

Write your name here

Surname

Other names

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

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--

# Core Mathematics C12

## Advanced Subsidiary

Wednesday 20 May 2015 – Morning  
**Time: 2 hours 30 minutes**

Paper Reference

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

Mathematical Formulae and Statistical Tables (Blue)

Total Marks

--

**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 ►

P44964A

©2015 Pearson Education Ltd.

5/1/1/1/


**PEARSON**





2.

$$f(x) = x^4 - x^3 + 3x^2 + ax + b$$

where  $a$  and  $b$  are constants.

When  $f(x)$  is divided by  $(x - 1)$  the remainder is 4

When  $f(x)$  is divided by  $(x + 2)$  the remainder is 22

Find the value of  $a$  and the value of  $b$ .

(5)

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---









4. (a) Sketch the graph of  $y = \frac{1}{x}$ ,  $x > 0$

(2)

The table below shows corresponding values of  $x$  and  $y$  for  $y = \frac{1}{x}$ , with the values for  $y$  rounded to 3 decimal places where necessary.

$x$	1	1.5	2	2.5	3
$y$	1	0.667	0.5	0.4	0.333

(b) Use the trapezium rule with all the values of  $y$  from the table to find an

approximate value, to 2 decimal places, for  $\int_1^3 \frac{1}{x} dx$

(4)





Leave  
blank

**Question 4 continued**

Lined area for writing answers to Question 4 continued.

**(Total 6 marks)**

Q4



P 4 4 9 6 4 A 0 9 4 8

5. (i) Find, giving your answer to 3 significant figures, the value of  $y$  for which

$$3^y = 12$$

(2)

(ii) Solve, giving an exact answer, the equation

$$\log_2(x + 3) - \log_2(2x + 4) = 4$$

(You should show each step in your working.)

(4)

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---



Leave blank

**Question 5 continued**

Lined writing area for the answer to Question 5.

**(Total 6 marks)**

**Q5**







7.

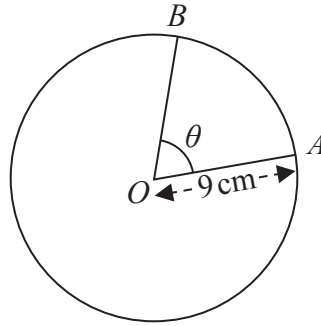


Figure 1

Figure 1 shows a circle with centre  $O$  and radius 9 cm. The points  $A$  and  $B$  lie on the circumference of this circle. The minor sector  $OAB$  has perimeter 30 cm and the angle between the radii  $OA$  and  $OB$  of this sector is  $\theta$  radians.

Find

- (a) the length of the arc  $AB$ , (1)
  
- (b) the value of  $\theta$ , (2)
  
- (c) the area of the minor sector  $OAB$ , (2)
  
- (d) the area of triangle  $OAB$ , giving your answer to 3 significant figures. (2)

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---









Question 8 continued

Lined writing area for the question.

Q8

(Total 7 marks)



9. The equation  $x^2 + (6k + 4)x + 3 = 0$ , where  $k$  is a constant, has no real roots.

(a) Show that  $k$  satisfies the inequality

$$9k^2 + 12k + 1 < 0 \tag{3}$$

(b) Find the range of possible values for  $k$ , giving your boundaries as fully simplified surds.

**(4)**

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---











Leave  
blank

**Question 10 continued**

Lined writing area for the answer to Question 10, consisting of 25 horizontal lines.

**(Total 8 marks)**

**Q10**

Small empty box for marking the question.













12.

