Write your name here

Surname	Other names

Pearson Edexcel International GCSE

Centre Number

Candidate Number

Further Pure Mathematics

Paper 1

Monday 19 January 2015 – Afternoon

Time: 2 hours

Paper Reference

4PM0/01

Calculators may be used.

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 ▶

P 4 4 0 2 9 A 0 1 3 2

PEARSON

Answer all TEN questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1 An equilateral triangle has sides of length x cm.

(a) Show that the area of the triangle is $\frac{\sqrt{3}}{4}x^2$ cm^2

(2)

The length of each side of the equilateral triangle is increasing at a rate of 0.1 cm/s.

(b) Find the length of each side of the triangle when the area of the triangle is increasing at a rate of $\frac{\sqrt{3}}{10}$ cm^2/s.

(4)

Question 1 continued

(Total for Question 1 is 6 marks)

2 A small stone is thrown vertically upwards from a point A above the ground. At time t seconds after being thrown from A, the height of the stone above the ground is s metres. Until the stone hits the ground, $s = 1.4 + 19.6t - 4.9t^2$

(a) Write down the height of A above the ground.
(1)

(b) Find the speed with which the stone was thrown from A.
(2)

(c) Find the acceleration of the stone until it hits the ground.
(1)

(d) Find the greatest height of the stone above the ground.
(3)

Question 2 continued

(Total for Question 2 is 7 marks)

3

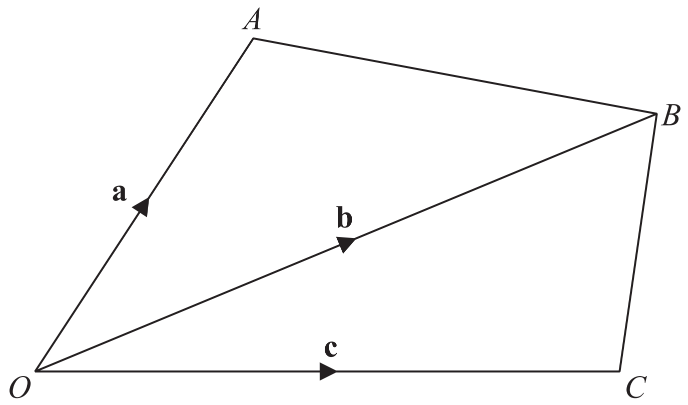


Figure 1

Figure 1 shows the quadrilateral $OABC$.

$$\overrightarrow{OA} = \mathbf{a},\ \overrightarrow{OB} = \mathbf{b} \text{ and } \overrightarrow{OC} = \mathbf{c}$$

(a) Find, in terms of **a** and **b**, $\overrightarrow{AB}$.

(1)

The midpoint of OA is P and the midpoint of AB is Q.

(b) Show that $\overrightarrow{PQ} = \mu\mathbf{b}$, where μ is a scalar, stating the value of μ.

(2)

The point S lies on OC and the point R lies on BC such that $\overrightarrow{OS} = \lambda\overrightarrow{OC}$ and $\overrightarrow{BR} = \lambda\overrightarrow{BC}$.

(c) Show that PQ is parallel to SR.

(4)

Given that $\overrightarrow{PQ} = \dfrac{3}{2}\overrightarrow{SR}$,

(d) find the value of λ.

(2)

Question 3 continued

Question 3 continued

(Total for Question 3 is 9 marks)

4

Diagram **NOT** accurately drawn

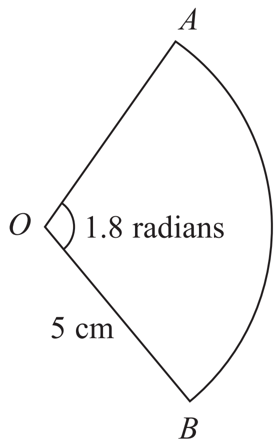


Figure 2

Figure 2 shows the sector AOB of a circle of radius 5 cm. The centre of the circle is O and the angle AOB is 1.8 radians.

(a) Find the length of the arc AB.

