Write your name here

Surname	Other names

Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Further Pure Mathematics

Paper 2

Monday 21 May 2012 – Afternoon
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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P 4 1 7 7 5 A 0 1 3 2

PEARSON

Answer all ELEVEN questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1 Solve the equation

$$5^{x+1} = 120$$

giving your answer to 3 significant figures.

(4)

(Total for Question 1 is 4 marks)

2 Given that $x = t^3 + 4$ and $y = 1 - t + 5t^2$

(a) find (i) $\frac{dx}{dt}$

(ii) $\frac{dy}{dt}$

(2)

(b) Find $\frac{dy}{dx}$ in terms of t.

(2)

(Total for Question 2 is 4 marks)

3 Solve the equations

$$2x^2 + xy - y^2 = 36$$

$$x + 2y = 1$$

(6)

Question 3 continued

(Total for Question 3 is 6 marks)

4 Differentiate with respect to x

(a) $\dfrac{1}{x^2}$

(2)

(b) $\dfrac{1}{(2x+1)^2}$

(2)

(c) $\dfrac{1}{1-\cos^2 x}$

(3)

Question 4 continued

(Total for Question 4 is 7 marks)

5 The curve R has equation $y = x^2 - 7x + 10$

The curve S has equation $y = -x^2 + 7x - 2$

(a) Find the coordinates of each of the two points where the curves R and S intersect.

(4)

(b) Find the area of the finite region bounded by the curve R and the curve S.

(4)

Question 5 continued

Question 5 continued

Question 5 continued

(Total for Question 5 is 8 marks)

6 The first term of a geometric series S is $\sqrt{2}$

The second term of S is $\sqrt{2} - 2$

(a) (i) Find the exact value of the common ratio of S.

(ii) Find the third term of S, giving your answer in the form $a\sqrt{2} + b$, where a and b are integers.

(5)

(b) (i) Explain why the series is convergent.

(ii) Find the sum to infinity of S.

(3)

Question 6 continued

(Total for Question 6 is 8 marks)

7 The curve G has equation $y = 3 - \dfrac{1}{x-1}$, $x \neq 1$

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

(i) the x-axis,

(ii) the y-axis.

(2)

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

(i) the x-axis,

(ii) the y-axis.

(2)

(c) Sketch G, showing clearly the asymptotes and the coordinates of the points where the curve crosses the coordinate axes.

(3)

A straight line l intersects G at the points P and Q. The x-coordinate of P and the x-coordinate of Q are roots of the equation $2x - 3 = \dfrac{1}{x-1}$

(d) Find an equation of l.

(2)

Question 7 continued

(Total for Question 7 is 9 marks)

8 The curve C has equation $y = 4x + 8 + \dfrac{25}{x - 2}, x \neq 2$

(a) Find the coordinates of the stationary points on C.

(6)

(b) Determine the nature of each of these stationary points.

(3)

Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 9 marks)

9 The particle M is moving along the straight line PQ with a constant acceleration of 2 m/s^2.

At time $t = 0$, M is at the point P moving with velocity 6 m/s towards Q.

(a) Find an expression for the velocity of M at time t seconds.

(2)

(b) Show that the displacement of M from P at time t seconds is $(t^2 + 6t)$ metres.

(2)

A second particle N is moving along PQ. The acceleration of N at time t seconds is $6t$ m/s^2.
At time $t = 0$, N is stationary at the point P.

(c) Find an expression for the velocity of N at time t seconds.

(2)

(d) Find an expression for the displacement of N from P at time t seconds.

(2)

(e) Find the distance between M and N at time $t = 5$ seconds.

(2)

(f) Find the value of t, $t > 0$, when the two particles meet.

(3)

Question 9 continued

Question 9 continued

Question 9 continued

(Total for Question 9 is 13 marks)

10 The points A, B, C and D are the vertices of a quadrilateral and

$\overrightarrow{AB} = 3\mathbf{i} + 5\mathbf{j}$, $\overrightarrow{AC} = 6\mathbf{i} + 6\mathbf{j}$ and $\overrightarrow{AD} = 9\mathbf{i} + 3\mathbf{j}$

(a) (i) Find $\overrightarrow{BC}$

(ii) Hence show that $ABCD$ is a trapezium.

