

Write your name here

Surname

Other names

Edexcel

International GCSE

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--	--

Further Pure Mathematics

Paper 2

Thursday 26 January 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 ►

P40665A

©2012 Pearson Education Ltd.

6/6/6/c2



PEARSON

Answer all TEN questions

**Write your answers in the spaces provided
You must write down all stages in your working**

1 Referred to a fixed origin O , the position vectors of the points P and Q are $(10\mathbf{i} - 3\mathbf{j})$ and $(4\mathbf{i} + 6\mathbf{j})$ respectively. The point R divides PQ internally in the ratio 2:1

(a) Find the position vector of R (2)

The point S divides OQ internally in the ratio 5 : 4 and $\text{area } \triangle OPQ = \lambda \text{ area } \triangle SRQ$.

(b) Find the exact value of λ . (4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



Question 1 continued

Ruled area for writing the answer to Question 1.

(Total for Question 1 is 6 marks)



Diagram NOT accurately drawn

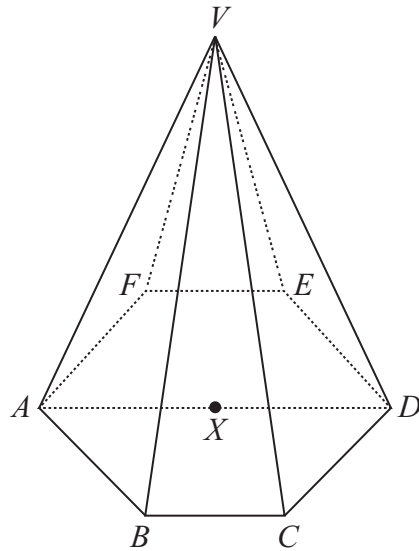


Figure 1

Figure 1 shows a right pyramid with vertex V and base $ABCDEF$ which is a regular hexagon. The diagonal AD of the base is 10 cm and X is the mid-point of AD . The height VX of the pyramid is 12 cm.

- (a) Find the length of VA . (2)

- (b) Find, in degrees to 1 decimal place, the size of the angle between the plane VAB and the base. (4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



Question 2 continued

Handwriting practice area consisting of 25 horizontal dotted lines.



Question 2 continued

Handwriting practice area consisting of 25 horizontal dotted lines.

(Total for Question 2 is 6 marks)



3 Find the coordinates of the points of intersection of the curve with equation $y = 3 + 6x - x^2$ and the line with equation $y - x = 7$

(5)

Handwritten response area consisting of numerous horizontal dotted lines for writing.

(Total for Question 3 is 5 marks)



4

Diagram **NOT**
accurately drawn

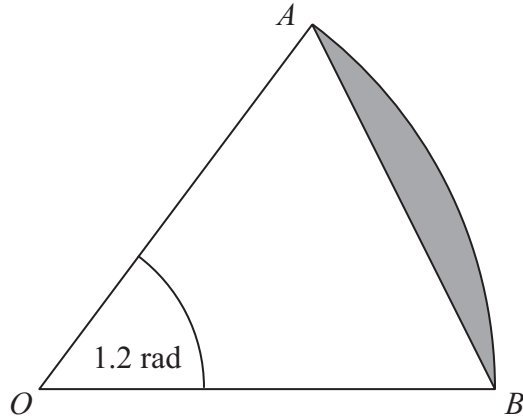


Figure 2

Figure 2 shows an arc AB of a circle with centre O . The arc subtends an angle of 1.2 radians at O and the area of the sector AOB is 15 cm^2 .

Find

- (a) the radius of the circle, (2)
- (b) the length of the arc AB , (2)
- (c) the area of the shaded segment, giving your answer to 3 significant figures. (3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



Question 4 continued

A large area of the page is filled with horizontal dotted lines, providing space for the student to write their answer to Question 4.

(Total for Question 4 is 7 marks)



5 (a) Expand $(1+3x)^{\frac{1}{5}}$ in ascending powers of x up to and including the term in x^3 , simplifying your terms as far as possible. (4)

(b) By substituting $x = -\frac{1}{8}$ into your expansion, obtain an approximation for $\sqrt[5]{20}$. Write down all the figures on your calculator display. (4)

(c) Explain why you cannot obtain an approximation for $\sqrt[5]{4}$ by substituting $x = 1$ into your expansion. (1)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



Question 5 continued

Handwriting practice area consisting of 25 horizontal dotted lines.



Question 5 continued

Handwriting practice area consisting of 25 horizontal dotted lines.