(1)

(b) Find the area of the sector AOB.

(2)

(Total for Question 4 is 3 marks)

5 (a) On the axes opposite, draw the lines with equations

(i) $y = -x - 1$ (ii) $y = 3x - 9$ (iii) $2y = x + 7$

(4)

(b) Show, by shading, the region R defined by the inequalities

$$y \geqslant -x - 1, \qquad y \geqslant 3x - 9 \quad \text{and} \quad 2y \leqslant x + 7$$

(1)

For all points in R, with coordinates (x, y),

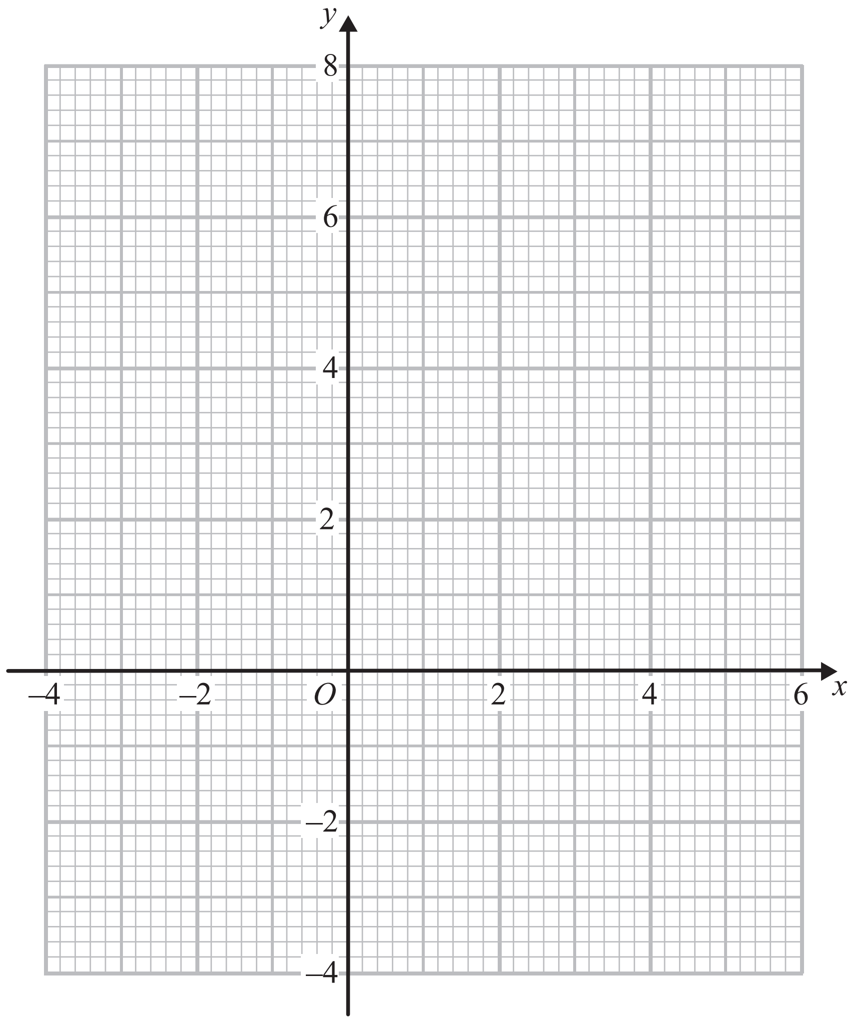
$$P = y - 2x$$

(c) Find (i) the greatest value of P,

(ii) the least value of P.

(4)

Question 5 continued



(Total for Question 5 is 9 marks)

6 (a) Solve, giving your answer to 3 significant figures,

$$3^z - 4 = 0$$

(3)

Solve, giving your answers to 3 significant figures where appropriate,

(b) $9^y - 13(3^y) + 36 = 0$

(4)

(c) $6^x - 4(2^x) - 3^x + 4 = 0$

(5)

Question 6 continued

Question 6 continued

Question 6 continued

(Total for Question 6 is 12 marks)

7 The curve C has equation $y = x^2 + 3$

The point A with coordinates (0, 3) and the point B with coordinates (4, 19) lie on C, as shown below in Figure 3.

