Centre Number						Candidate Number				
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For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16 – 17	
TOTAL	

Level 2 Certificate in Further Mathematics
January 2013

Further Mathematics 8360/1

Level 2

Paper 1 Non-Calculator

Monday 28 January 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

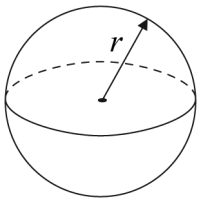
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this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

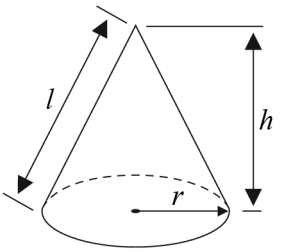
Volume of sphere $= \frac{4}{3}\pi r^3$

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



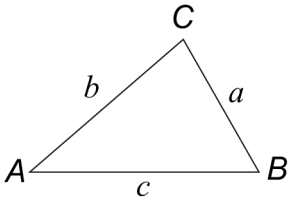
Volume of cone $= \frac{1}{3}\pi r^2 h$

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 The line $y = mx + c$ passes through the point $(4, 3)$.
It is parallel to the line $y = 5x + 6$

Work out the values of m and c.

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$m =$ ....., $c =$ ..... *(3 marks)*

2 The matrix $\begin{pmatrix} 5 & b \\ 4 & -1 \end{pmatrix}$ maps the point $(a, 2)$ onto the point $(28, 18)$,

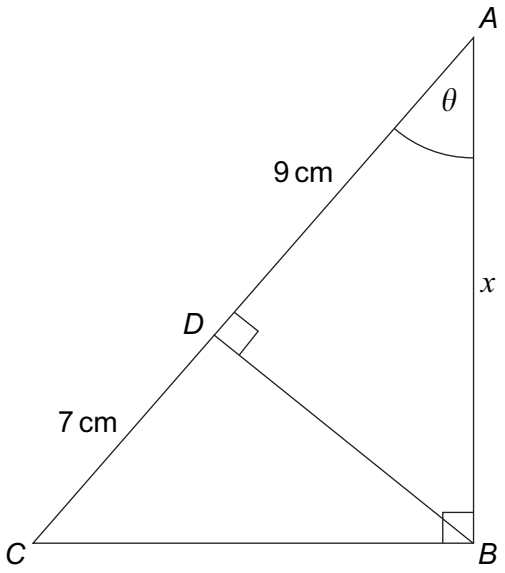
such that $\begin{pmatrix} 5 & b \\ 4 & -1 \end{pmatrix} \begin{pmatrix} a \\ 2 \end{pmatrix} = \begin{pmatrix} 28 \\ 18 \end{pmatrix}$

Work out the values of a and b.

$a =$ ....., $b =$ ..... *(4 marks)*

7

3 *ABC* is a right-angled triangle.
D is a point on *AC*.
BD is perpendicular to *AC*.



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3 (a) Use triangle *ABC* to write $\cos\theta$ in terms of x.

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$\cos\theta =$ ..... *(1 mark)*

3 (b) By writing another expression for $\cos\theta$ in terms of x, or otherwise, work out the value of x.

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$x =$ ..... cm *(2 marks)*

4 $w \blacktriangledown h$ is defined as $5w^2 - 8w + h^2 - 2h$

For example $1 \blacktriangledown 6 = 5 \times 1^2 - 8 \times 1 + 6^2 - 2 \times 6$
$= 5 - 8 + 36 - 12$
$= 21$

4 (a) Work out $2 \blacktriangledown 4$

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

4 (b) Solve $x \blacktriangledown 3 = 0$

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

9

5 (a) n is a positive integer.

Write down the **next** odd number after $2n - 1$

Answer..... *(1 mark)*

5 (b) Prove that the product of two consecutive odd numbers is **always** one less than a multiple of 4 .

