

Write your name here

Surname

Other names

**Pearson Edexcel**  
**International**  
**Advanced Level**

Centre Number

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Candidate Number

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# Core Mathematics C12

## Advanced Subsidiary

Monday 19 May 2014 – Morning  
**Time: 2 hours 30 minutes**

Paper Reference

**WMA01/01****You must have:**

Mathematical Formulae and Statistical Tables (Blue)

Total Marks

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**Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.**

### Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B). Coloured pencils and highlighter pens must not be used.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- When a calculator is used, the answer should be given to an appropriate degree of accuracy.

### Information

- The total mark for this paper is 125.
- 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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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**PEARSON**

1.

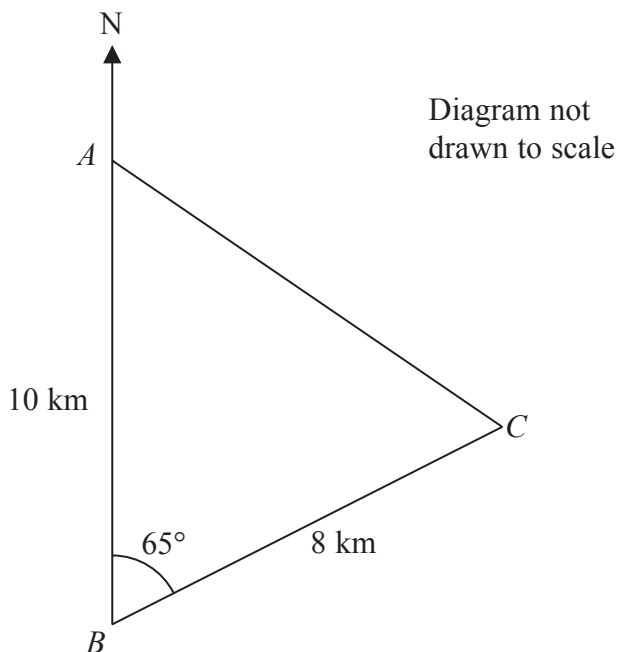


Figure 1

Figure 1 shows the position of three stationary fishing boats *A*, *B* and *C*, which are assumed to be in the same horizontal plane.

Boat *A* is 10 km due north of boat *B*.

Boat *C* is 8 km on a bearing of  $065^\circ$  from boat *B*.

- (a) Find the distance of boat *C* from boat *A*, giving your answer to the nearest 10 metres.

**(3)**

- (b) Find the bearing of boat *C* from boat *A*, giving your answer to one decimal place.

**(3)**

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**Question 2 continued**

Lined area for writing answers to Question 2.

**(Total 4 marks)**

**Q2**



P 4 4 9 6 8 A 0 5 4 8





4.

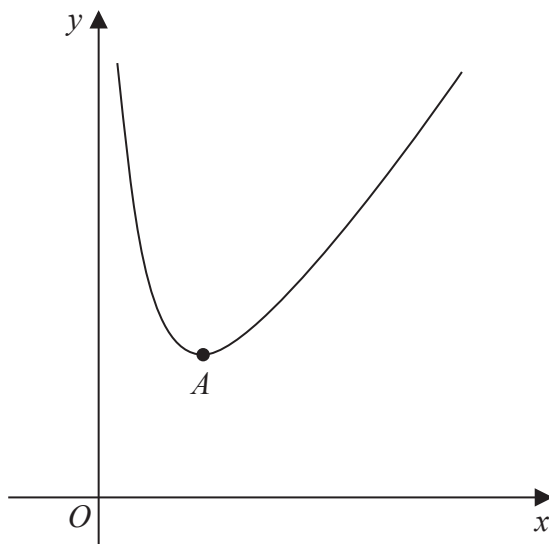


Figure 2

Figure 2 shows a sketch of part of the curve with equation  $y = f(x)$  where

$$f(x) = x^2 + \frac{16}{x}, \quad x > 0$$

The curve has a minimum turning point at  $A$ .

