

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 ►

P41775A

©2012 Pearson Education Ltd.

6/5/6/



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)

Handwriting practice area consisting of 20 horizontal dotted lines.



Question 3 continued

A series of horizontal dotted lines for writing answers.

(Total for Question 3 is 6 marks)



P 4 1 7 7 5 A 0 5 3 2

4 Differentiate with respect to x

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

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

(c) $\frac{1}{1 - \cos^2 x}$ (3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



Question 4 continued

Ruled area for writing the answer to Question 4, consisting of 26 horizontal dotted lines.

(Total for Question 4 is 7 marks)



Question 5 continued

Handwriting practice area consisting of 25 horizontal dotted lines.



Question 5 continued

A series of horizontal dotted lines for writing.



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)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



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

(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 $2x - 3 = \frac{1}{x-1}$

(d) Find an equation of l .

(2)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



Question 7 continued

Dotted lines for writing.

(Total for Question 7 is 9 marks)



P 4 1 7 7 5 A 0 1 5 3 2

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

(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

Handwriting practice area with 25 horizontal dotted lines.



Question 8 continued

Handwriting practice area consisting of 20 horizontal dotted lines.



Question 8 continued

Area containing 25 horizontal dotted lines for writing the answer to Question 8.

(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 $6t \text{ m/s}^2$.
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

Ruled area for writing the answer to Question 9.



Question 9 continued

Handwriting practice lines consisting of 21 horizontal dotted lines.



Question 9 continued

[A large area of horizontal dotted lines for writing.]

(Total for Question 9 is 13 marks)



P 4 1 7 7 5 A 0 2 3 3 2

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

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

(a) (i) Find \vec{BC}

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

(3)

(b) (i) Find the exact value of $|\vec{BD}|$

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

(4)

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

(c) Find \vec{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

Handwriting practice area consisting of 25 horizontal dotted lines.



Question 10 continued

A series of horizontal dotted lines for writing.



Question 10 continued

Ruled area for writing the answer to Question 10. The area contains 25 horizontal dotted lines.

(Total for Question 10 is 15 marks)



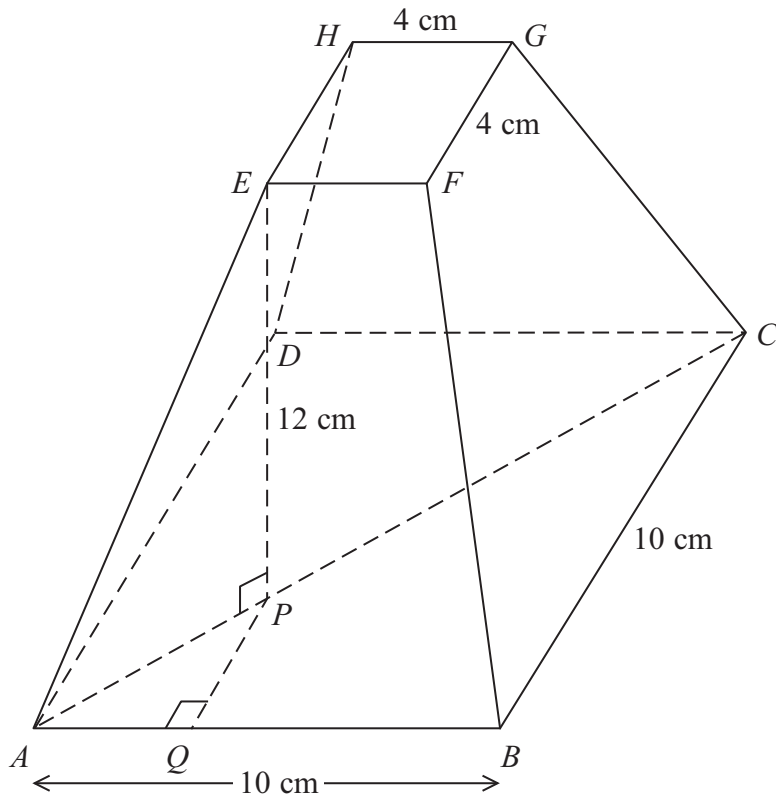


Diagram **NOT** accurately drawn

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

A series of horizontal dotted lines for writing.



Question 11 continued

Lined area for writing the answer to Question 11.