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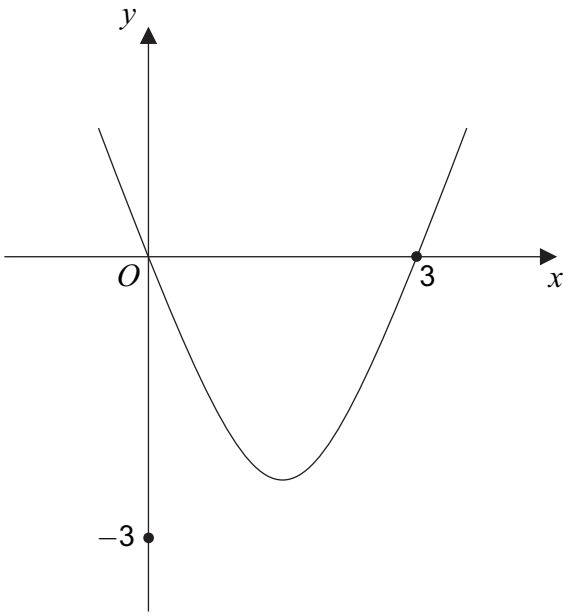
(3 marks)

6 The diagram shows a sketch of $y = x^2 - 3x$



6 (a) Sketch the line $y = \frac{1}{2}(x - 3)$ on the diagram.

Mark the value where this line crosses the y-axis. *(2 marks)*

6 (b) By factorising $x^2 - 3x$, or otherwise, work out the smaller solution of

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

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$x =$ ..... *(2 marks)*

8

7 $y = \dfrac{2x^2(3x^3 - 7x)}{x}$

Work out $\dfrac{\mathrm{d}y}{\mathrm{d}x}$

$\dfrac{\mathrm{d}y}{\mathrm{d}x} =$ ..... *(4 marks)*

8 f(x) is a decreasing function.

$$\text{f}(x) = b - ax \quad \text{for} \quad 4 \leqslant x < 8$$

The range of f(x) is $5 < \text{f}(x) \leqslant 7$

Work out the values of a and b.

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$a =$ ....., $b =$ ..... *(4 marks)*

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9 Bag *A* contains $7x$ counters.

Bag *B* contains $2x$ counters.

Five counters are taken from bag *A* and put in bag *B*.

9 (a) Write an expression, in terms of x, for the number of counters now in bag *B*.

Answer..... *(1 mark)*

9 (b) The ratio of counters in bag *A* to bag *B* is now 8 : 3

Use algebra to work out the **total** number of counters in the bags.

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

10 Solve the simultaneous equations

$$\frac{x-1}{y-2}=3 \qquad \frac{x+6}{y-1}=4$$

Do **not** use trial and improvement.
You **must** show your working.

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$x =$ ....., $y =$ ..... *(5 marks)*

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11 Write $\sqrt{500} - 2\sqrt{45}$ in the form $a\sqrt{5}$ where a is an integer.

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

12 Simplify fully $\dfrac{4x^2 + 19x - 5}{9x^2 - 16} \div \dfrac{x + 5}{3x - 4}$

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

13 $y = 2x^3 - 12x^2 + 24x - 11$

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

Give your answer in the form $\frac{dy}{dx} = a(x - b)^2$, where a and b are integers.

$\frac{dy}{dx} =$ ..... *(3 marks)*

13 (b) Hence, or otherwise, work out the coordinates of the stationary point of

$$y = 2x^3 - 12x^2 + 24x - 11$$

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

13 (c) Explain how you know that this stationary point is a point of inflection.

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(1 mark)

13

Turn over ▶

14 $x^2 - 2x + y^2 - 6y = 0$ is the equation of a circle.

By writing the equation in the form $(x - a)^2 + (y - b)^2 = r^2$
work out the centre and radius of the circle.

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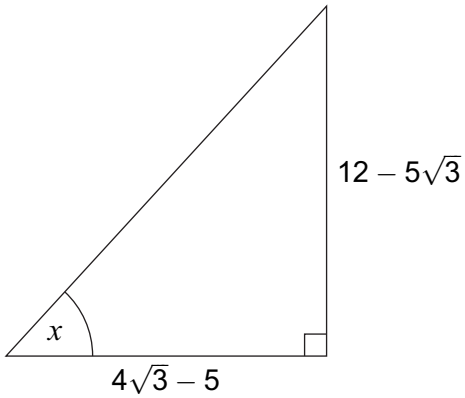
Centre = (....., ...)

Radius = ... *(5 marks)*

15 Show that angle $x = 60°$



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You **must** show your working.

