Write your name here

Surname	Other names

Pearson Edexcel International GCSE

Centre Number

Candidate Number

Further Pure Mathematics

Paper 2

Thursday 23 January 2014 – Morning
Time: 2 hours

Paper Reference
4PM0/02

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

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PEARSON

Answer all TEN questions

Write your answers in the spaces provided

You must write down all stages in your working

1 The points A and B have coordinates (5, 9) and (9, 3) respectively. The line l is the perpendicular bisector of AB.

Find an equation for l in the form $ax + by + c = 0$, where a, b and c are integers.

(5)

(Total for Question 1 is 5 marks)

2 The volume of a right circular cone is increasing at a constant rate of 12 cm^3/s. The radius of the base of the cone is always half the height of the cone. Find, in cm/s, the exact value of the rate of increase of the height of the cone when the height is 4 cm.

(5)

(Total for Question 2 is 5 marks)

3 Solve the equations

$$x^2 + xy - 3x = 2$$

$$5y + 6x = 22$$

(6)

Question 3 continued

(Total for Question 3 is 6 marks)

4

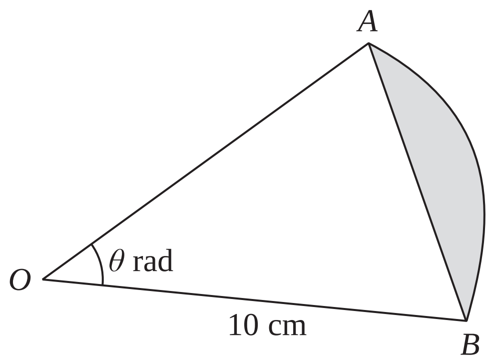

Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows a sector of a circle of radius 10 cm and centre O. The area of triangle OAB is 20 cm^2 and the size of angle AOB is θ radians.

Find, to 3 significant figures,

(a) the value of θ,

(2)

(b) the length of the arc AB,

(2)

(c) the area of the shaded segment.

(3)

Question 4 continued

(Total for Question 4 is 7 marks)

5 A curve C has equation $y = \dfrac{2x - 5}{x + 3}$, $x \neq -3$

(a) Find an equation of the asymptote to C which is parallel to

(i) the x-axis, (ii) the y-axis.

(2)

(b) Find the coordinates of the point where C crosses

(i) the x-axis, (ii) the y-axis.

(2)

(c) Sketch the graph of C, showing clearly its asymptotes and the coordinates of the points where the graph crosses the coordinate axes.

(3)

(d) Find the gradient of C at the point on C where $x = -1$

(3)

Question 5 continued

Question 5 continued

Question 5 continued

(Total for Question 5 is 10 marks)

6

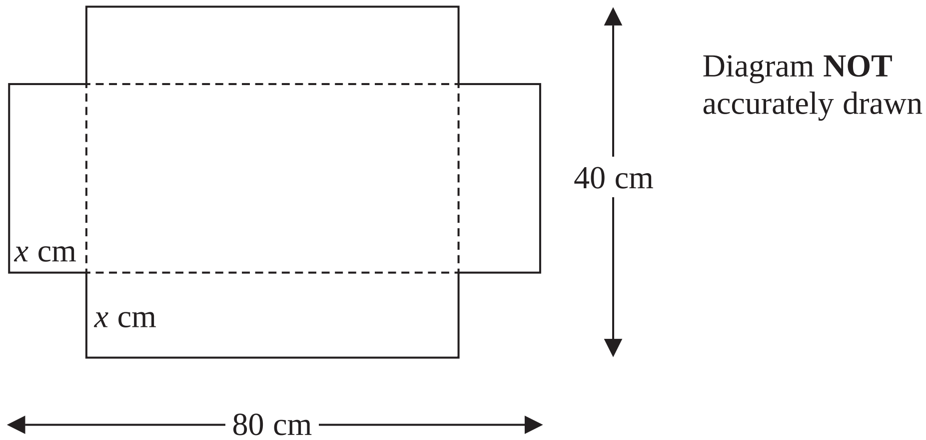

Figure 2

A rectangular sheet of card measures 80 cm by 40 cm. A square of side x cm is cut away from each corner of the card as shown in Figure 2. The card is then folded along the dotted lines to form an open box.

The volume of the box is V cm^3.

(a) Show that $V = 3200x - 240x^2 + 4x^3$

(3)

(b) Find, to 3 significant figures, the value of x for which V is a maximum, justifying that this value of x gives a maximum value of V.

(6)

(c) Find, to 3 significant figures, the maximum value of V.

(2)

Question 6 continued

Question 6 continued

Question 6 continued

(Total for Question 6 is 11 marks)

Turn over

7

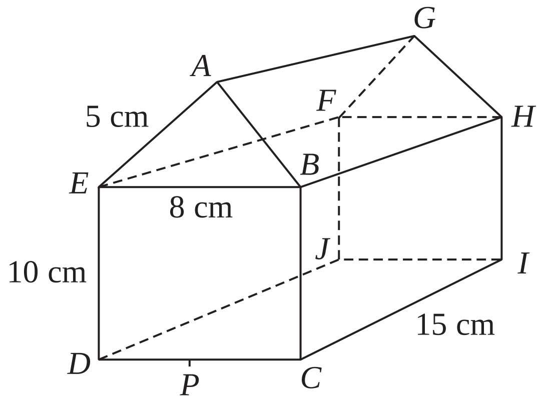

Diagram **NOT** accurately drawn

Figure 3

Figure 3 shows a prism *ABCDEFGHIJ* which consists of a triangular prism *ABEFGH* on top of a cuboid *BCDEFHIJ*.

$$AB = AE = 5 \text{ cm}, \quad EB = 8 \text{ cm}, \quad ED = 10 \text{ cm}, \quad CI = 15 \text{ cm}$$

P is the midpoint of DC.