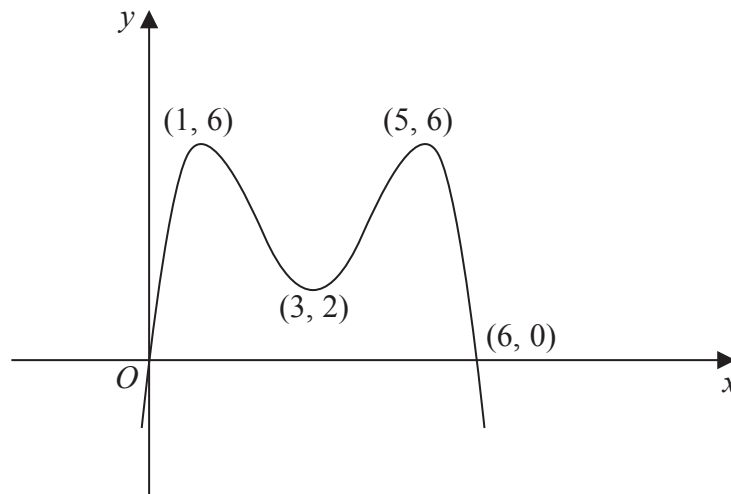
Diagram not  
drawn to scale

Figure 2

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

The curve crosses the  $x$ -axis at the origin and at the point  $(6, 0)$ . The curve has maximum points at  $(1, 6)$  and  $(5, 6)$  and has a minimum point at  $(3, 2)$ .

On **separate** diagrams sketch the curve with equation

(a)  $y = -f(x)$  (3)

(b)  $y = f\left(\frac{1}{2}x\right)$  (3)

(c)  $y = f(x + 4)$  (3)

On each diagram show clearly the coordinates of the maximum and minimum points, and the coordinates of the points where the curve crosses the  $x$ -axis.



**Question 12 continued**



**Question 12 continued**



Leave  
blank

**Question 12 continued**

**Q12**

**(Total 9 marks)**



13. (i) Showing each step in your reasoning, prove that

$$(\sin x + \cos x)(1 - \sin x \cos x) \equiv \sin^3 x + \cos^3 x \quad (3)$$

(ii) Solve, for  $0 \leq \theta < 360^\circ$ ,

$$3\sin \theta = \tan \theta$$

giving your answers in degrees to 1 decimal place, as appropriate. (6)

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

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---





**Question 13 continued**

Lined writing area for the answer to Question 13.





**Question 13 continued**

Lined area for writing the answer to Question 13.

**(Total 9 marks)**

**Q13**



14.

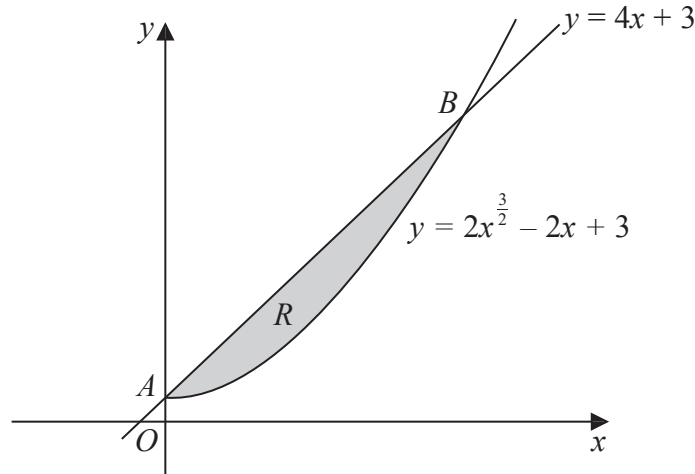


Figure 3

The finite region  $R$ , which is shown shaded in Figure 3, is bounded by the straight line  $l$  with equation  $y = 4x + 3$  and the curve  $C$  with equation  $y = 2x^{3/2} - 2x + 3, x \geq 0$

The line  $l$  meets the curve  $C$  at the point  $A$  on the  $y$ -axis and  $l$  meets  $C$  again at the point  $B$ , as shown in Figure 3.

(a) Use algebra to find the coordinates of  $A$  and  $B$ .

(4)

(b) Use integration to find the area of the shaded region  $R$ .

(6)

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---





Question 14 continued

Lined writing area with 30 horizontal lines for the student's response.





15.

