AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

Level 2 Certificate in Further Mathematics
FURTHER MATHEMATICS

Level 2 Paper 1 Non-Calculator

Monday 20 June 2016 Morning Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- mathematical instruments.

You must **not** use a calculator.

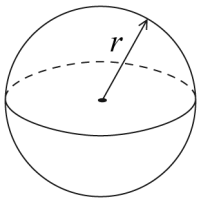
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want 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.

Formulae Sheet

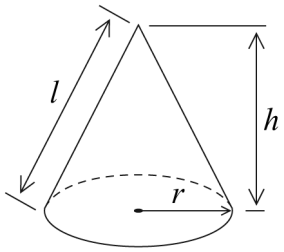
Volume of sphere $= \frac{4}{3}\pi r^3$

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



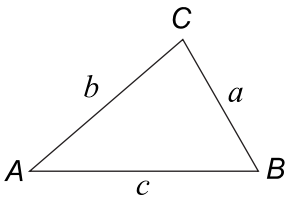
Volume of cone $= \frac{1}{3}\pi r^2 h$

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



In any triangle *ABC*

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



Sine rule $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

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

$\tan\theta \equiv \dfrac{\sin\theta}{\cos\theta}$ $\qquad \sin^2\theta + \cos^2\theta \equiv 1$

Answer **all** questions in the spaces provided.

1 $y = x^2(x - 10)$

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

[3 marks]

Answer _____

2 $4\begin{pmatrix} 1 - 2a \\ a \end{pmatrix} = \begin{pmatrix} b \\ 12 \end{pmatrix}$

Work out the values of a and b.

[3 marks]

$a =$ _____

$b =$ _____

6

3 The nth term of a sequence is $\dfrac{3n}{5n+12}$

3 (a) Work out the position of the term that has a value of $\frac{1}{2}$

[2 marks]

Answer _____

3 (b) Write down the limiting value of $\dfrac{3n}{5n+12}$ as $n \to \infty$

[1 mark]

Answer _____

4 The equation of a circle is $(x+5)^2+(y-8)^2=10$

4 (a) What are the coordinates of the centre of the circle?
Circle your answer.

[1 mark]

$(-5, -8)$ $(-5, 8)$ $(5, 8)$ $(5, -8)$

4 (b) Write down the radius of the circle.

[1 mark]

Answer _____

Turn over for the next question

5

5 *A*, *B*, *C* and *D* are points on a circle, centre *O*.

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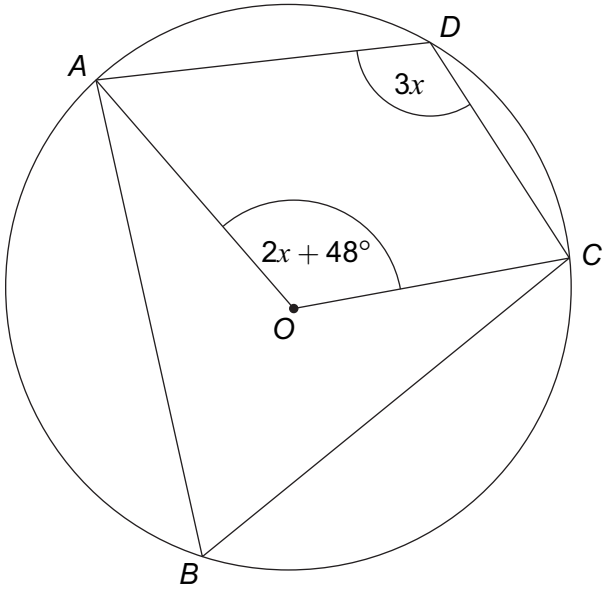

Work out the value of x.

[3 marks]

$x =$ _____ degrees

6 $mx + 4 - 2(x + p) \equiv 6(x + 1)$ where m and p are integers.

Work out the values of m and p.

[4 marks]

$m =$ _____

$p =$ _____

7 Work out the integer values of x for which $x^2 - 20x + 96 < 0$

[3 marks]

Answer _____

10

8 Solve $(3-\sqrt{x})^{\frac{1}{3}} = -2$

[3 marks]

$x =$ _____

9 Expand and simplify $(x-5)^3$

[3 marks]

Answer _____

10 $\sqrt[4]{x} = 2$ and $y^{-2} = 25$

$x > 0$ and $y < 0$

Work out the value of $\frac{x}{y}$

[4 marks]

Answer _____

Turn over for the next question

10

11 $A(1\frac{1}{5}, 3\frac{4}{5})$, $B(2, 1\frac{4}{5})$ and $C(5, 3)$ are points on a coordinate grid.

Show that the line segments AB and BC are perpendicular.

