

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

<p>For this paper you must have:</p> <ul style="list-style-type: none"> mathematical instruments. <p>You may not use a calculator.</p>	
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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.

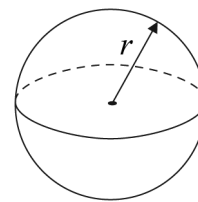


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Formulae Sheet

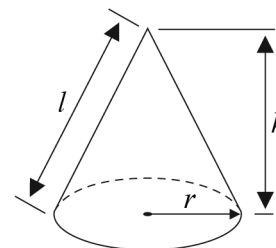
$$\text{Volume of sphere} = \frac{4}{3}\pi r^3$$

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



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

$$\text{Curved surface area of cone} = \pi r l$$



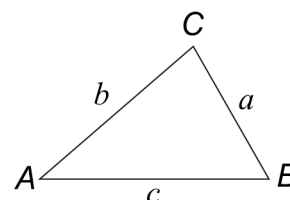
In any triangle ABC

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

$$\text{Sine rule} \quad \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\text{Cosine rule} \quad a^2 = b^2 + c^2 - 2bc \cos A$$

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$



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

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



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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$m = \dots\dots\dots, c = \dots\dots\dots$ (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 .

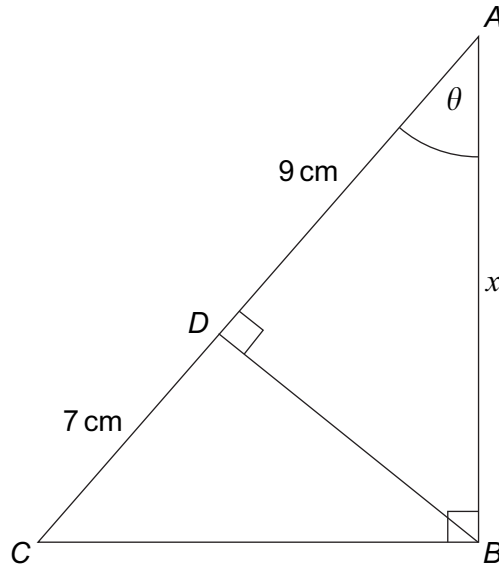
$a = \dots\dots\dots, b = \dots\dots\dots$ (4 marks)

7

Turn over ►



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



Not drawn
accurately

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

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$\cos \theta = \dots\dots\dots$ (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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$x = \dots\dots\dots$ 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)



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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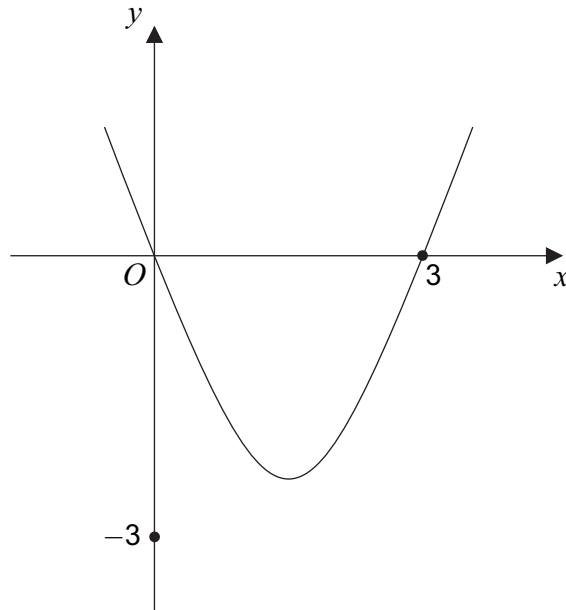
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(3 marks)



- 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)



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

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

$\frac{dy}{dx} = \dots\dots\dots$ (4 marks)



8 $f(x)$ is a decreasing function.

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

The range of $f(x)$ is $5 < f(x) \leq 7$

Work out the values of a and b .

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$a = \dots\dots\dots, b = \dots\dots\dots$ (4 marks)

8

Turn over ►



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)



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 $\frac{4x^2 + 19x - 5}{9x^2 - 16} \div \frac{x + 5}{3x - 4}$

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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.

$$\frac{dy}{dx} = \dots\dots\dots (3 \text{ marks})$$

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)



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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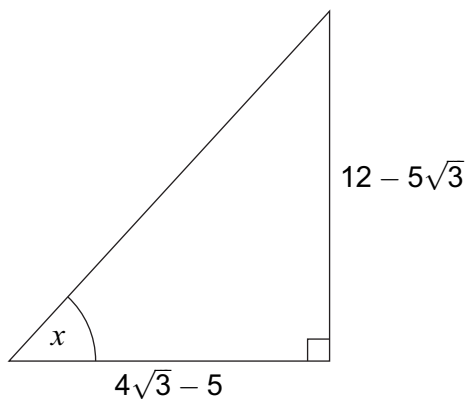
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Centre = (.....,))

Radius = (5 marks)



15

Show that angle $x = 60^\circ$ Not drawn
accuratelyYou **must** show your working.

