Write your name here

Surname	Other names

Edexcel
International GCSE

Centre Number | Candidate Number

Further Pure Mathematics

Paper 1

Thursday 17 May 2012 – Afternoon
Time: 2 hours

Paper Reference
4PM0/01

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

Answer all TEN questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1 Find the set of values of x for which $(2x + 1)(4 - x) > (x - 4)(2x - 3)$

(4)

Question 1 continued

(Total for Question 1 is 4 marks)

2 In triangle ABC, $AB = 8$ cm, $BC = 5$ cm and $CA = 7$ cm.

(a) Find, to the nearest 0.1°, the size of angle BAC.

(3)

(b) Find, to 3 significant figures, the area of triangle ABC.

(2)

Question 2 continued

(Total for Question 2 is 5 marks)

3 (a) Find the full binomial expansion of $(1 + x)^5$, giving each coefficient as an integer.
(2)

(b) Hence find the exact value of $\left(1 - 2\sqrt{3}\right)^5$, giving your answer in the form $a + b\sqrt{3}$, where a and b are integers.
(3)

Question 3 continued

(Total for Question 3 is 5 marks)

4 The equation $2x^2 - 7x + 4 = 0$ has roots α and β

Without solving this equation, form a quadratic equation with integer coefficients which has roots $\alpha + \dfrac{1}{\beta}$ and $\beta + \dfrac{1}{\alpha}$

(8)

Question 4 continued

(Total for Question 4 is 8 marks)

5 The first four terms of an arithmetic series, S, are

$$\log_a 2 + \log_a 4 + \log_a 8 + \log_a 16$$

(a) Write down an expression for the rth term of S.

(1)

(b) Find an expression for the common difference of S.

(2)

The sum of the first n terms of S is S_n

(c) Show that $S_n = \frac{1}{2}n(n + 1) \log_a 2$

(2)

The first four terms of a second arithmetic series, T, are

$$\log_a 6 + \log_a 12 + \log_a 24 + \log_a 48$$

The sum of the first n terms of T is T_n

(d) Find $T_n - S_n$ and simplify your answer.

(4)

Question 5 continued

Question 5 continued

Question 5 continued

(Total for Question 5 is 9 marks)

6

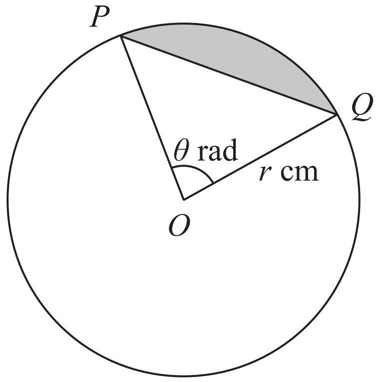

Figure 1

The points P and Q lie on the circumference of a circle with centre O and radius r cm. Angle $POQ = \theta$ radians. The segment shaded in Figure 1 has area A cm^2.

(a) Show that $A = \frac{1}{2}r^2(\theta - \sin\theta)$

(3)

When angle POQ is increased to $(\theta + \delta\theta)$ radians, where $\delta\theta$ is small, the area of the shaded segment is increased to $(A + \delta A)$ cm^2, where δA is small.

(b) Show that $\delta A \approx \frac{1}{2}r^2(1 - \cos\theta)\delta\theta$

(3)

For a circle of radius 4 cm, the area of the shaded segment is increased by 0.05 cm^2 when angle POQ increases by 0.02 radians.

(c) Find, to 1 decimal place, an estimate for θ

(4)

Question 6 continued

Question 6 continued

Question 6 continued

(Total for Question 6 is 10 marks)

7

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

(a) Express $\cos(2x + 45°)$ in the form $M\cos 2x + N\sin 2x$, where M and N are constants, giving the exact value of M and the exact value of N.

(2)

(b) Solve, for $0° \leqslant x \leqslant 180°$, the equation $\cos 2x - \sin 2x = 1$

(5)

The maximum value of $\cos 2x - \sin 2x$ is k.

(c) Find the exact value of k.

(2)

(d) Find the smallest positive value of x for which a maximum occurs.

(3)

Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 12 marks)

8 $\mathrm{f}(x) = ax^3 + bx^2 + cx + d$, where a, b, c and d are integers.

Given that $\mathrm{f}(0) = 6$

(a) show that $d = 6$

(1)

When $\mathrm{f}(x)$ is divided by $(x - 1)$ the remainder is -6
When $\mathrm{f}(x)$ is divided by $(x + 1)$ the remainder is 12

(b) Find the value of b.

(4)

Given also that $(x - 3)$ is a factor of $\mathrm{f}(x)$,

(c) find the value of a and the value of c,

(6)

(d) express $\mathrm{f}(x)$ as a product of linear factors.

(3)

Question 8 continued

Turn over

Question 8 continued

Question 8 continued

(Total for Question 8 is 14 marks)

9 The point P with coordinates (4, 4) lies on the curve C with equation $y = \frac{1}{4}x^2$

(a) Find an equation of

(i) the tangent to C at P,

(ii) the normal to C at P.

(6)

The point Q lies on the curve C. The normal to C at Q and the normal to C at P intersect at the point R. The line RQ is perpendicular to the line RP.

(b) Find the coordinates of Q.

(2)

(c) Find the x-coordinate of R.

(4)

The tangent to C at P and the tangent to C at Q intersect at the point S.

(d) Show that the line RS is parallel to the y-axis.

(5)

Question 9 continued

Question 9 continued

Question 9 continued

(Total for Question 9 is 17 marks)

10 The point A has coordinates (–3, 4) and the point C has coordinates (5, 2). The mid-point of AC is M. The line l is the perpendicular bisector of AC.

(a) Find an equation of l.

(4)

(b) Find the exact length of AC.

(2)

The point B lies on the line l. The area of triangle ABC is $17\sqrt{2}$

(c) Find the exact length of BM.

(2)

(d) Find the exact length of AB.

(2)

(e) Find the coordinates of each of the two possible positions of B.

(6)

Question 10 continued

Question 10 continued

(Total for Question 10 is 16 marks)

TOTAL FOR PAPER IS 100 MARKS