Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4 – 5	
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12 – 13	
14 – 15	
16	
TOTAL	

AQA

Level 2 Certificate in Further Mathematics
June 2013

Further Mathematics 8360/1

Level 2

Paper 1 Non-Calculator

Wednesday 19 June 2013 1.30 pm to 3.00 pm

For this paper you must have:
- mathematical instruments.

You may **not** use a calculator.

Time allowed
- 1 hour 30 minutes

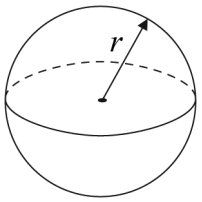
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this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

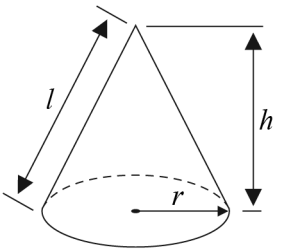
Volume of sphere $= \frac{4}{3}\pi r^3$

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



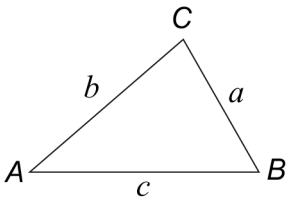
Volume of cone $= \frac{1}{3}\pi r^2 h$

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 A curve has gradient function $\frac{dy}{dx} = 9 - x^3$

1 (a) Work out the gradient of the curve when $x = -1$

$= 9 - (-1)^3$

$= 9 - -1$

Answer 10 *(2 marks)*

1 (b) Work out the value of x where the rate of change of y with respect to x is 1.

$9 - x^3 = 1$

$9 = x^3 + 1$

$x = \sqrt[3]{9}$

$x = 2$

? Haven't covered integration

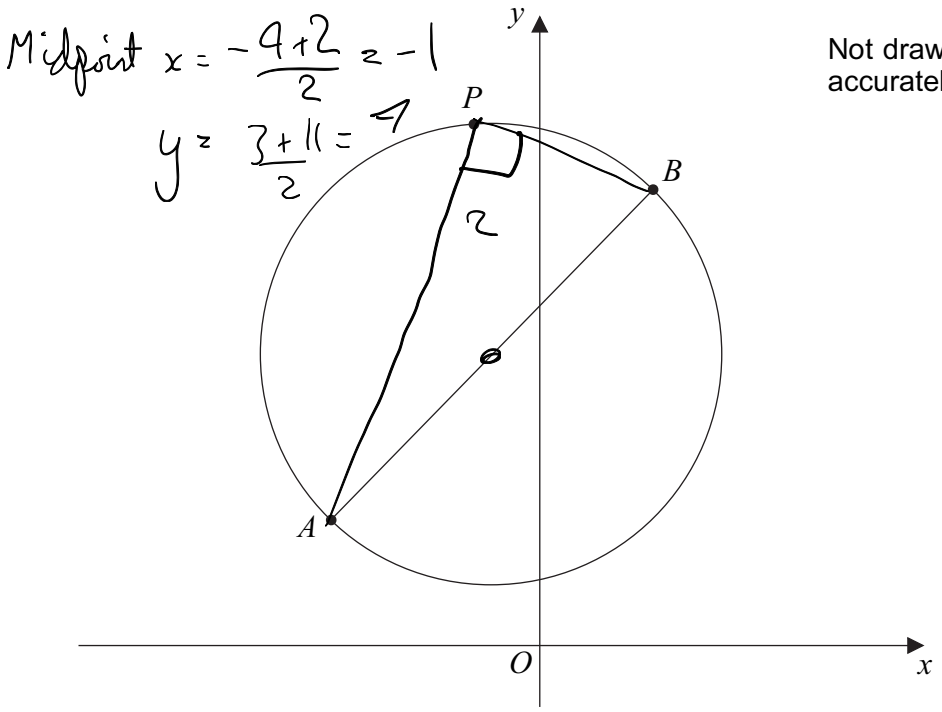
$y = 9x - \frac{x^4}{4}$ I guess? $= 19.09$

Answer *(2 marks)*

Turn over for the next question

2 A is $(-4, 3)$ and B is $(2, 11)$

AB is a diameter of the circle.



Not drawn accurately

2 (a) Work out the coordinates of the centre of the circle.

Centre = (−1 , 7)

(2 marks)

9

2 (b) Work out the radius of the circle.

$a^2 + b^2 = c^2$

$r = \sqrt{(-4 - -1)^2 + (3-7)^2}$

$= \sqrt{(-3)^2 + (4)^2}$

$= 5$

Radius = ... *(2 marks)*

2 (c) Write down the equation of the circle.

