawn  
accurately



Work out the coordinates of  $B$ .

**[4 marks]**

Answer ( \_\_\_\_\_ , \_\_\_\_\_ )





**9**  $y = 2x(x^2 - 5x)$

Circle the expression for  $\frac{dy}{dx}$

[1 mark]

$2(2x - 5)$

$6x^2 - 20$

$3x^2 - 10x$

$6x^2 - 20x$

**10** Factorise fully  $6x^2 + 26xy - 20y^2$

[3 marks]

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Answer \_\_\_\_\_

Turn over for the next question



11 A cone has base radius  $r$  cm, perpendicular height  $h$  cm and slant height  $l$  cm

The curved surface area is  $60\pi \text{ cm}^2$

$$l = 3r$$

Work out the value of  $h$ .

Give your answer in the form  $a\sqrt{10}$  where  $a$  is an integer greater than 1

You **must** show your working.

[5 marks]

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Answer \_\_\_\_\_



**12** A curve has the equation  $y = x^3 + ax^2 - 7$  where  $a$  is a constant.  
The gradient of the curve when  $x = 4$  is **twice** the gradient of the curve when  $x = -1$

Work out the value of  $a$ .  
You **must** show your working.

**[5 marks]**

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Answer \_\_\_\_\_

**Turn over for the next question**





**14** Here are two transformations.

A Rotation  $90^\circ$  clockwise about the origin.

B Reflection in the line  $y = x$

Use matrix multiplication to work out the single matrix which represents the combined transformation A followed by B.

**[4 marks]**

Answer \_\_\_\_\_

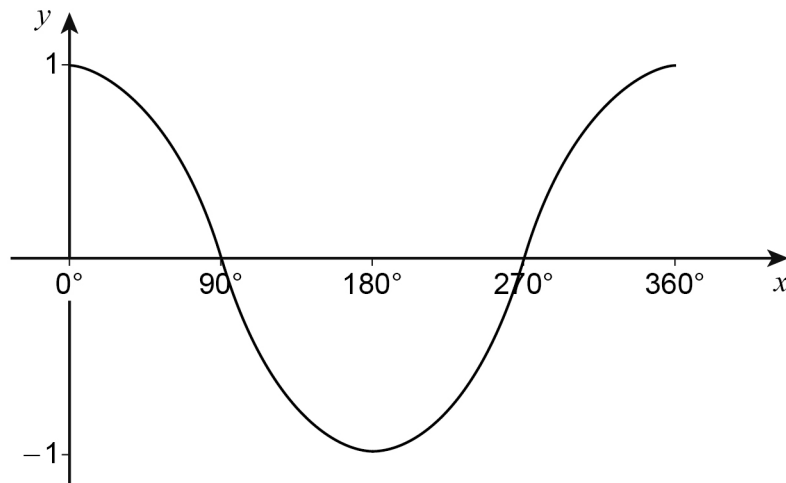
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8