(a) Find  $f'(x)$ . (2)

(b) Hence find the coordinates of  $A$ . (4)

(c) Use your answer to part (b) to write down the turning point of the curve with equation

(i)  $y = f(x + 1)$ ,

(ii)  $y = \frac{1}{2}f(x)$ . (2)

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**Question 4 continued**

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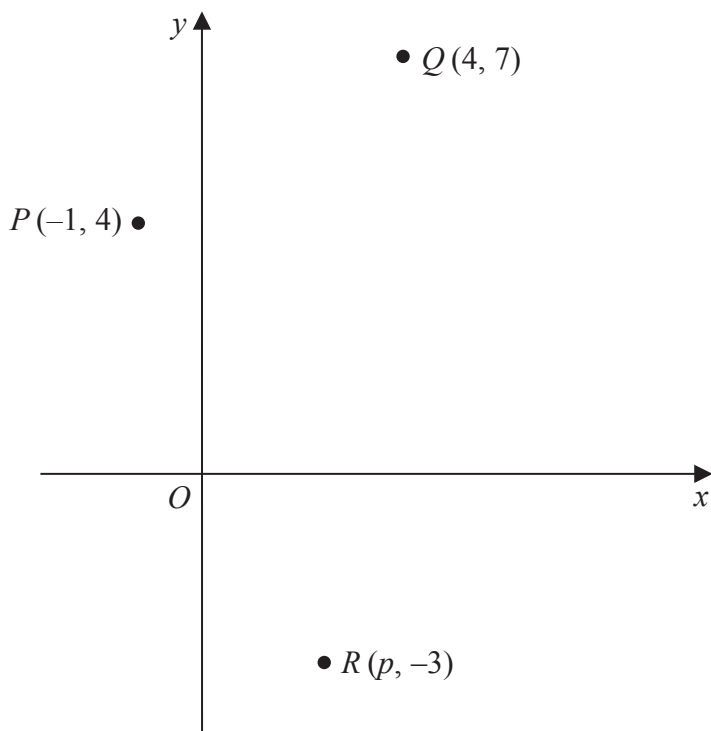


Diagram not drawn to scale

Figure 3

Figure 3 shows the points  $P$ ,  $Q$  and  $R$ .

Points  $P$  and  $Q$  have coordinates  $(-1, 4)$  and  $(4, 7)$  respectively.

(a) Find an equation for the straight line passing through points  $P$  and  $Q$ .

Give your answer in the form  $ax + by + c = 0$ , where  $a$ ,  $b$  and  $c$  are integers. (4)

The point  $R$  has coordinates  $(p, -3)$ , where  $p$  is a positive constant.

Given that angle  $QPR = 90^\circ$ ,

(b) find the value of  $p$ . (3)

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6. (a) Show that

$$\frac{\cos^2 x - \sin^2 x}{1 - \sin^2 x} \equiv 1 - \tan^2 x, \quad x \neq (2n + 1)\frac{\pi}{2}, \quad n \in \mathbb{Z}$$

(2)

(b) Hence solve, for  $0 \leq x < 2\pi$ ,

$$\frac{\cos^2 x - \sin^2 x}{1 - \sin^2 x} + 2 = 0$$

Give your answers in terms of  $\pi$ .

(5)

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9. (i) Find the value of  $\sum_{r=1}^{20} (3 + 5r)$  (3)

(ii) Given that  $\sum_{r=0}^{\infty} \frac{a}{4^r} = 16$ , find the value of the constant  $a$ . (4)

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11.