Answer $25 = (x+1)^2 + (y-7)^2$ *(1 mark)*

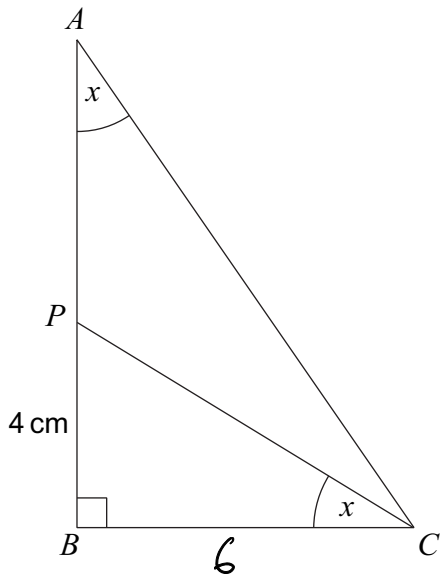
2 (d) P is another point on the circle.
The gradient of the line AP is 2.

Write down the gradient of the line PB.

Answer $-\frac{1}{2}$ *(1 mark)*

Turn over for the next question

3 ABC is a right-angled triangle.
P is a point on AB.



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$\tan\theta = \frac{O}{A}$

$\frac{2}{3} = \frac{4}{BC}$

$BC = 6$

$\tan\theta = \frac{O}{A}$

$\frac{2}{3} = \frac{6}{AB}$

$AB = 9$

$BP = 4\,\text{cm}$ and $\tan x = \frac{2}{3}$

3 (a) Work out the length of BC.

.....

.....

.....

Answer 6 cm *(2 marks)*

3 (b) Work out the length of AP.

$AP + 4 = AB$

$AP = 5$

.....

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Answer ..... cm *(3 marks)*

4 Solve $\sqrt{(33+\sqrt{x})} = 6$

$33 + \sqrt{x} = 36$

$\sqrt{x} = 3$

$x = 9$

$x =$ ..... *(3 marks)*

5 (a) Show that $(x+7)^2 - (x-3)^2$ simplifies to $20(x+2)$

$= x^2 + 14x + 49 - (x^2 - 6x + 9)$

$= x^2 + 14x + 49 - x^2 + 6x - 9$

$= x^2 + 14x + 49 - x^2 + 6x - 9$

$= 20x + 40$

$= 20(x+2)$

(3 marks)

5 (b) Hence, or otherwise, work out $107^2 - 97^2$

$= (100+7)^2 - (100-3)^2$

$= 20(100+2)$

$= 2040$

Answer..... *(2 marks)*

13

Turn over ▶

6 Simplify $(3xy^5)^4$

Answer $81x^9y^{20}$ *(2 marks)*

7 Expand and simplify $(y^2 - 5y + 2)(2y - 3)$

$= 2y^3 - 3y^2 - 10y^2 + 15y + 4y - 6$

$= 2y^3 - 13y^2 + 19y - 6$

Answer *(3 marks)*

8 A curve has equation $y = x^4 - 5x^2 + 9$

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

$\frac{dy}{dx} = 4x^3 - 10x$ *(2 marks)*

8 (b) Work out the equation of the tangent to the curve at the point where $x = 2$

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

$m = 4x^3 - 10x$ where $x = 2$

$= 12$

$y = x^4 - 5x^2 + 9$ where $x = 2$

$= 5$

$y = mx + c$

$5 = 12 \times 2 + c$

$5 - 24 = c$

$c = -19$

Answer $y = 12x - 19$ *(4 marks)*

9 Solve $x^2 + 6x + 7 = 0$

Give your answer in the form $a \pm \sqrt{b}$, where a and b are integers.

$(x+3)^2 - 9 + 7 = 0$

$(x+3)^2 - 2 = 0$

Answer $-3 \pm \sqrt{2}$ *(4 marks)*

10 Make x the subject of the formula $\frac{a+2x}{a-x} = n$

$a + 2x = an - xn$

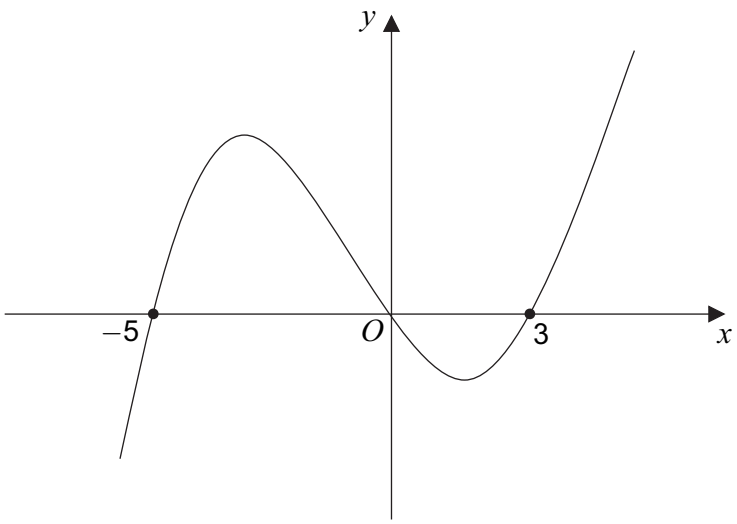
$a - an = -2x - xn$

$a(1-n) = x(-2-n)$

$x = \frac{a-an}{-2-n}$ unaccepted

Answer *(4 marks)*

11 Here is a sketch of a cubic function $y = f(x)$



11 (a) Use the sketch to write down the **three** linear factors of $f(x)$.

