

Centre Number						Candidate Number				
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For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
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12 – 13	
14 – 15	
16	
TOTAL	



Level 2 Certificate in Further Mathematics  
June 2014

## Further Mathematics

**8360/1**

### Level 2

**Paper 1 Non-Calculator**

**Monday 16 June 2014 9.00 am to 10.30 am**

**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.

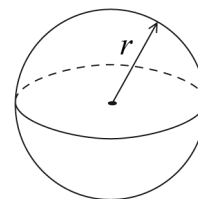


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## Formulae Sheet

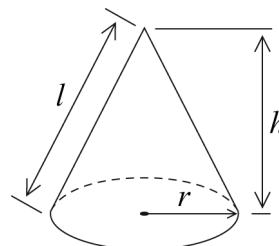
**Volume of sphere**  $= \frac{4}{3}\pi r^3$

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



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

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



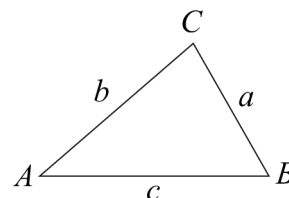
**In any triangle ABC**

**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** A straight line has gradient  $-2$  and passes through the point  $(-3, 10)$ .

Work out the equation of the line.  
Give your answer in the form  $y = mx + c$

**[2 marks]**

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Answer .....

**2**  $y = 4x^3 - 7x$

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

**[2 marks]**

Answer .....

**Turn over for the next question**



3 A transformation is given by the matrix  $\mathbf{M}$ , where  $\mathbf{M} = \begin{pmatrix} 1 & a \\ 0 & 2 \end{pmatrix}$

The image of the point  $(b, 5)$  under  $\mathbf{M}$  is  $(5, b)$ .

Work out the values of  $a$  and  $b$ .

[3 marks]

$a = \dots\dots\dots, b = \dots\dots\dots$

4 Solve  $20 + w < 3(w + 2)$

[3 marks]

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Answer .....



**5**  $f(x) = 10 - x^2$  for all values of  $x$ .  
 $g(x) = (x + 2a)(x + 3)$  for all values of  $x$ .

**5 (a)** Circle the correct value of  $f(-4)$  **[1 mark]**

26                  -6                  36                  16                  196

**5 (b)** Write down the range of  $f(x)$ . **[1 mark]**

Answer .....

**5 (c)**  $g(0) = 24$   
 Show that  $a = 4$  **[1 mark]**

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**5 (d)** Hence solve  $f(x) = g(x)$  **[4 marks]**

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Answer .....



6 The  $n$ th term of a sequence is  $\frac{2n^2 + 7}{3n^2 - 2}$

6 (a) Work out the 7th term.  
Give your answer as a fraction in its simplest form.

[2 marks]

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Answer .....

6 (b) Show that the limiting value of  $\frac{2n^2 + 7}{3n^2 - 2}$  as  $n \rightarrow \infty$  is  $\frac{2}{3}$

[2 marks]

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**8 (a)** Factorise fully  $3x^2 - 12$

**[2 marks]**

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Answer .....

**8 (b)** Factorise  $5x^2 + 4xy - 12y^2$

**[3 marks]**

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Answer .....



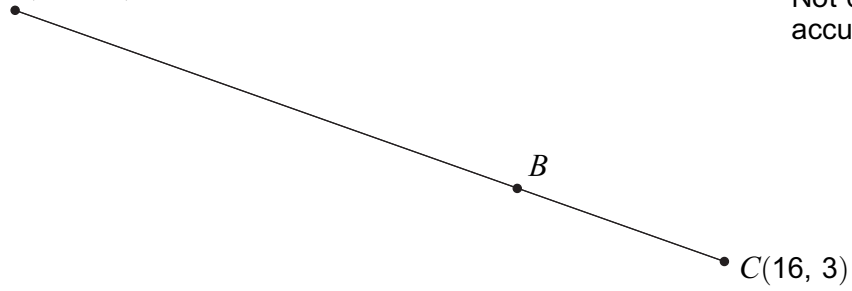


9

$ABC$  is a straight line.  
 $BC$  is 20% of  $AC$ .

$A(-9, 18)$

Not drawn  
accurately



Work out the coordinates of  $B$ .

[4 marks]

Answer ( ..... , ..... )

Turn over for the next question

Turn over ►



10 Rationalise the denominator of  $\frac{8}{3 - \sqrt{5}}$

Give your answer in the form  $a + b\sqrt{5}$  where  $a$  and  $b$  are integers.

