MR BARTON'S ANSWERS

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4 - 5	
6 - 7	
8 - 9	
10 - 11	
12 - 13	
TOTAL	

AQA Level 2 Certificate in Further Mathematics

Further Mathematics 8360/1
Level 2

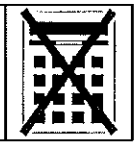
Practice Paper Set 2

Paper 1

Non-Calculator

For this paper you must have:
- mathematical instruments.

You may **not** use a calculator.



Time allowed
1 hour 30 minutes

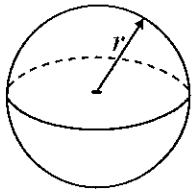
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book.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

Formulae Sheet

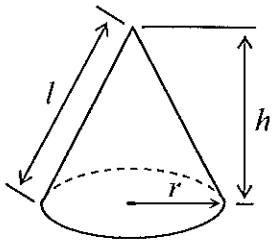
Volume of sphere $= \frac{4}{3}\pi r^3$

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



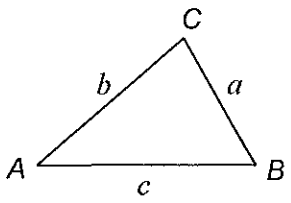
Volume of cone $= \frac{1}{3}\pi r^2 h$

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

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

Do not write outside the box

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

1 $y = 2x^3 - 5x$

$3 \times 2x^2 - 5$

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

Answer $6x^2 - 5$ *(2 marks)*

2 Here is a linear sequence.

	4	11	18	25	.....
$7n$	7	14	21	28	

2 (a) Work out an expression for the nth term.

Answer $7n - 3$ *(2 marks)*

2 (b) How many terms are less than 150?

Solve $7n - 3 < 150$

$\rightarrow 7n < 153$

$\rightarrow n < 21\frac{3}{7}$

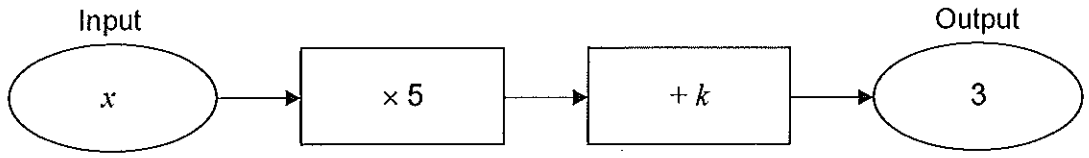
Answer 21 terms *(2 marks)*

Turn over for the next question

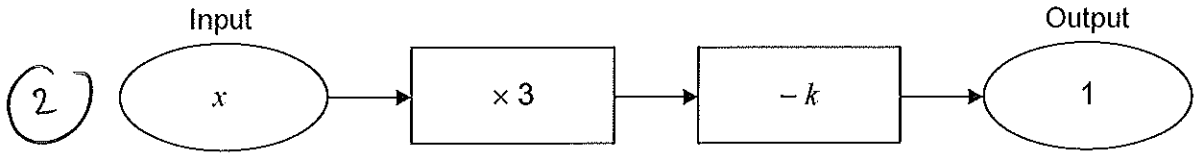
6

3 Here are two number machines with the same input, x.

(1)



(2)



Work out the value of x.

(1) $5x + k = 3$

(2) (+) $3x - k = 1$

$8x = 4$

$\rightarrow x = 4/8 = 1/2$

Answer $x =$ 0.5 *(4 marks)*

4 The transformation matrix $\begin{pmatrix} a & 2 \\ -1 & 1 \end{pmatrix}$ maps the point (3, 4) onto the point (2, b).

Work out the values of a and b.

$$\begin{pmatrix} a & 2 \\ -1 & 1 \end{pmatrix} \begin{pmatrix} 3 \\ 4 \end{pmatrix} = \begin{pmatrix} 2 \\ b \end{pmatrix}$$

$\therefore 3a + 2 \times 4 = 2$

$\rightarrow 3a + 8 = 2$

$\rightarrow 3a = -6$

$\rightarrow a = -2$

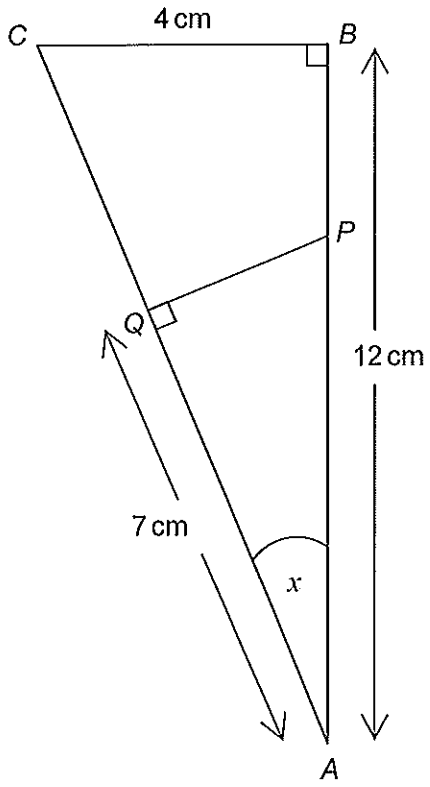
$-3 + 4 = b$

$\rightarrow b = 1$

Answer $a =$ −2, $b =$ 1 *(3 marks)*

Do not write outside the box

5 The diagram shows two right-angled triangles *ABC* and *APQ*.



Not drawn accurately

5 (a) Using triangle *ABC*, write down the value of tan x. = $\frac{Opp}{Adj}$

Answer tan x = 4/12 or 1/3 *(1 mark)*

5 (b) Work out the length of *PQ*.

