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| Write your name here   |                  |
| Surname  | Other names      |
| <b>Edexcel</b>   | Centre Number    |
| <b>International GCSE</b>  | Candidate Number |
| <h1 style="margin: 0;">Further Pure Mathematics</h1> <h2 style="margin: 0;">Paper 1</h2> |                  |
| Wednesday 22 May 2013 – Afternoon  | Paper Reference  |
| <b>Time: 2 hours</b>   | <b>4PM0/01</b>   |
| <b>Calculators may be used.</b>  | Total Marks      |

### 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.

Turn over ►

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PEARSON



2 Find the set of values of  $x$  for which

$$3(x + 1)^2 < 9 - x$$

(4)

A series of horizontal dotted lines for writing the solution to the inequality.

(Total for Question 2 is 4 marks)



3

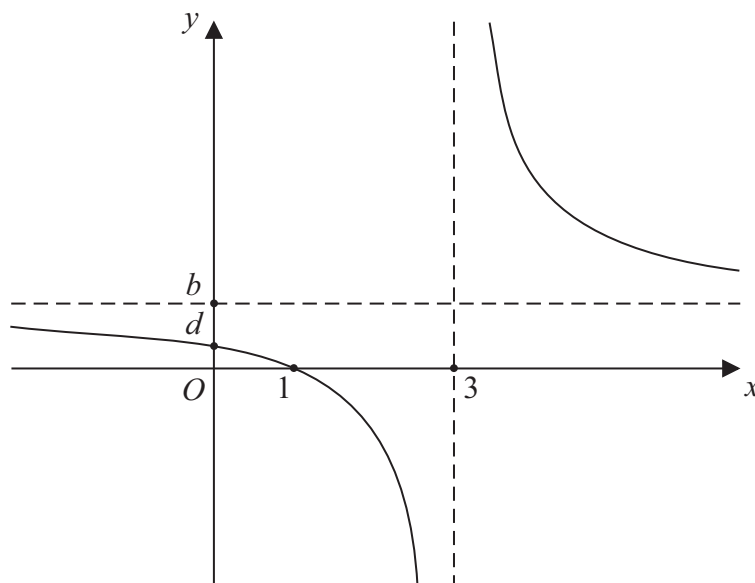


Figure 1

Figure 1 shows a sketch of the curve with equation  $y = 1 + \frac{c}{x+a}$ , where  $a$  and  $c$  are integers.

The equations of the asymptotes to the curve are  $x = 3$  and  $y = b$ .

(a) Find the value of  $a$  and the value of  $b$ . (2)

The curve crosses the  $x$ -axis at  $(1, 0)$  and the  $y$ -axis at  $(0, d)$ .

(b) Find the value of  $c$  and the value of  $d$ . (4)

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**Question 3 continued**

Dotted lines for writing.

**(Total for Question 3 is 6 marks)**



4 Solve, for  $-90 < x \leq 90$ , the equation

$$6 \sin^2 x^\circ - \cos x^\circ - 4 = 0$$

(6)

(Total for Question 4 is 6 marks)



- 5 The volume of liquid in a container is  $V \text{ cm}^3$  when the depth of the liquid is  $h \text{ cm}$ . Liquid is added to the container at a rate of  $36 \text{ cm}^3/\text{s}$ . Given that  $V = 4h^3$ , find the rate at which the depth of the liquid is increasing when  $V = 500$

(7)

(Total for Question 5 is 7 marks)



6 The equation  $x^2 + px + 1 = 0$  has roots  $\alpha$  and  $\beta$

(a) Find, in terms of  $p$ , an expression for

(i)  $\alpha + \beta$

(ii)  $\alpha^2 + \beta^2$

(iii)  $\alpha^3 + \beta^3$

(6)

(b) Find a quadratic equation, with coefficients expressed in terms of  $p$ , which has roots  $\alpha^3$  and  $\beta^3$

(2)

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**Question 6 continued**

A series of 30 horizontal dotted lines for writing the answer.

**(Total for Question 6 is 8 marks)**





**Question 7 continued**

Ruled area for writing the answer to Question 7 continued.



**Question 7 continued**

A series of horizontal dotted lines for writing, spanning the width of the page.



