Centre Number						Candidate Number				
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Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16 – 17	
18 – 19	
20 – 21	
TOTAL	

AQA

Level 2 Certificate in Further Mathematics
June 2015

Further Mathematics 8360/1

Level 2

Paper 1 Non-Calculator

Monday 15 June 2015 9.00 am to 10.30 am

For this paper you must have:
- mathematical instruments.

You may **not** use a calculator.

Time allowed
- 1 hour 30 minutes

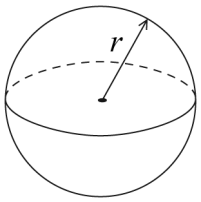
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this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

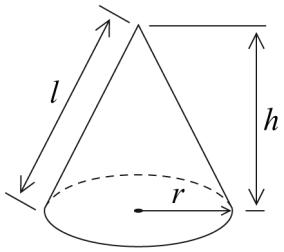
Volume of sphere $= \frac{4}{3}\pi r^3$

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



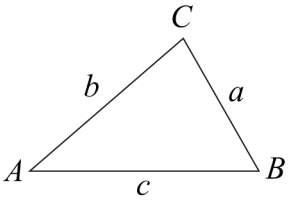
Volume of cone $= \frac{1}{3}\pi r^2 h$

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 *GH* is a straight line.

The coordinates of *G* are $(-2, 8)$
The midpoint of *GH* is $(5, -3)$

Work out the coordinates of *H*.

[2 marks]

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Answer $\left(\text{.....}, \text{.....}\right)$

Turn over for the next question

2

2 A straight line with equation $y = mx + c$ has gradient m and y-intercept c.

Here are the equations of four straight lines, P, Q, R and S.

P $2y - 4x = 5$ Q $5y = 2x - 4$

R $2y - 4 = 5x$ S $4y = 5 - 2x$

2 (a) Circle the line that passes through $(7, 2)$ **[1 mark]**

P Q R S

2 (b) Circle the line with gradient $2\frac{1}{2}$ **[1 mark]**

P Q R S

2 (c) Circle the line with y-intercept $2\frac{1}{2}$ **[1 mark]**

P Q R S

2 (d) Circle the line with a negative gradient. **[1 mark]**

P Q R S

2 (e) Circle a pair of perpendicular lines. **[1 mark]**

P Q R S

3 Solve $2(3x + 1) > 3 - 4x$

[2 marks]

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Answer .....

Turn over for the next question

7

4 The equation of a curve is $y = x^2 - 5x$

4 (a) Work out $\frac{dy}{dx}$

[2 marks]

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Answer .....

4 (b) *P* is a point on the curve.
The tangent to the curve at *P* has gradient 1

Work out the coordinates of *P*.

[2 marks]

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Answer $\left(\text{.....}, \text{.....}\right)$

5 In the expansion of $(x+2)(x^2+kx-3)$ the coefficient of x^2 is zero.

5 (a) Work out the value of k.

[1 mark]

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Answer .....

5 (b) Work out the coefficient of x.

[2 marks]

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Answer .....

Turn over for the next question

6 A bag contains $5x$ red balls and $2x$ blue balls.

The number of red balls is **decreased** by 20%

The number of blue balls is **increased** by 30%

There are now 35 **more** red balls than blue balls in the bag.

Work out the value of x.

[4 marks]

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Answer .....

7 $3x^3 - 2x^2 - 147x + 98 \equiv (ax - c)(bx + d)(bx - d)$

where a, b, c and d are positive integers.

Work out the values of a, b, c and d.

[3 marks]

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$a =$ ..... $b =$ ..... $c =$ ..... $d =$ .....

Turn over for the next question

7

8 Simplify fully $\dfrac{5x}{(x+4)(x-6)} - \dfrac{3}{(x-6)}$

[4 marks]

Answer .....