Tan(x) = $\frac{PQ}{7}$

→ 1/3 = PQ/7

→ 7 × 1/3 = PQ

Answer 7/3 or 2 1/3 cm *(2 marks)*

Turn over for the next question

10

Do not write outside the box

6 Expand and simplify $(5x - 2y)(4x + 3y)$

$20x^2 + 15xy - 8xy - 6y^2$

Answer $20x^2 + 7xy - 6y^2$ *(3 marks)*

7 $p \Delta t$ is defined as $3p^2 + p - t^2 - t$

For example $7 \Delta 2 = 3(7^2) + 7 - 2^2 - 2$
$= 147 + 7 - 4 - 2$
$= 148$

7 (a) Work out $4 \Delta -3$

$3(4^2) + 4 - (-3)^2 - (-3)$

$48 + 4 - 9 + 3$

Answer 46 *(2 marks)*

7 (b) Work out all the solutions of the equation $x \Delta 5 = 0$

$3x^2 + x - 5^2 - 5 = 0$

$3x^2 + x - 30 = 0$

$(3x + 10)(x - 3) = 0$

$3x + 10 = 0$ $\quad$ $x - 3 = 0$

$x = -10/3$ $\quad$ $x = 3$

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

Do not write outside the box

8 The equation of line L is $2x + y = 3$

8 (a) Line M is parallel to line L and passes through (1, –6).

Work out the equation of line M.

Give your answer in the form $y = ax + b$

Gradient of $2x + y = 3 \rightarrow y = -2x + 3$

$\therefore$ Gradient $= -2$

$m = -2$ $\quad y - y_1 = m(x - x_1)$

$x_1 = 1$ $\quad y + 6 = -2(x - 1)$

$y_1 = -6$ $\quad \rightarrow y + 6 = -2x + 2$

$y = -2x - 4$

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

8 (b) Line N is perpendicular to line L and passes through (–5, 4).

Work out the point of intersection of line N and the x-axis.