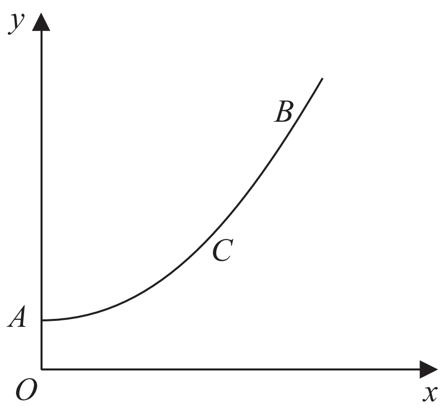


Figure 3

The finite area enclosed by the arc AB of curve C, the axes and the line with equation $x = 4$ is rotated through 360° about the x-axis.

(a) Using algebraic integration, calculate, to 1 decimal place, the volume of the solid generated.

(6)

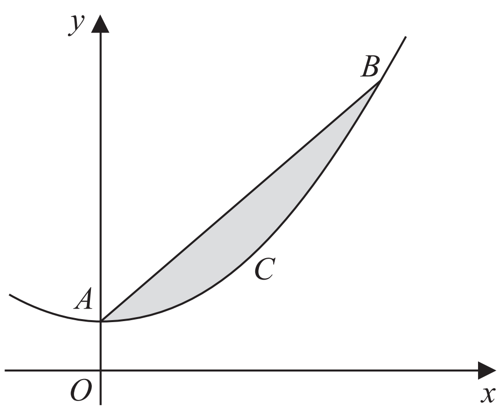


Figure 4

(b) Using algebraic integration, calculate the area of the region between the chord AB and the arc AB of C, shown shaded in Figure 4.

(6)

Question 7 continued

Turn over

Question 7 continued

Question 7 continued

(Total for Question 7 is 12 marks)

8

$$\tan\theta = \frac{\sin\theta}{\cos\theta}$$

(a) Using the above identity, show that $1 + \tan^2\theta = \dfrac{1}{\cos^2\theta}$

(3)

(b) Show that $\dfrac{1 + \sin\theta\cos\theta + \sin^2\theta}{\cos^2\theta} = 1 + \tan\theta + 2\tan^2\theta$

(3)

(c) Solve the equation $1 + \sin\theta\cos\theta + \sin^2\theta = 4\cos^2\theta$ for $0 \leqslant \theta \leqslant 180°$.
Give your answers to 1 decimal place, where appropriate.

(6)

Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 12 marks)

9

$$f(x) = 2x^3 + ax^2 + bx + 15 \qquad \text{where } a \text{ and } b \text{ are constants.}$$

The remainder when f(x) is divided by (x – 1) is –12

The remainder when f(x) is divided by (x + 1) is 48

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

(6)

(b) Show that $f\left(\frac{1}{2}\right) = 0$

(1)

(c) Express f(x) as a product of linear factors.

(4)

(d) Solve the equation f(x) = 0

(1)

Question 9 continued

Question 9 continued

Question 9 continued

(Total for Question 9 is 12 marks)

10 The points A, B and C have coordinates (–2, 3), (2, 5) and (4, 1) respectively.

(a) Show, by calculation, that AB is perpendicular to BC.

(3)

(b) Show that the length of AB = the length of BC.

(3)

The midpoint of AC is M.

(c) Find the coordinates of M.

(1)

(d) Find the exact length of the radius of the circle which passes through the points A, B and C.

(3)

The point P lies on BM such that $BP : PM = 2 : 1$

(e) Find the coordinates of P.

(2)

The point Q lies on AP produced such that $AP : PQ = 2 : 1$

(f) Find the coordinates of Q.

(3)

(g) Show that Q lies on BC.

(3)

Question 10 continued

Question 10 continued

Question 10 continued

Question 10 continued

(Total for Question 10 is 18 marks)

TOTAL FOR PAPER IS 100 MARKS