Answer - 5 (x+5) , 0 (x) , 3 (x-3) *(3 marks)*

11 (b) You are given that $f(x) = x^3 + bx^2 + cx$

Work out the values of b and c.

$= x(x^2 + bx + c)$

$f2(x) = x^2 + bx + c$ where -5 and 3 are 0

$c = -15$

$f2(-5) = 25 + -5b - 15$

$0 = 10 - 5b$

$5b = 10$

$b = 2$

$b =$ 2 , $c =$ - 15 *(2 marks)*

12 Work out **all** solutions for x and y if $\begin{pmatrix} x & 3 \\ 1 & y \end{pmatrix}\begin{pmatrix} x \\ -4 \end{pmatrix} = \begin{pmatrix} 4x \\ 8 \end{pmatrix}$

$x^2 - 12$

$\begin{pmatrix} -4x + 3x \\ -4 + xy \end{pmatrix} = \begin{pmatrix} 4x \\ 8 \end{pmatrix}$

$x - 4y$

$-4x + 3x = 4x$

$3x = 8x$

$0 = 5x$

$x = 0$?

$-4 + xy = 8$

???

Ooft Child!

Answer..... *(5 marks)*

13 Solve $y(\sqrt{3}-1)=8$

Give your answer in the form $a+b\sqrt{3}$ where a and b are integers.

$y = \frac{8}{\sqrt{3}-1}$

$= \frac{8}{\sqrt{3}-1} \times \frac{-\sqrt{3}-1}{-\sqrt{3}-1}$

$= \frac{-8\sqrt{3}-8}{-2} = 4\sqrt{3}+4$

$= (-1+\sqrt{3})(-1-\sqrt{3})$

$= 1-3$

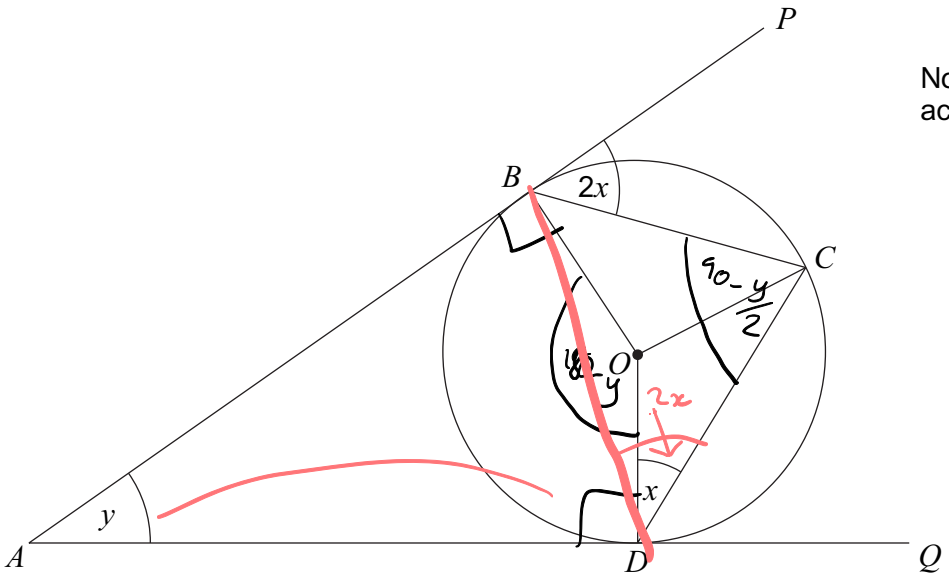
$= -2$

$y =$ ..... *(4 marks)*

Turn over for the next question

14 ABP and ADQ are tangents to the circle, centre O.

C lies on the circumference of the circle.



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Prove that $y = 2x$

Give reasons for any statements you make.

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(2 marks)

15 Express $2x^2 - 12x - 7$ in the form $a(x+b)^2 + c$

$= 2(x^2 - 6x) - 7$

$= 2((x-3)^2 - 9) - 7$

$= 2(x-3)^2 - 18 - 7$

$= 2(x-3)^2 - 25$

Answer..... *(4 marks)*

Turn over for the next question

16 Solve $x^{-\frac{2}{3}} = 7\frac{1}{9}$

Write your answer as a proper fraction.

$1 / \sqrt[3]{x^2} = \frac{64}{9}$

$\sqrt[3]{x^2} = \frac{9}{64}$

$\sqrt[3]{x} = \frac{3}{8}$

$x = \frac{27}{512}$

$x = \pm \frac{27}{512}$ *(5 marks)*

4

END OF QUESTIONS

5