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(4 marks)

Turn over ►



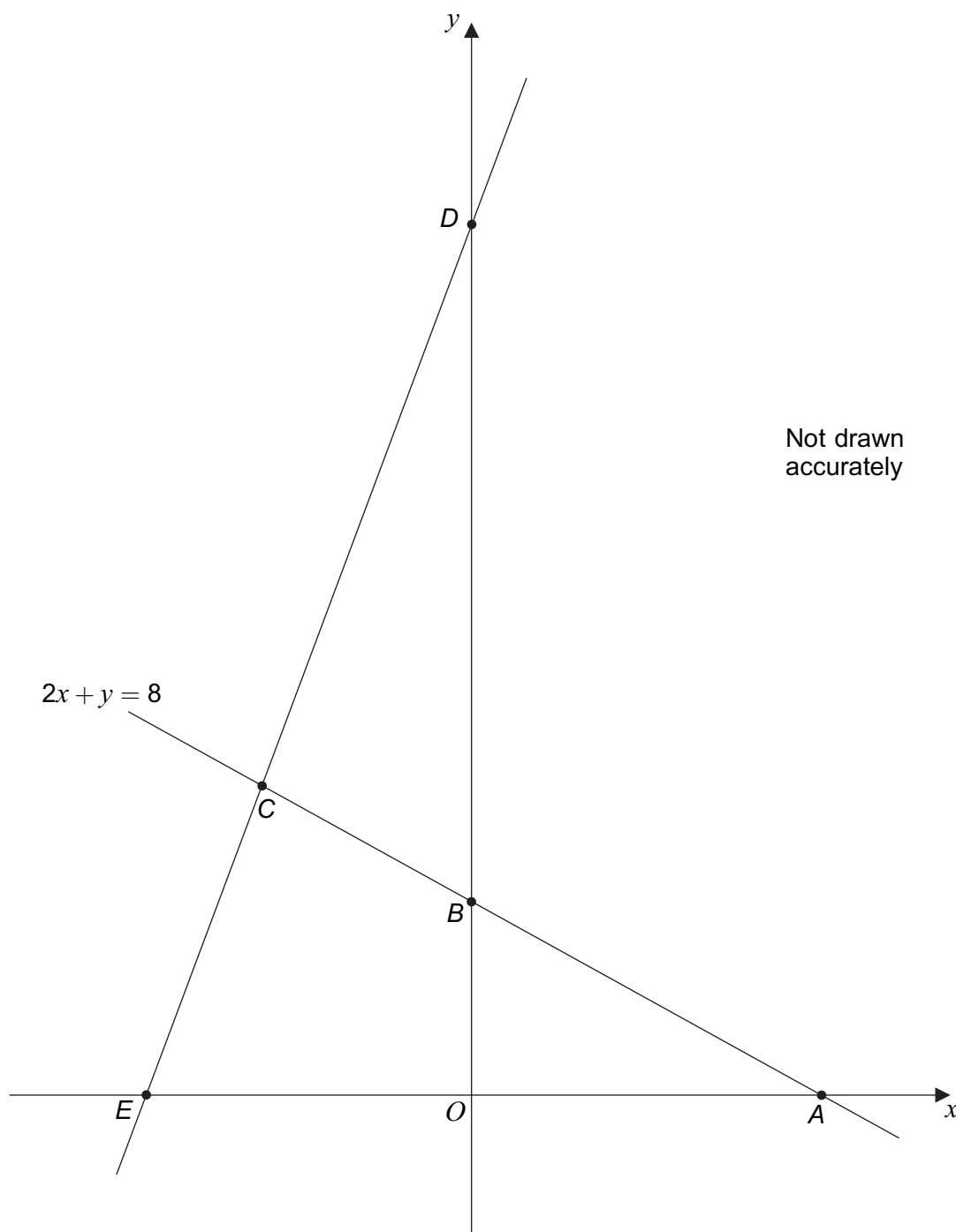
16

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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