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(4 marks)

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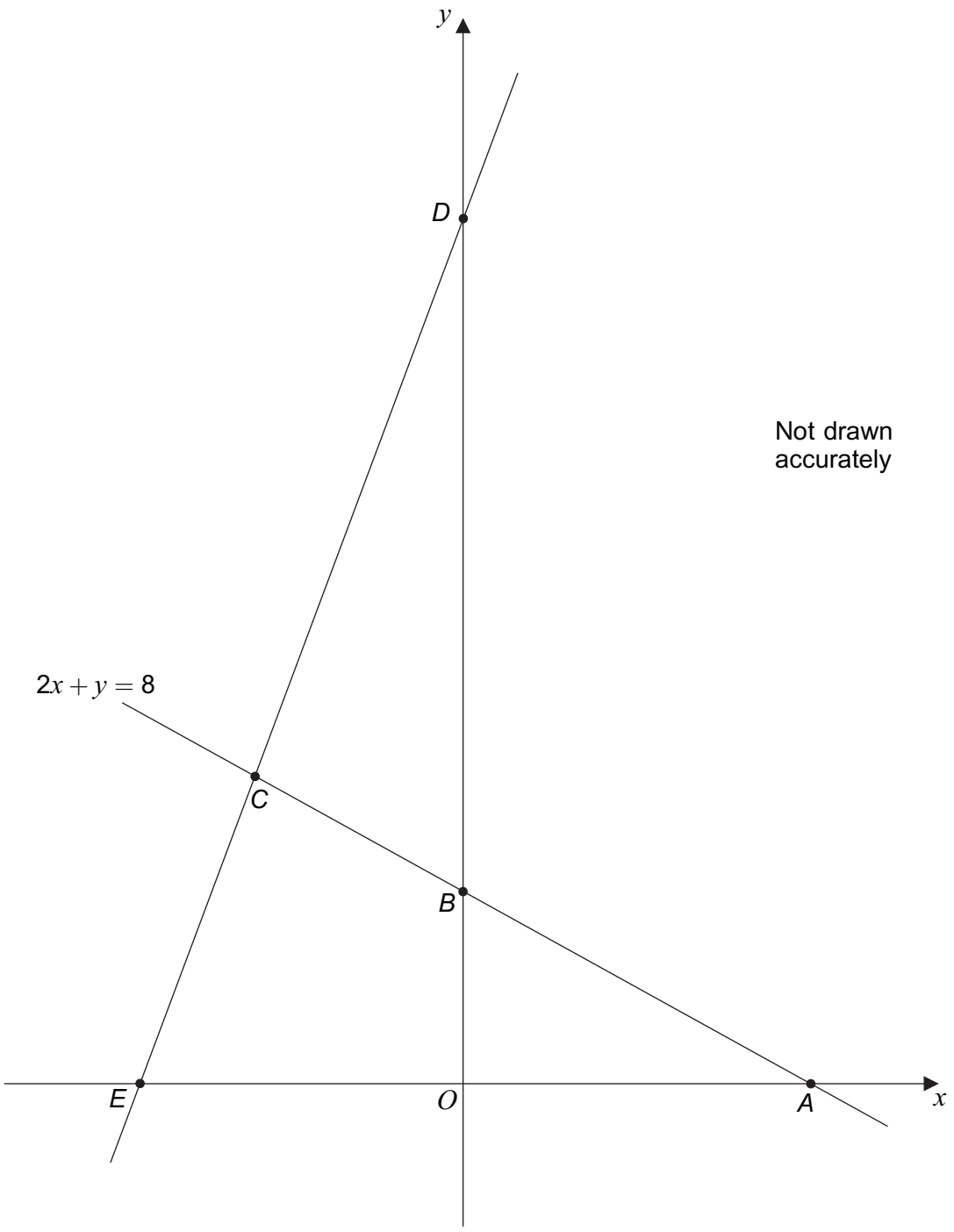
16 A, B and C are points on the line $2x + y = 8$

DCE is a straight line.

$AB : BC = 2 : 1$

$EC : CD = 1 : 2$



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Work out the ratio Area of triangle *AEC* : Area of triangle *BCD*

Give your answer in its simplest form.

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Answer ..... : ..... *(6 marks)*

END OF QUESTIONS

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