[3 marks]

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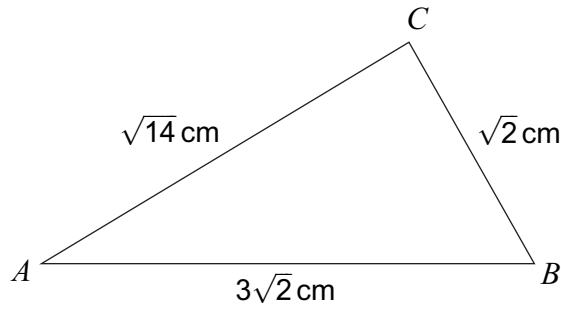
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Answer .....



11 (a) Here is triangle  $ABC$ .



Not drawn  
accurately

Show that angle  $B = 60^\circ$

[3 marks]

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11 (b) Hence work out the area of triangle  $ABC$ .

[3 marks]

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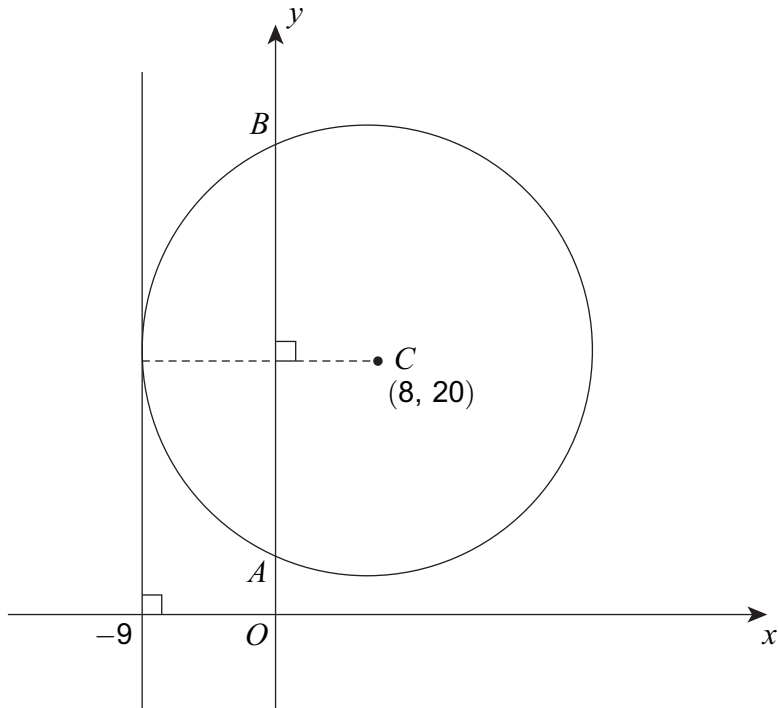
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Answer .....  $\text{cm}^2$



**12** The line  $x = -9$  is a tangent to the circle, centre  $C(8, 20)$



Not drawn  
accurately

**12 (a)** Show that the radius of the circle is 17.

[1 mark]

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**12 (b)** The circle intersects the  $y$ -axis at  $A$  and  $B$ .  
Show that the length  $AB$  is 30.

[3 marks]

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**13** A curve has equation  $y = x^3 - 3x^2 + 5$

**13 (a)** Show that the curve has a minimum point when  $x = 2$

**[4 marks]**

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**13 (b)** Show that the tangent at the minimum point meets the curve again when  $x = -1$

**[3 marks]**

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**14**  $(x - a)$  is a factor of  $x^3 + 2ax^2 - a^2x - 16$

**14 (a)** Show that  $a = 2$

**[2 marks]**

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**14 (b)** Solve  $x^3 + 4x^2 - 4x - 16 = 0$

**[4 marks]**

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Answer .....



15

Prove that

$$\frac{\sin \theta - \sin^3 \theta}{\cos^3 \theta} \equiv \tan \theta$$

[3 marks]

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Turn over for the next question

Turn over ►



16

$$2x^2 - 2bx + 7a \equiv 2(x - a)^2 + 3$$

Work out the **two** possible pairs of values of  $a$  and  $b$ .

[6 marks]

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$$a = \dots\dots\dots, b = \dots\dots\dots$$

and

$$a = \dots\dots\dots, b = \dots\dots\dots$$

**END OF QUESTIONS**

