

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



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>	
---	--

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.

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	

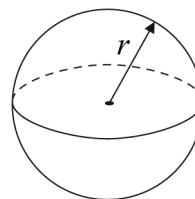


J A N 1 3 8 3 6 0 1 0 1

Formulae Sheet

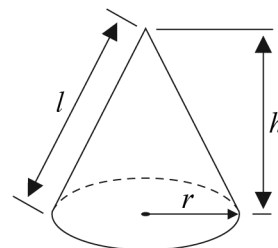
Volume of sphere $= \frac{4}{3}\pi r^3$

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



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

Curved surface area of cone $= \pi r l$



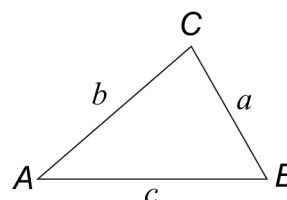
In any triangle ABC

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

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



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 .

.....

.....

.....

.....

.....

.....

.....

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

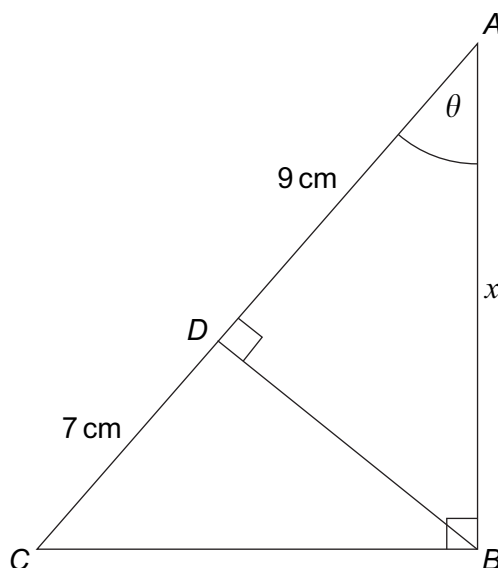
$a = \dots\dots\dots$, $b = \dots\dots\dots$ (4 marks)

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 .

.....

$\cos \theta = \dots\dots\dots$ (1 mark)

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

.....

$x = \dots\dots\dots$ cm (2 marks)



$w \blacktriangledown h$ 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 $2 \nabla 4$

.....

.....

.....

Answer..... (2 marks)

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

This image shows a full page of white paper with horizontal dashed lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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.

.....

.....

.....

.....

.....

.....

.....

.....

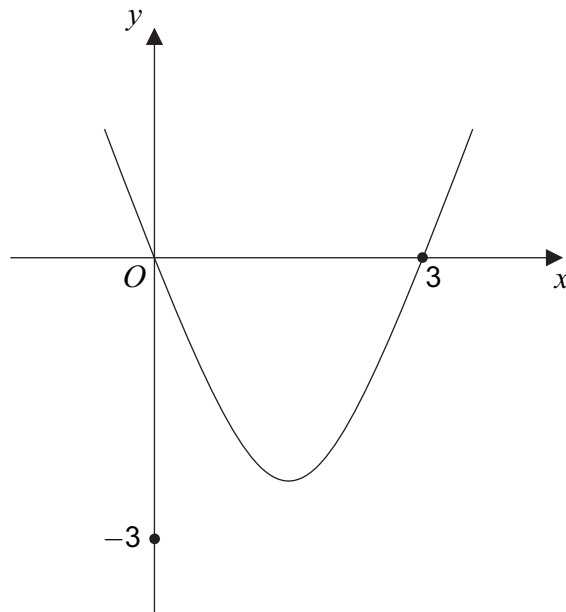
.....

.....

(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

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

.....

.....

.....

.....

.....

.....

.....

$x =$ (2 marks)



7

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

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

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



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 .

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

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.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Answer..... (4 marks)



Solve the simultaneous equations

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

[illegible]

$x = \dots\dots\dots, y = \dots\dots\dots$ (5 marks)

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

.....

.....

.....

.....

Answer..... (2 marks)

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

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

.....

.....

.....

.....

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

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

.....

.....

.....

(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.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

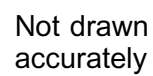
.....