9 Given that $\begin{pmatrix} 3 & -1 \\ 2 & 1 \end{pmatrix} \begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} b \\ a+1 \end{pmatrix}$

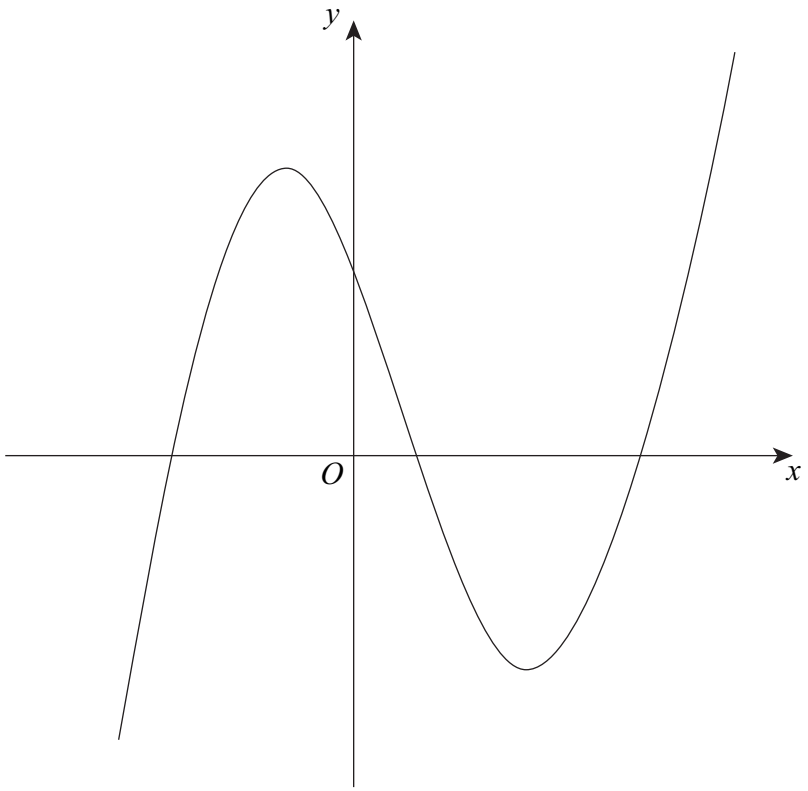
work out the values of a and b.

[5 marks]

$a =$ ....., $b =$ .....

9

10 This is a sketch of the curve $y = f(x)$



10 (a) For this curve $\frac{dy}{dx} = 3x^2 - 4x - 4$

Work out the range of values of x for which $f(x)$ is a decreasing function.
Write your answer as an inequality.

[4 marks]

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Answer .....

10 (b) Work out the equation of the normal to the curve at the point $(1, -2)$
Give your answer in the form $y = mx + c$

[5 marks]

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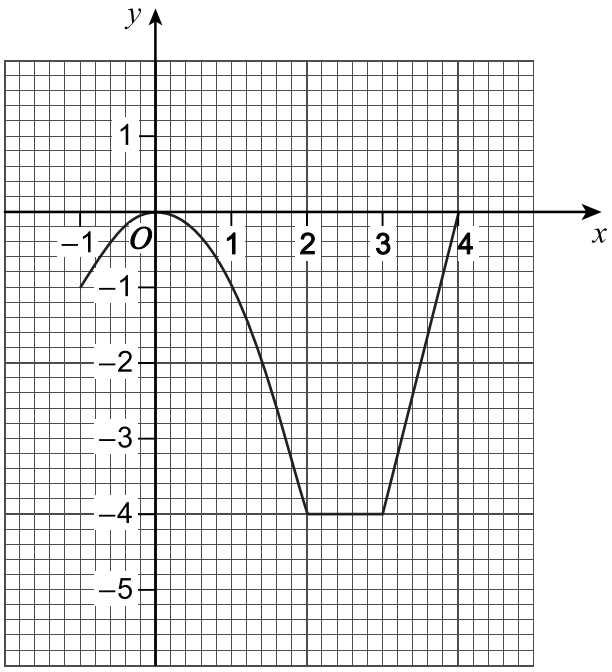
Answer .....

Turn over for the next question

9

11 Here is the graph of $y = \mathrm{f}(x)$

It consists of a quadratic curve and two straight lines.



Define $\mathrm{f}(x)$, stating clearly the domain for each part.

[4 marks]

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$\mathrm{f}(x) =$ .....

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$=$ .....

12 Make y the subject of $\sqrt{\frac{3xy}{x+y}} = 4$

[4 marks]

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Answer .....