Question 5 continued

Handwriting practice area consisting of 25 horizontal dotted lines.

(Total for Question 5 is 9 marks)



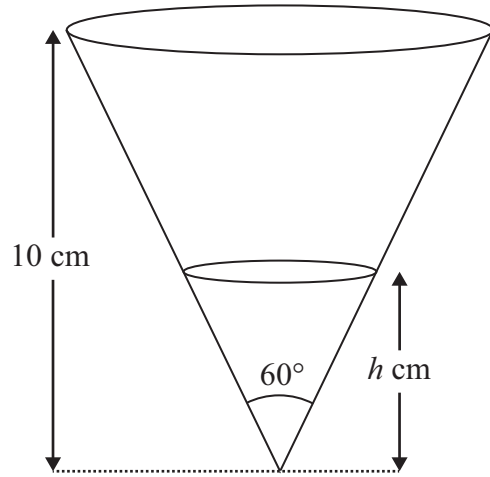


Diagram NOT accurately drawn

Figure 3

A container in the shape of a right circular cone of height 10 cm is fixed with its axis of symmetry vertical. The vertical angle of the container is 60°, as shown in Figure 3. Water is dripping out of the container at a constant rate of 2 cm³/s. At time $t = 0$ the container is full of water. At time t seconds the depth of water remaining is h cm.

- (a) Show that $h = \left[1000 - \frac{18t}{\pi} \right]^{\frac{1}{3}}$ (6)
- (b) Find, in cm²/s, to 3 significant figures, the rate of change of the area of the surface of the water when $t = 15$ (6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



Question 6 continued

Handwriting practice area consisting of 25 horizontal dotted lines.



Question 6 continued

A series of horizontal dotted lines for writing.



Question 6 continued

Handwriting practice area consisting of 25 horizontal dotted lines.

(Total for Question 6 is 12 marks)



Question 7 continued

Handwriting practice area consisting of 25 horizontal dotted lines.



Question 7 continued

Handwriting practice area with 25 horizontal dotted lines.



$$\begin{aligned} \sin(A + B) &= \sin A \cos B + \cos A \sin B \\ \cos(A + B) &= \cos A \cos B - \sin A \sin B \end{aligned}$$

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

(a) Show that $\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$ (3)

(b) Hence write down an expression for $\tan 2\theta$ in terms of $\tan \theta$ (1)

(c) Show that $\tan 3\theta = \frac{3 \tan \theta - \tan^3 \theta}{1 - 3 \tan^2 \theta}$ (4)

Given that $\tan 3\theta = -1$ and $\tan \theta \neq \pm \frac{\sqrt{3}}{3}$

(d) without finding the value of θ , show that $\tan^3 \theta + 3 \tan^2 \theta - 3 \tan \theta - 1 = 0$ (1)

Given also that $\tan \theta \neq 1$

(e) find the exact values of $\tan \theta$, giving your answers in the form $a \pm \sqrt{b}$ where a and b are integers. (4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



Question 8 continued

A series of horizontal dotted lines for writing the answer to Question 8.



Question 8 continued

A series of horizontal dotted lines for writing.



Question 8 continued

A series of horizontal dotted lines for writing the answer to Question 8.

(Total for Question 8 is 13 marks)



P 4 0 6 6 5 A 0 2 5 3 2

9 The curve C , with equation $y = f(x)$, passes through the point with coordinates $(0, 4)$.

Given that $f'(x) = x^3 - 3x^2 - x + 3$

(a) find $f(x)$. (3)

(b) Show that C has a minimum point at $x = -1$ and a minimum point at $x = 3$ (6)

(c) (i) Find the coordinates of the maximum point on C .

(ii) Show that the point found in (i) is a maximum point. (3)

(d) State the ranges of values of x for which $f'(x) > 0$ (2)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



Question 9 continued

Ruled writing area with 26 horizontal dotted lines for student response.



Question 9 continued

A series of horizontal dotted lines for writing.



10 The sum of the first and third terms of a geometric series G is 104

The sum of the second and third terms of G is 24

Given that G is convergent and that the sum to infinity is S , find

(a) the common ratio of G (4)

(b) the value of S (4)

The sum of the first and third terms of another geometric series H is also 104 and the sum of the second and third terms of H is 24

The sum of the first n terms of H is S_n

(c) Write down the common ratio of H (1)

(d) Find the least value of n for which $S_n > S$ (6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



Question 10 continued

A series of horizontal dotted lines for writing.