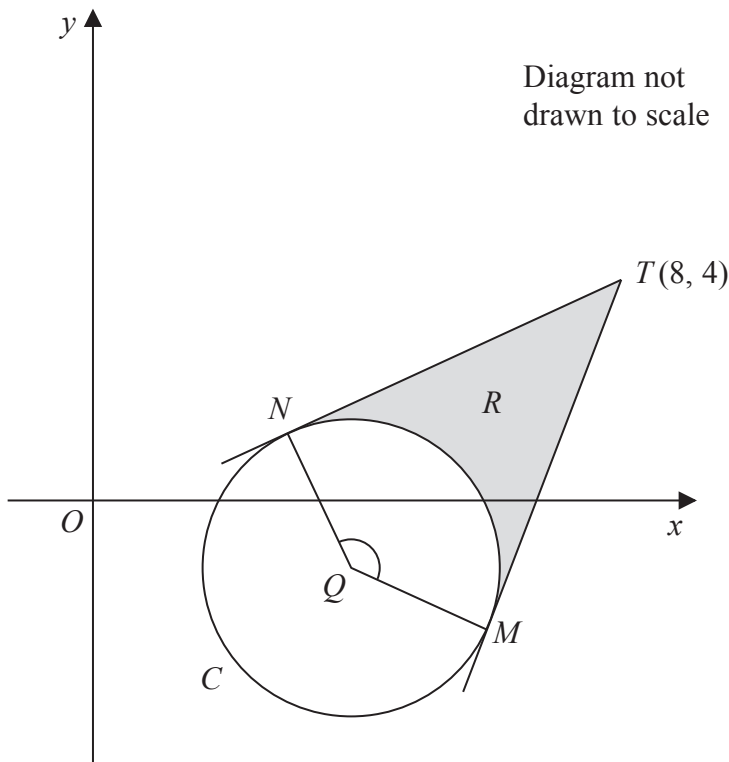


Figure 4

Figure 4 shows a sketch of the circle  $C$  with centre  $Q$  and equation

$$x^2 + y^2 - 6x + 2y + 5 = 0$$

(a) Find

- (i) the coordinates of  $Q$ ,
- (ii) the exact value of the radius of  $C$ .

(5)

The tangents to  $C$  from the point  $T(8, 4)$  meet  $C$  at the points  $M$  and  $N$ , as shown in Figure 4.

(b) Show that the obtuse angle  $MQN$  is 2.498 radians to 3 decimal places.

(5)

The region  $R$ , shown shaded in Figure 4, is bounded by the tangent  $TN$ , the minor arc  $NM$ , and the tangent  $MT$ .

(c) Find the area of region  $R$ .

(5)

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12.

