

Write your name here	
Surname	Other names
Centre Number	Candidate Number
<input type="text"/>	<input type="text"/>
Edexcel IGCSE	
Further Pure Mathematics	
Paper 2	
Tuesday 21 June 2011 – Morning Time: 2 hours	Paper Reference 4PM0/02
Calculators may be used.	Total Marks
<input type="text"/>	<input type="text"/>

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Check your answers if you have time at the end.

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P 3 8 6 4 8 R A 0 1 3 2

Turn over ►

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Answer all ELEVEN questions
Write your answers in the spaces provided
You must write down all stages in your working

1 Evaluate $\sum_{n=6}^{20} (2n-3)$

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(Total for Question 1 is 3 marks)



- 2 A particle is moving along a straight line. At time t seconds, $t \geq 0$, the displacement, s metres, of the particle from a fixed point of the line is given by $s = t^3 + 2t^2 - 3t + 6$

Find the value of t for which the particle is moving with velocity 12 m/s.

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(Total for Question 2 is 4 marks)



Question 3 continued

Handwriting practice area consisting of 25 horizontal dotted lines.

(Total for Question 3 is 6 marks)



4 A curve has equation $y = x^3 + 2x^2 - 11x - m$, where m is a positive integer. The curve crosses the x -axis at the point with coordinates $(-4, 0)$.

(a) Show that $m = 12$ (2)

(b) Factorise $x^3 + 2x^2 - 11x - 12$ completely. (3)

The curve also crosses the x -axis at two other points.

(c) Write down the x -coordinate of each of these points. (1)

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Question 4 continued

Dotted lines for writing.

(Total for Question 4 is 6 marks)



Question 5 continued

Dotted lines for writing the answer to Question 5.

(Total for Question 5 is 6 marks)



P 3 8 6 4 8 R A 0 9 3 2

6

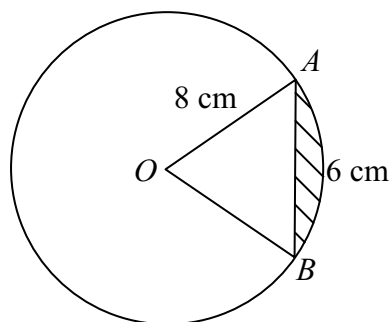


Figure 1

Figure 1 shows a circle, centre O , with radius 8 cm. The arc AB has length 6 cm.

- (a) Find, in radians, the size of angle AOB . (2)
- (b) Find the area of the sector AOB . (2)
- (c) Find, to 3 significant figures, the area of the shaded segment. (3)

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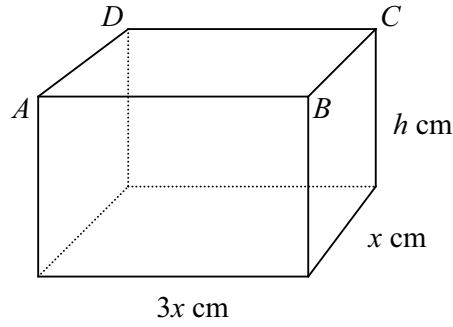


Figure 2

A rectangular box has length $3x \text{ cm}$, width $x \text{ cm}$ and height $h \text{ cm}$, as shown in Figure 2. The top of the box, $ABCD$, is open. The volume of the box is 30 cm^3 and the total external surface area of the box is $S \text{ cm}^2$.

(a) Show that $S = 3x^2 + \frac{80}{x}$ (4)

Given that x can vary,

(b) find, to 3 significant figures, the minimum value of S . (5)

(c) Verify that your answer to part (b) does give the minimum value for S . (2)

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Question 7 continued

Handwriting practice area with 25 horizontal dotted lines.



Question 7 continued

Handwriting practice area consisting of 25 horizontal dotted lines.



Question 7 continued

A series of horizontal dotted lines for writing.

(Total for Question 7 is 11 marks)



Question 8 continued

Dotted lines for writing.



Question 8 continued

A series of horizontal dotted lines for writing.



Question 8 continued

[Area with horizontal dotted lines for writing]

(Total for Question 8 is 11 marks)



9 (a) Expand $\left(1 - \frac{3x}{4}\right)^{\frac{1}{3}}$ in ascending powers of x up to and including the term in x^3 , simplifying your terms as far as possible. (3)

(b) Expand $\left(1 + \frac{3x}{4}\right)^{-\frac{1}{3}}$ in ascending powers of x up to and including the term in x^3 , simplifying your terms as far as possible. (3)

(c) Write down the range of values of x for which both of your expansions are valid. (1)

(d) Expand $\left(\frac{4-3x}{4+3x}\right)^{\frac{1}{3}}$ in ascending powers of x up to and including the term in x^3 , simplifying your terms as far as possible. (3)

(e) Hence obtain an estimate, to 3 significant figures, of

$$\int_0^{0.5} \left(\frac{4-3x}{4+3x}\right)^{\frac{1}{3}} dx \quad (4)$$

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Question 9 continued

A series of horizontal dotted lines for writing.



Question 9 continued

Lined area for writing the answer to Question 9. The page contains 20 horizontal dotted lines for writing.



Question 9 continued

A series of horizontal dotted lines for writing.

(Total for Question 9 is 14 marks)



P 3 8 6 4 8 R A 0 2 3 3 2

10 The roots of the equation $x^2 + 6x + 2 = 0$ are α and β , where $\alpha > \beta$. Without solving the equation

(a) find

(i) the value of $\alpha^2 + \beta^2$

(ii) the value of $\alpha^4 + \beta^4$

(5)

(b) Show that $\alpha - \beta = 2\sqrt{7}$

(3)

(c) Factorise completely $\alpha^4 - \beta^4$

(2)

(d) Hence find the exact value of $\alpha^4 - \beta^4$

(2)

Given that $\beta^4 = A + B\sqrt{7}$ where A and B are positive constants

(e) find the value of A and the value of B .

(2)

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Question 10 continued

Handwriting practice area with horizontal dotted lines.



Question 10 continued

Handwriting practice area consisting of 25 horizontal dotted lines.



11

$$f(x) = x^2 + 6x + 8$$

Given that $f(x)$ can be expressed in the form $(x + A)^2 + B$ where A and B are constants,

(a) find the value of A and the value of B . (3)

(b) Hence, or otherwise, find

(i) the value of x for which $f(x)$ has its least value

(ii) the least value of $f(x)$. (2)

The curve C has equation $y = x^2 + 6x + 8$

The line l , with equation $y = 2 - x$, intersects C at two points.

(c) Find the x -coordinate of each of these two points. (4)

(d) Find the x -coordinate of the points where C crosses the x -axis. (2)

(Parts (e) and (f) follow on page 30 and 31)

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Question 11 continued

[Dotted lines for writing]

Turn over for parts (e) and (f)



Question 11 continued

The curve C has equation $y = x^2 + 6x + 8$ and the line l has equation $y = 2 - x$

In the space below,

(e) sketch, on the same axes, the curve C and the line l . (2)

(f) Find the area of the finite region bounded by the curve C and the line l . (5)



Question 11 continued

A series of 24 horizontal dotted lines provided for writing the answer to Question 11.

(Total for Question 11 is 18 marks)

TOTAL FOR PAPER IS 100 MARKS