If perpendicular gradient $= \frac{1}{2}$ $\quad (-2 \times \frac{1}{2} = -1)$

$m = \frac{1}{2}$ $\quad y - y_1 = m(x - x_1)$

$x_1 = -5$ $\quad y - 4 = \frac{1}{2}(x + 5)$

$y_1 = 4$ $\quad y - 4 = \frac{1}{2}x + \frac{5}{2}$

$y = \frac{1}{2}x + 6\frac{1}{2}$

$(x - axis)$ when $y = 0 \rightarrow 0 = \frac{1}{2}x + 6\frac{1}{2}$

$\frac{1}{2}x = -6\frac{1}{2} \rightarrow x = -13$

Answer (....-13...., ...0....) *(4 marks)*

Turn over for the next question

16

Do not write outside the box

9 Simplify fully $\dfrac{3x}{(x-3)(x+6)} - \dfrac{2}{(x+6)}$

$\dfrac{3x}{(x-3)(x+6)} \quad \dfrac{2(x-3)}{(x-3)(x+6)}$

$= \dfrac{3x - 2(x-3)}{(x-3)(x+6)}$

$= \dfrac{3x - 2x + 6}{(x-3)(x+6)} = \dfrac{x+6}{(x-3)(x+6)} = \dfrac{1}{(x-3)}$

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

10 Make y the subject of the formula $x = \sqrt{\dfrac{y+1}{y-2}}$

$\times 2$: $x^2 = \dfrac{y+1}{y-2}$

$\times (y-2)$: $x^2(y-2) = y+1$

$x^2y - 2x^2 = y + 1$

$+2x^2$: $x^2y = 2x^2 + y + 1$

$-y$: $x^2y - y = 2x^2 + 1$

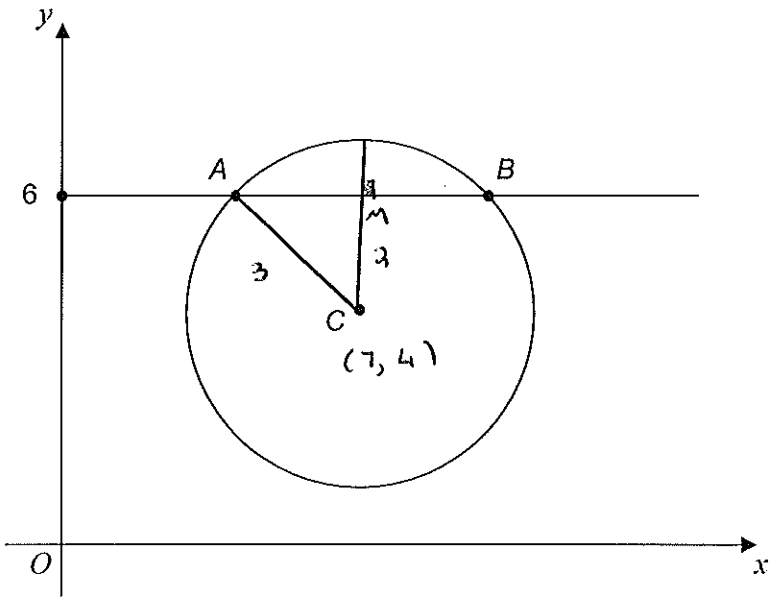
FACT: $y(x^2-1) = 2x^2 + 1$

$\div (x^2-1)$: $y = \dfrac{2x^2+1}{x^2-1}$

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

12 The diagram shows a sketch of the circle $(x-7)^2+(y-4)^2=9$ with centre C.
The line $y=6$ intersects the circle at A and B.

Show that $AB=2\sqrt{5}$



Centre of circle = (7, 4), Radius = $\sqrt{9}$ = 3

CM = 2 (6 - 4)

→ $AC^2 = AM^2 + CM^2$

$3^2 = AM^2 + 2^2$

$9 - 4 = AM^2$ → $AM^2 = 5$ → $AM = \sqrt{5}$

∴ $AB = 2 \times \sqrt{5} = 2\sqrt{5}$

(5 marks)

Do not write outside the box

13 Work out the value of x if $\dfrac{\sqrt{x} \times \sqrt{8}}{\sqrt{3}} = 4\sqrt{5}$

$\times\sqrt{3}$: $\sqrt{x} \times \sqrt{8} = 4\sqrt{15}$

$\div\sqrt{8}$: $\sqrt{x} = \dfrac{4\sqrt{15}}{\sqrt{8}}$

2: $x = \dfrac{16 \times 15}{8} = 30$

Answer $x =$ 30 *(4 marks)*

14 $(x - 5)$ is a factor of $x^3 - 6x^2 + ax - 20$ $= f(x)$

Work out the value of a.

By Factor Theorem: $f(5) = 0$

$\Rightarrow 5^3 - 6(5)^2 + 5a - 20 = 0$

$\Rightarrow 125 - 150 + 5a - 20 = 0$

$5a - 45 = 0$

$5a = 45$

$a = 9$

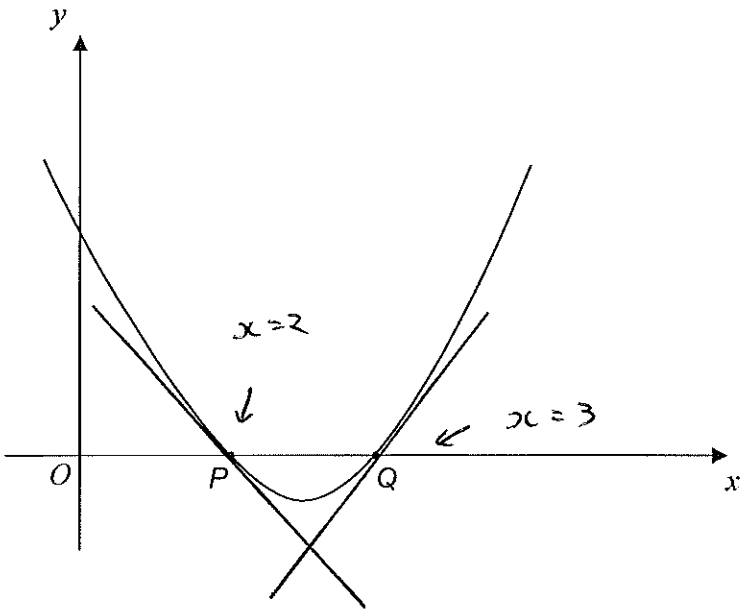
Answer $a =$ ..... *(3 marks)*

12

Do not write outside the box

15 The graph shows a sketch of $y = (x - 2)(x - 3)$

The curve intersects the x-axis at P and Q.



Show that the tangents at P and Q are perpendicular.

$y = x^2 - 3x - 2x + 6 \Rightarrow y = x^2 - 5x + 6$

Find Gradient of Tangents

$dy/dx = 2x - 5$

P $x = 2$, $dy/dx = 2(2) - 5 = -1$

Q $x = 3$ $dy/dx = 2(3) - 5 = 1$

$-1 \times 1 = -1$

$\therefore$ product of gradients $= -1$

$\therefore$ tangents are parallel

(5 marks)

Do not write outside the box

16 n is a positive integer.

Prove that $(n+2)^2 + (n+1)^2 - 1$ is **always** a multiple of 4.

$n^2 + 4n + 4 + n^2 + 2n + 1 - 1$

$\rightarrow 2n^2 + 6n + 4$

$= 2(n^2 + 3n + 2)$

$= 2(n+1)(n+2)$

$(n+1)$ & $(n+2)$ are consecutive numbers, so one must be even. Then the answer is multiplied by 2. Any 2 even numbers multiplied together are divisible by 4. *(6 marks)*

11

END OF QUESTIONS