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.

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P 4 0 6 6 5 A 0 1 3 2

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 area $\Delta OPQ = \lambda$ area ΔSRQ.

(b) Find the exact value of λ.

(4)

Question 1 continued

(Total for Question 1 is 6 marks)

2

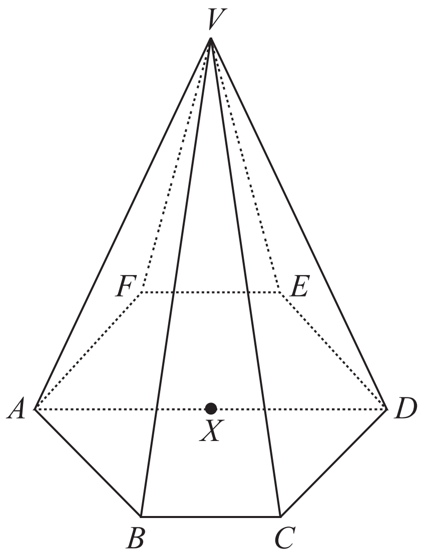

Diagram **NOT** accurately drawn

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)

P 4 0 6 6 5 A 0 4 3 2

Question 2 continued

Question 2 continued

(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)

(Total for Question 3 is 5 marks)

4

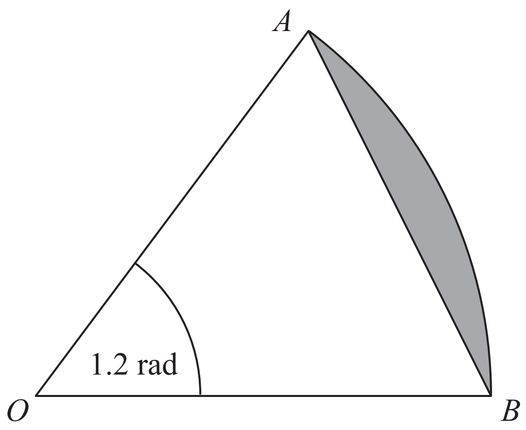

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Figure 2

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)

P 4 0 6 6 5 A 0 8 3 2

Question 4 continued

(Total for Question 4 is 7 marks)

P 4 0 6 6 5 A 0 9 3 2

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

Question 5 continued

Question 5 continued

(Total for Question 5 is 9 marks)

6

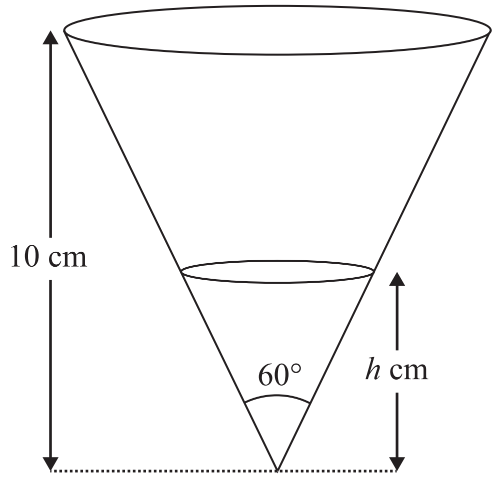

Diagram **NOT** accurately drawn

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 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)

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

Question 6 continued

Question 6 continued

Question 6 continued

(Total for Question 6 is 12 marks)

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)

Question 7 continued

Question 7 continued

Question 7 continued

(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 $\tan\left(A+B\right) = \dfrac{\tan A + \tan B}{1 - \tan A\tan B}$

(3)

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

(1)

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

(4)

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

(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

Question 8 continued

Question 8 continued

(Total for Question 8 is 13 marks)

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

Given that $\mathrm{f}'(x) = x^3 - 3x^2 - x + 3$

(a) find $\mathrm{f}(x)$.

(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 $\mathrm{f}'(x) > 0$

(2)

Question 9 continued

Question 9 continued

Question 9 continued

(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)

Question 10 continued

Question 10 continued

(Total for Question 10 is 15 marks)

TOTAL FOR PAPER IS 100 MARKS