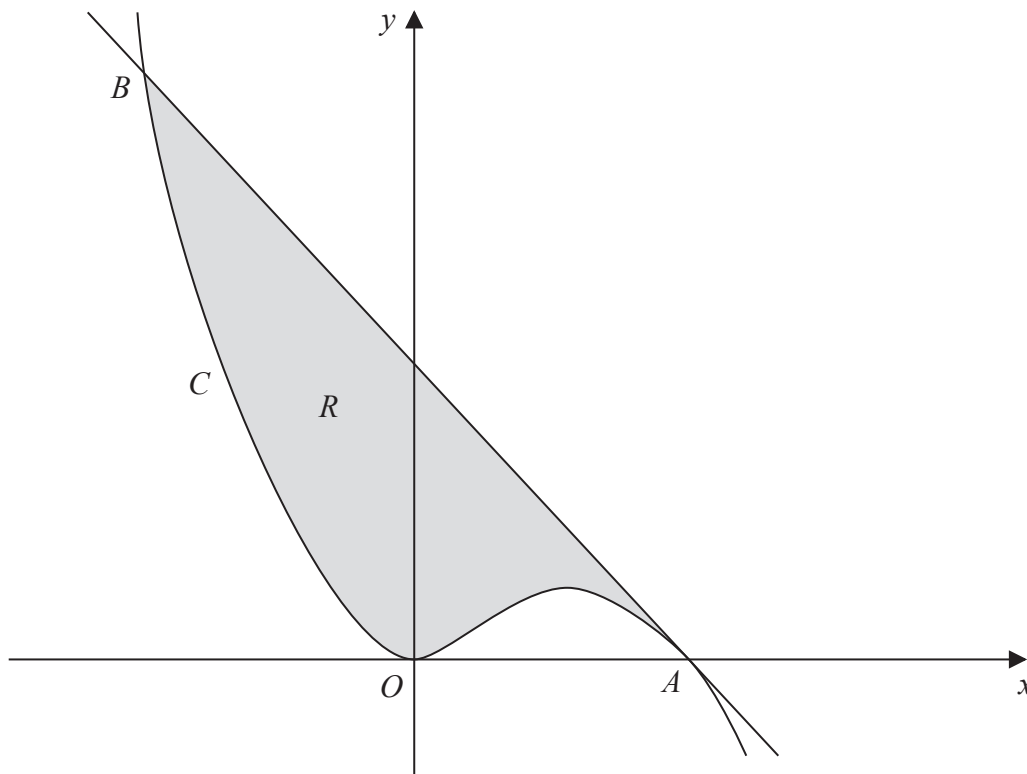


Figure 5

Figure 5 shows a sketch of part of the curve  $C$  with equation  $y = x^2 - \frac{1}{3}x^3$

$C$  touches the  $x$ -axis at the origin and cuts the  $x$ -axis at the point  $A$ .

(a) Show that the coordinates of  $A$  are  $(3, 0)$ . (1)

(b) Show that the equation of the tangent to  $C$  at the point  $A$  is  $y = -3x + 9$  (5)

The tangent to  $C$  at  $A$  meets  $C$  again at the point  $B$ , as shown in Figure 5.

(c) Use algebra to find the  $x$  coordinate of  $B$ . (4)

The region  $R$ , shown shaded in Figure 5, is bounded by the curve  $C$  and the tangent to  $C$  at  $A$ .

(d) Find, by using calculus, the area of region  $R$ .

*(Solutions based entirely on graphical or numerical methods are not acceptable.)* (5)

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**Question 12 continued**

Lined area for writing the answer to Question 12.

**(Total 15 marks)**

**Q12**

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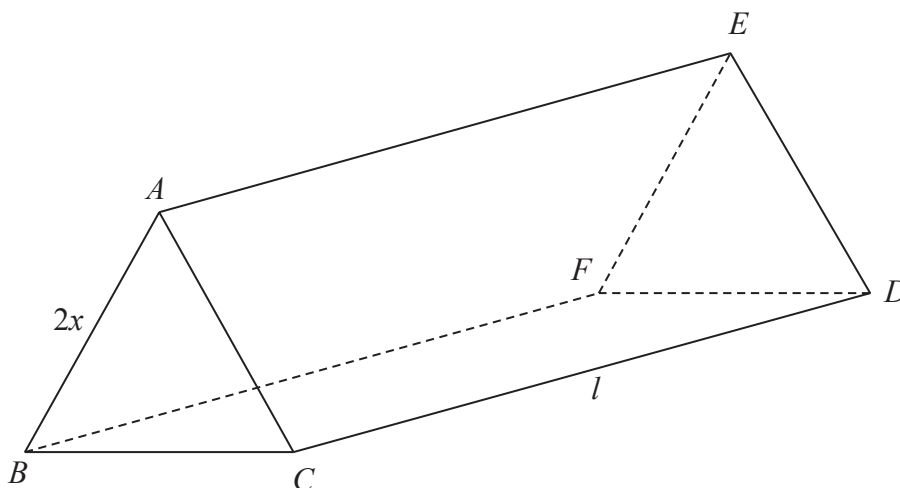








14.



**Figure 6**

Figure 6 shows a solid triangular prism  $ABCDEF$  in which  $AB = 2x$  cm and  $CD = l$  cm.

The cross section  $ABC$  is an equilateral triangle.

The rectangle  $BCDF$  is horizontal and the triangles  $ABC$  and  $DEF$  are vertical.

The total surface area of the prism is  $S$  cm<sup>2</sup> and the volume of the prism is  $V$  cm<sup>3</sup>.

(a) Show that  $S = 2x^2\sqrt{3} + 6xl$  (3)

Given that  $S = 960$ ,

(b) show that  $V = 160x\sqrt{3} - x^3$  (5)

(c) Use calculus to find the maximum value of  $V$ , giving your answer to the nearest integer. (5)

(d) Justify that the value of  $V$  found in part (c) is a maximum. (2)

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