[3 marks]

12 You are given that $x^2 + 6x + 2 \equiv (x + h)^2 + k$

12 (a) Work out the values of h and k.

[2 marks]

$h =$ _____

$k =$ _____

12 (b) Write down the coordinates of the minimum point on the curve $y = x^2 + 6x + 2$

[1 mark]

Answer $\left(\_\_\_\_\_ , \_\_\_\_\_\right)$

12 (c) Solve the equation $x^2 + 6x + 2 = 0$

Give your answers in the form $a \pm \sqrt{b}$

[1 mark]

Answer _____

7

13 Solve $\sqrt{125} + \sqrt{20} = \sqrt{80} + \sqrt{x}$

[3 marks]

$x =$ _____

14 (a) $(x - 3)$ is a factor of $x^3 - 8x^2 + ax + 42$ where a is an integer.

Show that the value of a is 1

[2 marks]

14 (b) Hence, factorise fully $x^3 - 8x^2 + x + 42$

[3 marks]

Answer _____

8

15 Rationalise the denominator and simplify fully $\dfrac{6}{\sqrt{7}+2}$ **[3 marks]**

Answer _____

16 Angle θ is obtuse and $\sin\theta = \frac{\sqrt{11}}{6}$

Work out the value of $\cos\theta$

[4 marks]

Answer _____

Turn over for the next question

7

17 The diagram shows a sketch of the cubic curve $y = \frac{1}{3}x^3 - x^2 - 3x + k$

where k is a constant.

The x-axis is a tangent to the curve at its minimum point.

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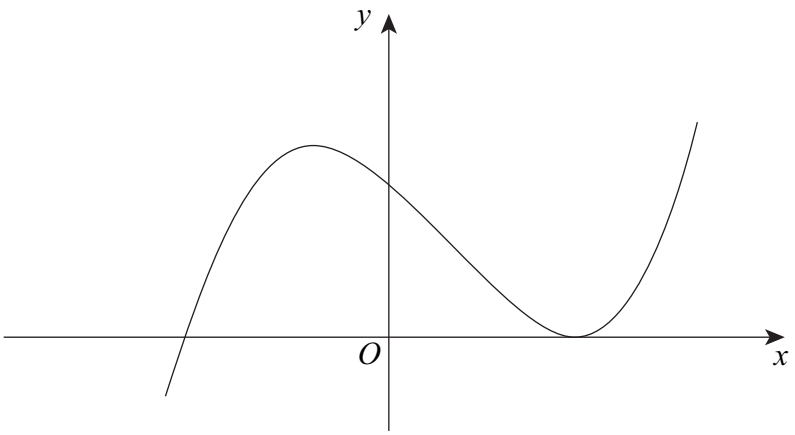


Work out the value of k.

[5 marks]

$k =$ _____

18 Factorise fully $x^4 - 81$

[2 marks]

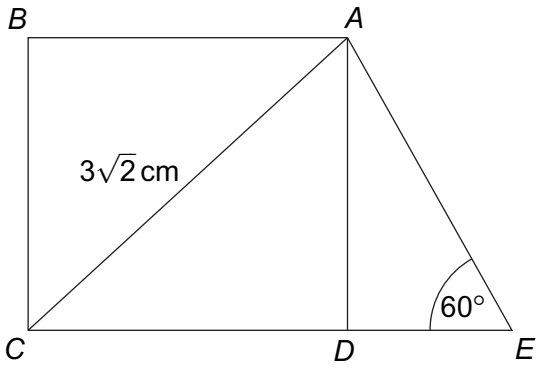
Answer _____

Turn over for the next question

7

19 *ABCD* is a square.
CDE is a straight line.

AC is $3\sqrt{2}$ cm and angle *DEA* $= 60°$



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19 (a) Show that the side of the square is 3 cm

[2 marks]

19 (b) Show that the perimeter of trapezium *ABCE* is $3(3 + \sqrt{3})$ cm

[4 marks]

20 In triangle PQR, $\cos P = \frac{1}{3}$

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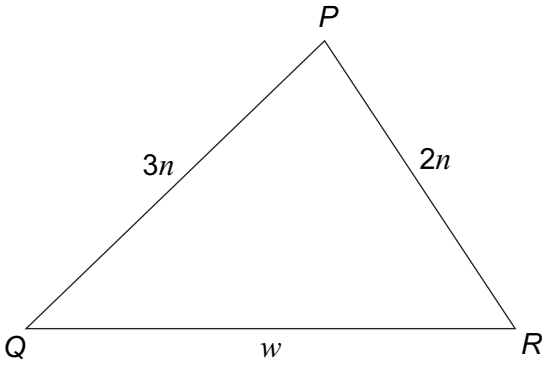

Show that triangle PQR is isosceles.

[4 marks]

END OF QUESTIONS

10

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