**Turn over ►**



15 Here is a sketch graph of  $y = \cos x$  for  $0^\circ \leq x \leq 360^\circ$



You are given that  $\cos 36^\circ = 0.8090$

Solve  $\cos x = -0.8090$  for  $0^\circ \leq x \leq 360^\circ$

**[2 marks]**

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Answer \_\_\_\_\_



16 Rationalise the denominator and simplify fully  $\frac{21 - 11\sqrt{5}}{3 - \sqrt{5}}$  [4 marks]

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Answer \_\_\_\_\_

Turn over for the next question

6
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Turn over ►



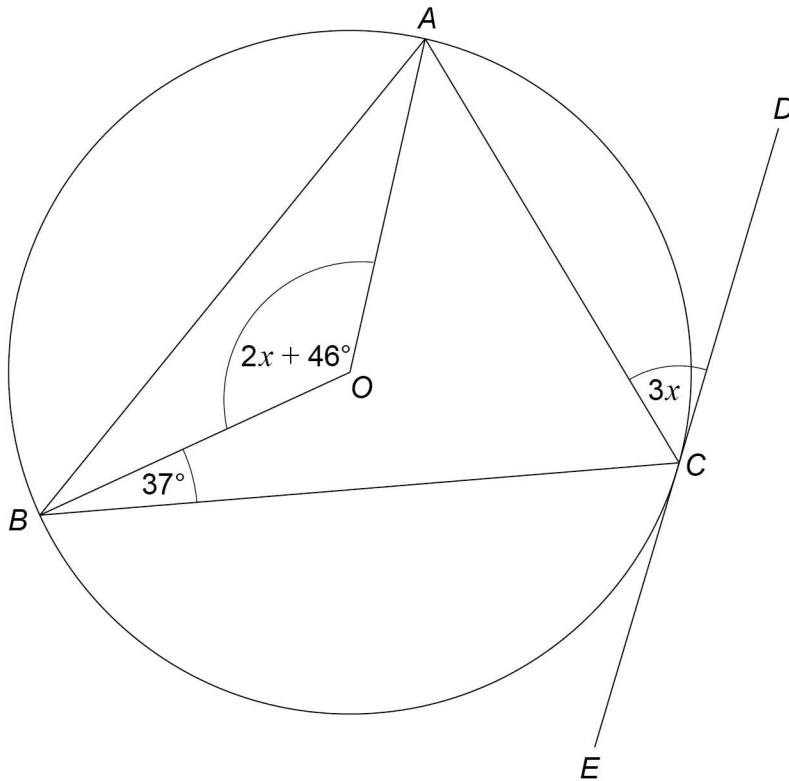
17  $A$ ,  $B$  and  $C$  are points on the circumference of a circle, centre  $O$ .

$ECD$  is a tangent to the circle at  $C$ .

Angle  $AOB = 2x + 46^\circ$

Angle  $OBC = 37^\circ$

Angle  $ACD = 3x$



Not drawn  
accurately





Work out the value of  $x$ .

[4 marks]

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Answer \_\_\_\_\_ degrees

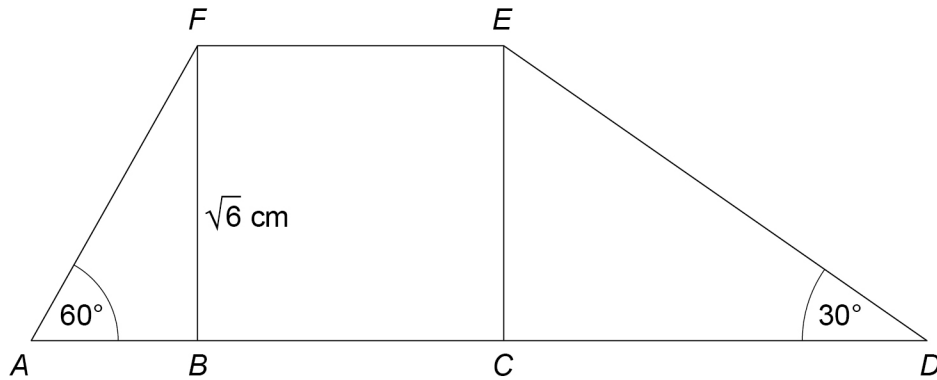
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Turn over ►



18

 $ADEF$  is a trapezium. $ABCD$  is a straight line. $BCEF$  is a square of side  $\sqrt{6}$  cmNot drawn  
accurately18 (a) Show that  $AB = \sqrt{2}$  cm

[1 mark]

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18 (b) Show that  $DE = 2\sqrt{6}$  cm

[1 mark]

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**18 (c)** Work out the perimeter of the trapezium  $ADEF$ .

Give your answer in the form  $t\sqrt{2} + w\sqrt{6}$  where  $t$  and  $w$  are integers.

You **must** show your working.

**[3 marks]**

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Answer \_\_\_\_\_ cm

Turn over for the next question

5

Turn over ►



19

$$f(x) = \frac{x-3}{2x}$$

Solve  $f(x+1) - f(2x) = 0.5$

You **must** show your working.

[6 marks]



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Answer \_\_\_\_\_

**END OF QUESTIONS**

6



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