Calculate, in cm to 3 significant figures,

(a) the length of PG,

(3)

(b) the length of AC.

(2)

Find, in degrees to the nearest 0.1°,

(c) the size of the angle between PG and the plane $CDJI$,

(3)

(d) the size of the angle between the plane $AGIC$ and the plane $CDJI$.

(3)

Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 11 marks)

PMT

8

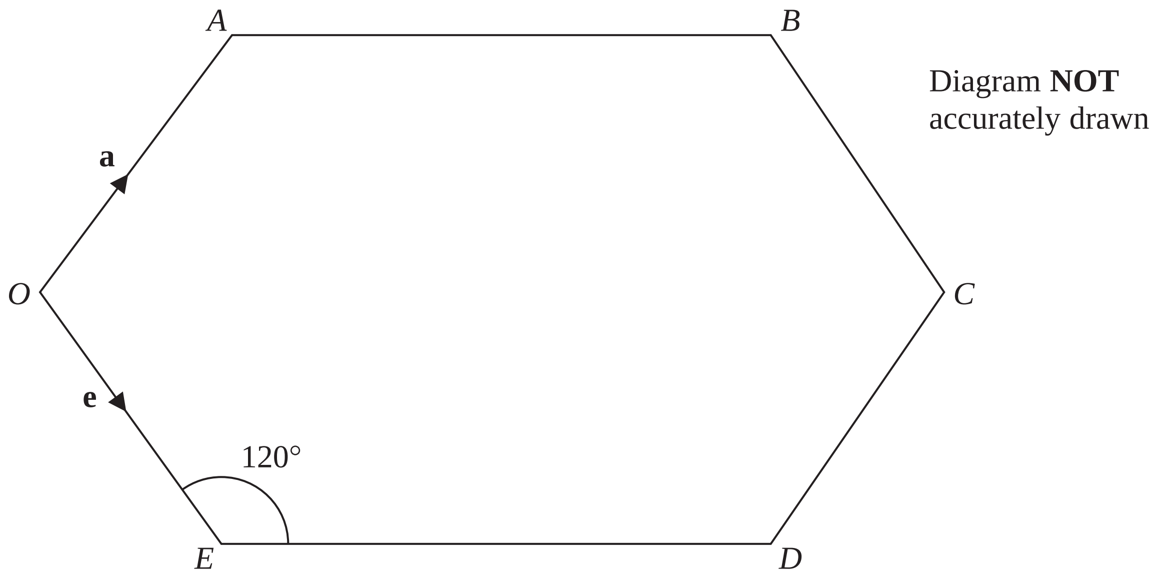

Figure 4

Figure 4 shows a hexagon $OABCDE$. Each internal angle of the hexagon is 120°.

$$OA = OE, \quad AB = ED = 2 \times OA \quad \text{and} \quad OC = 3 \times OA$$

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OE} = \mathbf{e}$.

Find as simplified expressions in terms of **a** and **e**

(a) $\overrightarrow{AB}$,

(2)

(b) $\overrightarrow{BE}$.

(2)

The point P divides AB internally in the ratio $2:3$

(c) Find $\overrightarrow{PC}$ as a simplified expression in terms of **a** and **e**.

(3)

The point Q lies on ED produced so that the points P, C and Q are collinear.

(d) Find $\overrightarrow{OQ}$ in the form $\lambda\mathbf{a} + \mu\mathbf{e}$, stating the value of λ and the value of μ.

(6)

Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 13 marks)

9 (a) Show that the first four terms of the expansion of $(1 - x)^{-k}$, $k \neq 0$, in ascending powers of x can be written as

$$1 + kx + \frac{k(k+1)}{2}x^2 + \frac{k(k+1)(k+2)}{6}x^3$$

(3)

(b) Expand $(1 + kx)^{\frac{1}{2}}$, $k \neq 0$, in ascending powers of x, up to and including the term in x^3, simplifying your terms.

(3)

Given that the coefficients of x^2 in the two expansions are equal,

(c) find the value of k.

(3)

Given that $\sqrt{15} = \lambda\sqrt{\frac{3}{5}}$

(d) find the value of λ.

(2)

(e) Hence, using your value of k and one of your expansions with a suitable value of x, obtain an approximation for $\sqrt{15}$

(4)

Question 9 continued

Question 9 continued

Question 9 continued

(Total for Question 9 is 15 marks)

Turn over

10 The sum of the second and third terms of a convergent geometric series is 7.5

The sum to infinity, S, of the series is 20

The common ratio of the series is r.

(a) Show that r is a root of the equation

$$8r^3 - 8r + 3 = 0$$

(4)

(b) Show that $r = \frac{1}{2}$ is a root of this equation.

(1)

Given that $r < 0.6$

(c) show that $\frac{1}{2}$ is the only possible value of r.

(4)

(d) Find the first term of the series.

(2)

The sum of the first n terms of the series is S_n

(e) Find the least value of n for which S_n exceeds 99% of S.

(6)

Question 10 continued

Question 10 continued

Question 10 continued

Question 10 continued

(Total for Question 10 is 17 marks)

TOTAL FOR PAPER IS 100 MARKS