(3)

(b) (i) Find the exact value of $\left|\overrightarrow{BD}\right|$

(ii) Find a unit vector parallel to $\overrightarrow{BD}$

(4)

The point F is on the line BD and $BF : FD = 1 : 2$

(c) Find $\overrightarrow{AF}$

(2)

The point E is on the line AD such that $ABCE$ is a parallelogram.

(d) (i) Show that F lies on the line CE

(ii) Find the ratio $EF : FC$

(6)

Question 10 continued

Question 10 continued

Question 10 continued

(Total for Question 10 is 15 marks)

11

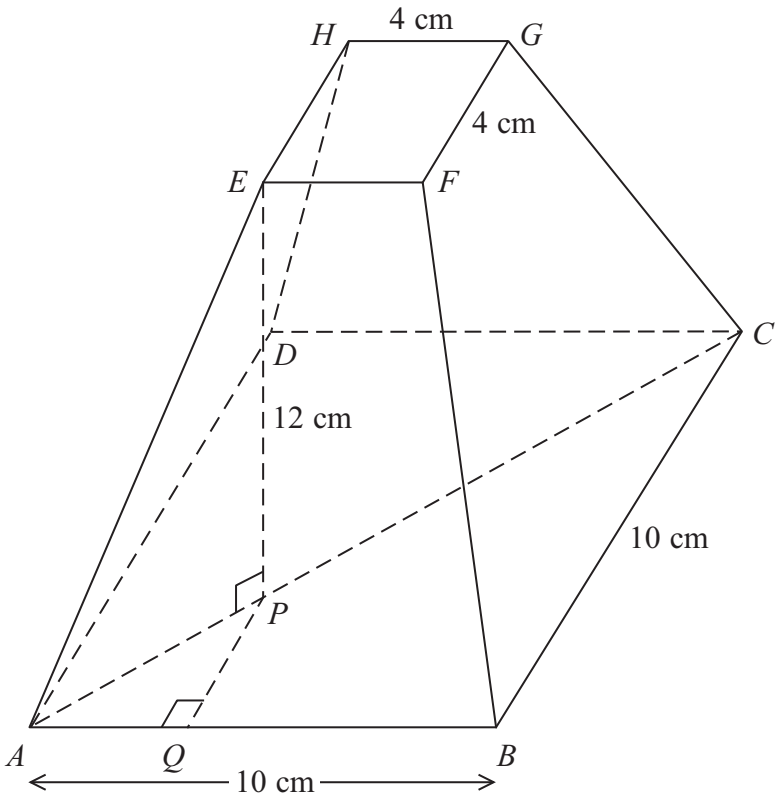

Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows a truncated right pyramid. The base $ABCD$ is a square with sides of length 10 cm. The top $EFGH$ is a square with sides of length 4 cm. The base is parallel to the top and $AE = BF = CG = DH$.

The point P is on the line AC such that angle APE is a right-angle and $EP = 12$ cm.

(a) Find, in centimetres, the exact length of

(i) AC (ii) EG (iii) AP

(6)

(b) Find, in centimetres to 3 significant figures, the length of AE.

(2)

(c) Find, in degrees to 1 decimal place, the angle between the line AE and the plane $ABCD$.

(2)

The point Q is on the line AB. Angle AQP is a right-angle.

(d) (i) Show that $PQ = 3$ cm.

(ii) Write down, in centimetres, the length of AQ.

(2)

(e) Find, in degrees to 1 decimal place, the angle between the line AE and the line AB.

(2)

(f) Find, in degrees to 1 decimal place, the angle between the plane $ABFE$ and the plane $ABCD$.

(3)

Question 11 continued

Question 11 continued

Question 11 continued

Question 11 continued

(Total for Question 11 is 17 marks)

TOTAL FOR PAPER IS 100 MARKS