**Question 7 continued**

*(This area contains 28 horizontal dotted lines for writing.)*

**(Total for Question 7 is 11 marks)**



8

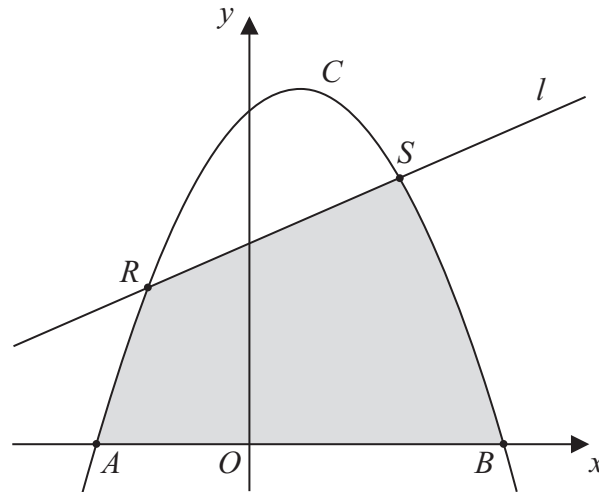


Figure 2

Figure 2 shows the curve  $C$  with equation  $y = 15 + 2x - x^2$

The curve crosses the  $x$ -axis at the points  $A$  and  $B$ .

(a) Find the  $x$ -coordinate of  $A$  and the  $x$ -coordinate of  $B$ . (3)

(b) Use calculus to find the area of the finite region bounded by  $C$  and the  $x$ -axis. (4)

The line  $l$  with equation  $y = x + 9$  intersects  $C$  at the points  $R$  and  $S$ .

(c) Find the  $x$ -coordinate of  $R$  and the  $x$ -coordinate of  $S$ . (3)

(d) Use calculus to find the area of the region bounded by  $C$ , the line  $l$  and the  $x$ -axis, shown shaded in Figure 2. (4)

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**Question 8 continued**

A series of horizontal dotted lines for writing.



**Question 8 continued**

A series of horizontal dotted lines for writing.





**Question 8 continued**

Dotted lines for writing.

