

Write your name here

Surname	Other names
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Edexcel
International GCSE

Centre Number

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Candidate Number

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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 ►

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PEARSON

2

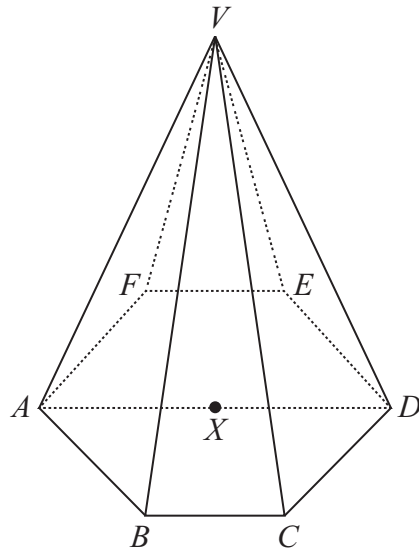


Diagram **NOT** accurately drawn

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)

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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)



4

Diagram **NOT** accurately drawn

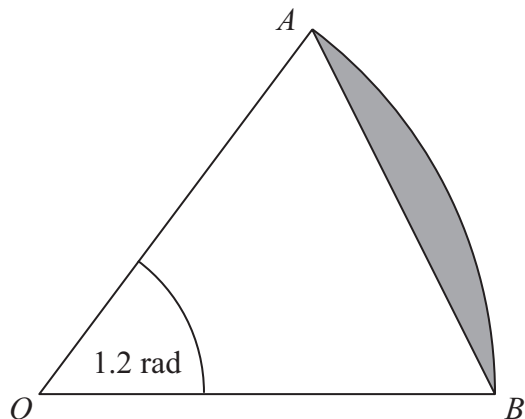


Figure 2

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)

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Question 4 continued

Handwriting practice area consisting of 25 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.



Question 5 continued

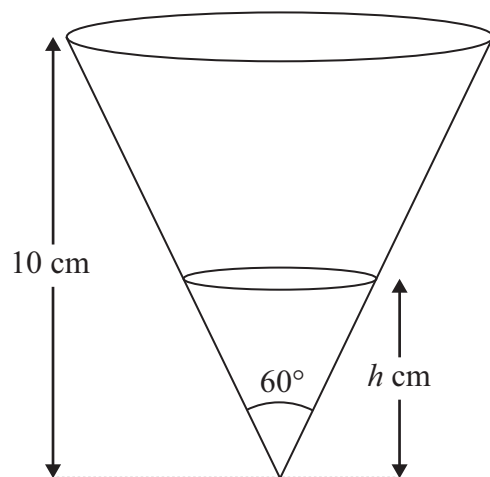
Handwriting practice area consisting of 25 horizontal dotted lines.

(Total for Question 5 is 9 marks)



P 4 0 6 6 5 A 0 1 3 3 2

6

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 $2 \text{ cm}^3/\text{s}$. 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 cm^2/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)



P 4 0 6 6 5 A 0 1 7 3 2

7 The points A, B and C have coordinates $(3,5), (7,8)$ and $(6,1)$ respectively.

(a) Show, by calculation, that AB is perpendicular to AC . (4)

(b) Find an equation for AC in the form $ax + by + c = 0$, where a, b and c are integers whose values must be stated. (3)

The point D is on AC produced and $AC : CD = 1 : 2$

(c) Find the coordinates of D . (2)

(d) Calculate the area of triangle ABD . (4)

Area for student solution with horizontal dotted lines.



Question 7 continued

Handwriting practice area consisting of 25 horizontal dotted lines.



Question 7 continued

A large rectangular area with rounded corners, containing 25 horizontal dotted lines for writing.



Question 7 continued

Dotted lines for writing.

(Total for Question 7 is 13 marks)



P 4 0 6 6 5 A 0 2 1 3 2

8

$$\sin(A + B) = \sin A \cos B + \cos A \sin B$$

$$\cos(A + B) = \cos A \cos B - \sin A \sin B$$

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

(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)

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Question 8 continued

Handwriting practice area consisting of 25 horizontal dotted lines for writing.



Question 8 continued

A series of horizontal dotted lines for writing, spanning the width of the page.



Question 8 continued

(Total for Question 8 is 13 marks)



- 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)

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Question 9 continued

Area with 25 horizontal dotted lines for writing.



Question 9 continued

A series of horizontal dotted lines for writing.



Question 9 continued

A large rectangular area for writing, bounded by a rounded border. It contains approximately 30 horizontal dotted lines spaced evenly down the page, providing a guide for handwriting.

(Total for Question 9 is 14 marks)



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)

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Question 10 continued

A series of horizontal dotted lines for writing.



Question 10 continued

A large rectangular area containing 25 horizontal dotted lines for writing the answer to Question 10.

(Total for Question 10 is 15 marks)

TOTAL FOR PAPER IS 100 MARKS