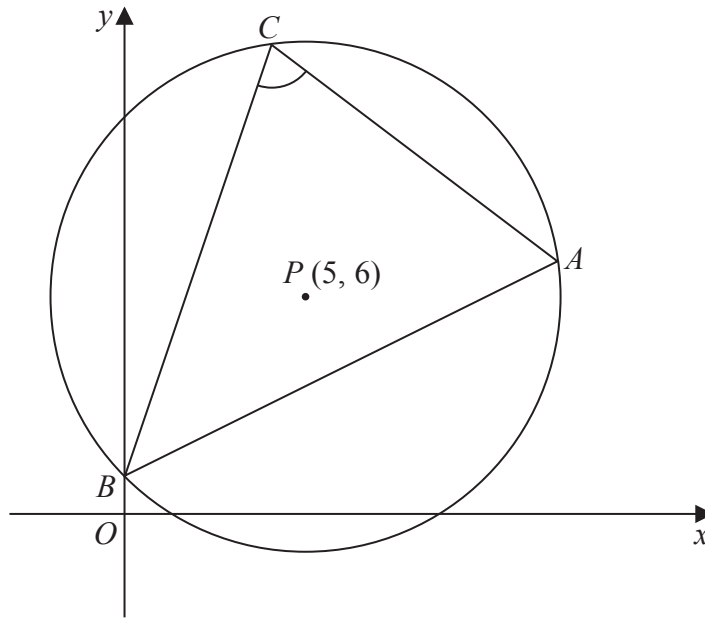


Diagram not drawn to scale

**Figure 4**

The circle shown in Figure 4 has centre  $P(5, 6)$  and passes through the point  $A(12, 7)$ .

Find

(a) the exact radius of the circle, (2)

(b) an equation of the circle, (3)

(c) an equation of the tangent to the circle at the point  $A$ . (4)

The circle also passes through the points  $B(0, 1)$  and  $C(4, 13)$ .

(d) Use the cosine rule on triangle  $ABC$  to find the size of the angle  $BCA$ , giving your answer in degrees to 3 significant figures. (5)

---

---

---

---

---

---

---

---











16. [In this question you may assume the formula for the area of a circle and the following formulae:

a **sphere** of radius  $r$  has volume  $V = \frac{4}{3}\pi r^3$  and surface area  $S = 4\pi r^2$

a **cylinder** of radius  $r$  and height  $h$  has volume  $V = \pi r^2 h$  and curved surface area  $S = 2\pi r h$

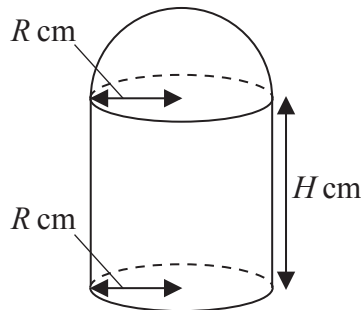


Figure 5

Figure 5 shows the model for a building. The model is made up of three parts. The roof is modelled by the curved surface of a hemisphere of radius  $R$  cm. The walls are modelled by the curved surface of a circular cylinder of radius  $R$  cm and height  $H$  cm. The floor is modelled by a circular disc of radius  $R$  cm. The model is made of material of negligible thickness, and the walls are perpendicular to the base.

It is given that the volume of the model is  $800\pi$  cm<sup>3</sup> and that  $0 < R < 10.6$

- (a) Show that

$$H = \frac{800}{R^2} - \frac{2}{3}R \quad (2)$$

- (b) Show that the surface area,  $A$  cm<sup>2</sup>, of the model is given by

$$A = \frac{5\pi R^2}{3} + \frac{1600\pi}{R} \quad (3)$$

- (c) Use calculus to find the value of  $R$ , to 3 significant figures, for which  $A$  is a minimum.

(5)

- (d) Prove that this value of  $R$  gives a minimum value for  $A$ .

(2)

- (e) Find, to 3 significant figures, the value of  $H$  which corresponds to this value for  $R$ .

(1)