**(Total for Question 8 is 14 marks)**



9

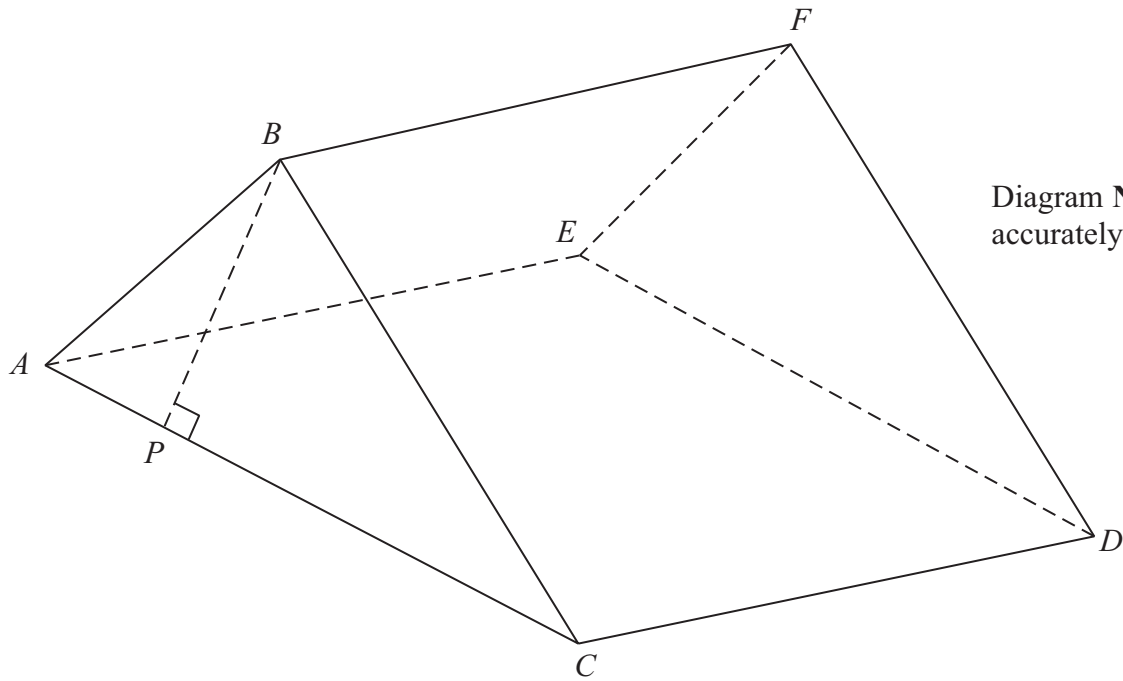


Diagram **NOT** accurately drawn

**Figure 3**

Figure 3 shows a triangular prism  $ABCDEF$ .

$ACDE$  is a rectangle. In triangle  $ABC$ ,  $AC = 12$  cm,  $\angle BAC = 60^\circ$  and  $\angle BCA = 30^\circ$

(a) Find the exact length of  $BC$ . (3)

The point  $P$  lies on the line  $AC$  and  $\angle BPC = 90^\circ$

(b) Show that  $BP = 3\sqrt{3}$  cm. (2)

The angle between the plane  $AFC$  and the plane  $ACDE$  is  $25^\circ$

(c) Find, to 3 significant figures, the length of  $BF$ . (3)

(d) Find the size of the angle between the line  $BD$  and the plane  $ACDE$ , giving your answer in degrees to 1 decimal place. (4)

(e) Find, to 3 significant figures, the volume of the prism  $ABCDEF$ . (2)

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**Question 9 continued**

A series of horizontal dotted lines for writing.



**Question 9 continued**

A series of horizontal dotted lines for writing.



**Question 9 continued**

Dotted lines for writing.

**(Total for Question 9 is 14 marks)**



10 The curve  $C$  has equation  $y = x^4 - 4x^3 - 2x^2 + 13x + 5$  and the line  $l_1$  is the tangent to  $C$  at the point  $R(1, 13)$ .

(a) Find an equation for  $l_1$  (4)

The points  $P$  and  $Q$  lie on  $C$ . The  $x$ -coordinates of  $P$  and  $Q$  are  $p$  and  $q$  respectively, where  $p < q$ . The tangent to  $C$  at  $P$  is parallel to  $l_1$  and the tangent to  $C$  at  $Q$  is parallel to  $l_1$ .

(b) Find the coordinates of  $P$  and the coordinates of  $Q$ . (4)

The line  $l_2$  passes through  $P$  and  $Q$ .

(c) Find an equation for  $l_2$  (2)

(d) Show that  $l_2$  is a tangent to  $C$  at  $P$  and a tangent to  $C$  at  $Q$ . (1)

The normal to  $C$  at  $R(1, 13)$  intersects  $l_2$  at the point  $S$ .

(e) Find the exact length of  $RS$ . (5)

(f) Find the area of the triangle  $PQR$ . (2)

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**Question 10 continued**

A series of horizontal dotted lines for writing.



Question 10 continued

A large area of the page is filled with horizontal dotted lines, providing space for a student's answer to Question 10.





**Question 10 continued**

Dotted lines for writing.

**(Total for Question 10 is 18 marks)**



11  $O, A, B$  and  $C$  are fixed points such that

$$\vec{OA} = \mathbf{p} + \mathbf{q} \quad \vec{OB} = 3\mathbf{p} - \mathbf{q} \quad \vec{OC} = 6\mathbf{p} - 4\mathbf{q}$$

(a) Find  $\vec{AB}$  in terms of  $\mathbf{p}$  and  $\mathbf{q}$ .

(1)

(b) Show that the points  $A, B$  and  $C$  are collinear.

(2)

(c) Find the ratio  $AB : BC$

(1)

The point  $D$  lies on  $AC$  produced such that  $AC = 2CD$

(d) Find  $\vec{OD}$  in terms of  $\mathbf{p}$  and  $\mathbf{q}$ , simplifying your answer.

(4)

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**Question 11 continued**

A series of horizontal dotted lines for writing.



**Question 11 continued**

Area with horizontal dotted lines for writing.

**(Total for Question 11 is 8 marks)**

**TOTAL FOR PAPER IS 100 MARKS**