Centre = (..... ,)

Radius = (5 marks)



Show that angle $x = 60^\circ$

[illegible]

9

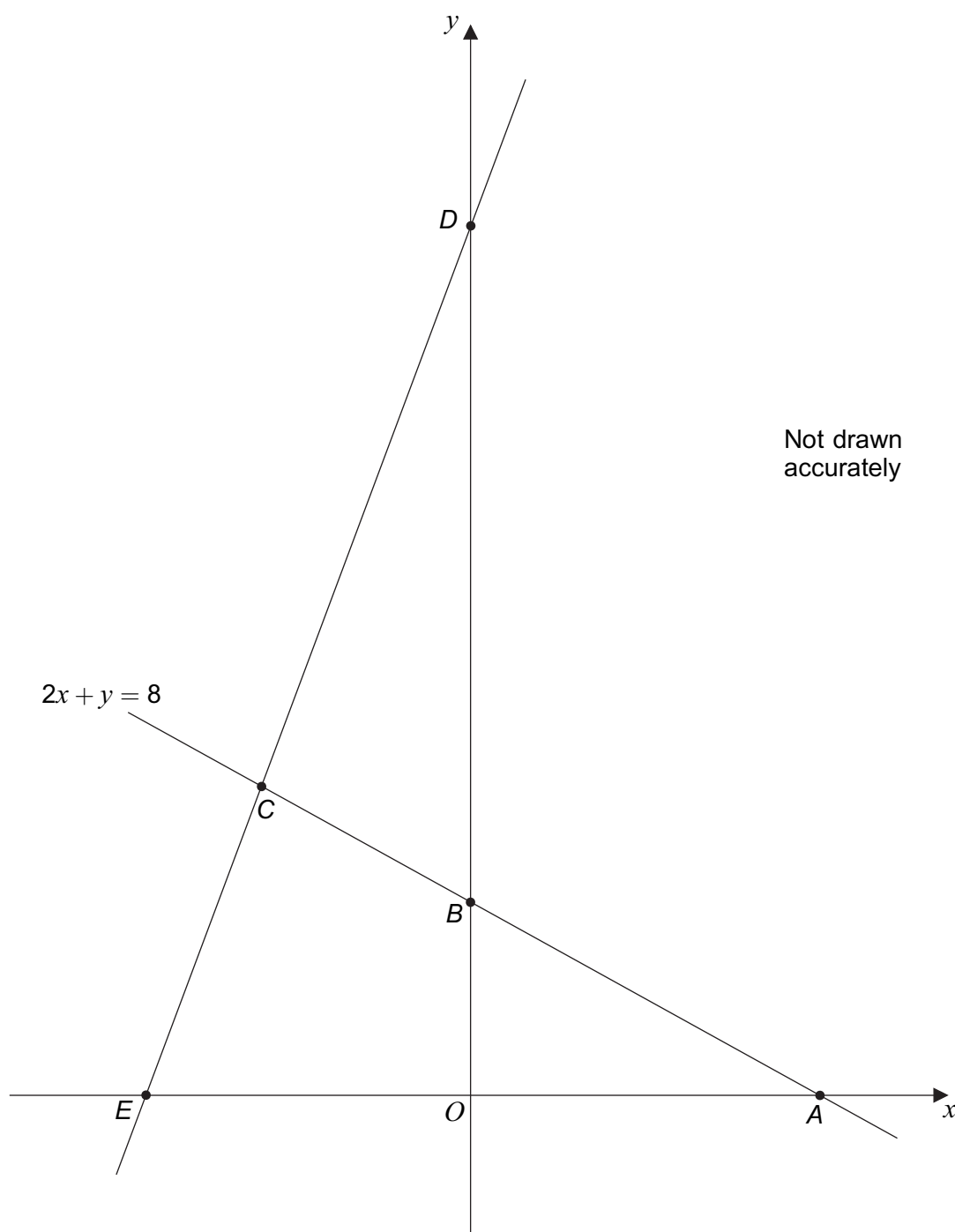
16

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

DCE is a straight line.

$AB : BC = 2 : 1$

$EC : CD = 1 : 2$



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

Give your answer in its simplest form.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Answer :

(6 marks)

END OF QUESTIONS



There are no questions printed on this page

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**



There are no questions printed on this page

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**



There are no questions printed on this page

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