Turn over for the next question

8

13 $x^2 + 2ax + b \equiv (x - 5)^2 - a$

Work out the values of a and b.

[3 marks]

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$a =$ ....., $b =$ .....

14 Write $\dfrac{5\sqrt{2}}{3\sqrt{6}-7}$ in the form $\sqrt{w}+\sqrt{k}$ where w and k are integers.

[5 marks]

Answer .....

8

15 The diagram shows two circles touching externally at T.
Points X, Y and W lie on the larger circle.

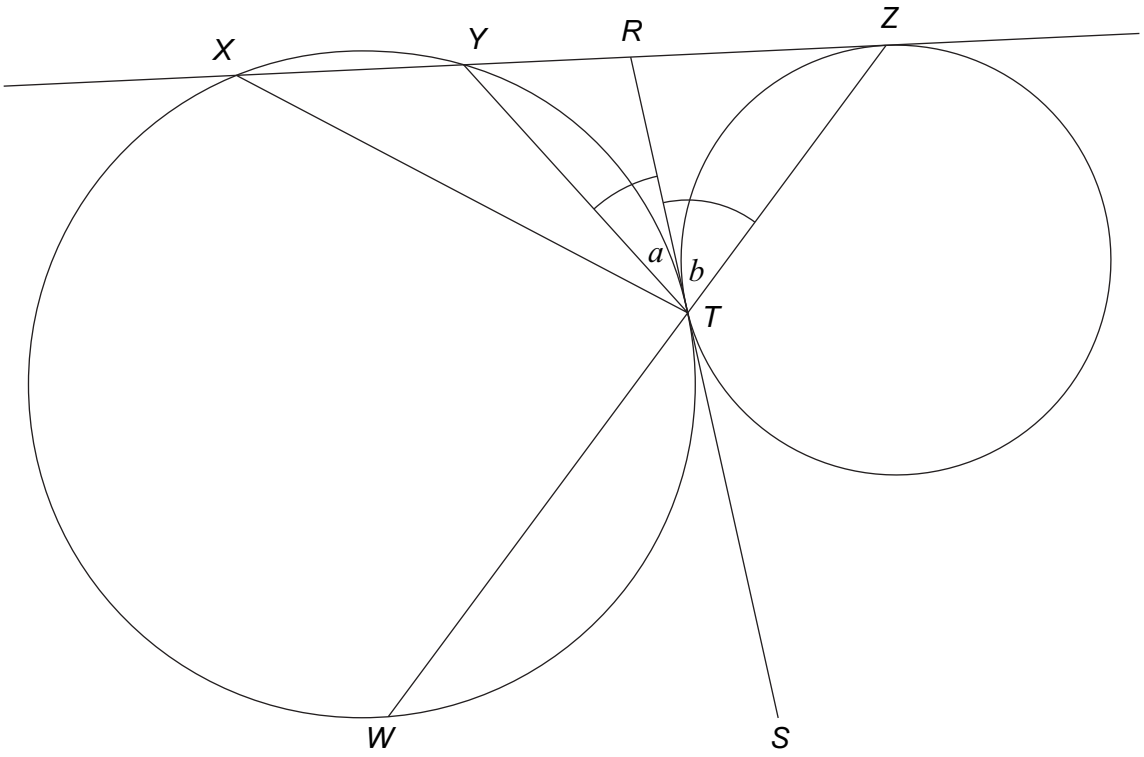
RTS is a tangent to both circles.

$XYRZ$ is a tangent to the smaller circle at Z.

ZTW is a straight line.

Angle $YTR = a$ and angle $ZTR = b$

Not drawn accurately



15 (a) Give reasons why angle $RZT = b$

[2 marks]

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15 (b) Angle $RZT = b$

Prove that angle $XTW =$ angle YTZ

[3 marks]

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16 By factorising fully, simplify $\dfrac{x^4 - x^3 - 2x^2}{x^4 - 5x^2 + 4}$ **[5 marks]**

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Answer .....

17 Prove that $2\tan^2\theta + 1 \equiv \dfrac{1+\sin^2\theta}{1-\sin^2\theta}$ where $\sin^2\theta \neq 1$

[3 marks]

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END OF QUESTIONS

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