Paper Reference(s)

6673

Edexcel GCE

Pure Mathematics P3

Advanced/Advanced Subsidiary

Thursday 8 January 2004 – Afternoon

Time: 1 hour 30 minutes

Materials required for examination	Items included with question papers
Answer Book (AB16)	Nil
Graph Paper (ASG2)	
Mathematical Formulae (Lilac)	

Candidates may only use one of the basic scientific calculators approved by the Qualifications and Curriculum Authority.

Instructions to Candidates

In the boxes on the Answer Book, write the name of the examining body (Edexcel), your centre number, candidate number, the unit title (Pure Mathematics P3), the paper reference (6673), your surname, other names and signature.
When a calculator is used, the answer should be given to an appropriate degree of accuracy.

Information for Candidates

A booklet 'Mathematical Formulae and Statistical Tables' is provided.
Full marks may be obtained for answers to ALL questions.
This paper has eight questions. There are no blank pages.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You must show sufficient working to make your methods clear to the examiner. Answers without working may gain no credit.

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Turn over

1. The point A has coordinates (2, 5) and the point B has coordinates (–2, 8).

Find, in cartesian form, an equation of the circle with diameter AB.

(4)

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2. When $(1 + ax)^n$ is expanded as a series in ascending powers of x, the coefficients of x and x^2 are –6 and 27 respectively.

(a) Find the value of a and the value of n.

(5)

(b) Find the coefficient of x^3.

(2)

(c) State the set of values of x for which the expansion is valid.

(1)

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3. The curve C has equation $5x^2 + 2xy - 3y^2 + 3 = 0$. The point P on the curve C has coordinates (1, 2).

(a) Find the gradient of the curve at P.

(5)

(b) Find the equation of the normal to the curve C at P, in the form $y = ax + b$, where a and b are constants.

(3)

4.

$$f(x) = 6x^3 + px^2 + qx + 8, \text{ where } p \text{ and } q \text{ are constants.}$$

Given that f(x) is exactly divisible by $(2x - 1)$, and also that when f(x) is divided by $(x - 1)$ the remainder is -7,

(a) find the value of p and the value of q.

(6)

(b) Hence factorise f(x) completely.

(3)

5.

Figure 1

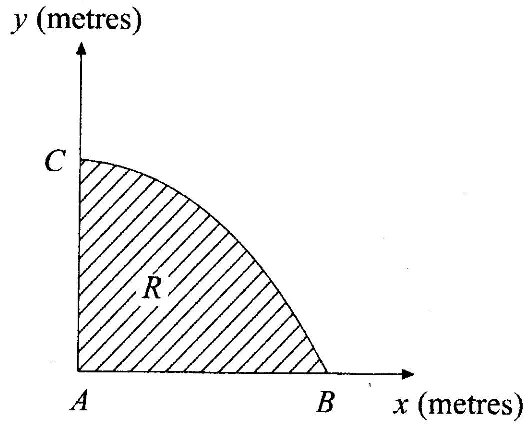

Figure 1 shows a cross-section R of a dam. The line AC is the vertical face of the dam, AB is the horizontal base and the curve BC is the profile. Taking x and y to be the horizontal and vertical axes, then A, B and C have coordinates $(0, 0)$, $(3\pi^2, 0)$ and $(0, 30)$ respectively. The area of the cross-section is to be calculated.

Initially the profile BC is approximated by a straight line.

(a) Find an estimate for the area of the cross-section R using this approximation.

(1)

The profile BC is actually described by the parametric equations

$$x = 16t^2 - \pi^2, \quad y = 30 \sin 2t, \quad \frac{\pi}{4} \leqslant t \leqslant \frac{\pi}{2}.$$

(b) Find the exact area of the cross-section R.

(7)

(c) Calculate the percentage error in the estimate of the area of the cross-section R that you found in part (a).

(2)

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6. (a) Express $\dfrac{13-2x}{(2x-3)(x+1)}$ in partial fractions.

(4)

(b) Given that $y = 4$ at $x = 2$, use your answer to part (a) to find the solution of the differential equation

$$\frac{dy}{dx} = \frac{y(13-2x)}{(2x-3)(x+1)}, \quad x > 1.5$$

Express your answer in the form $y = f(x)$.

(7)

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7. The curve C has equation $y = \dfrac{x}{4+x^2}$.

(a) Use calculus to find the coordinates of the turning points of C.

(5)

Using the result $\dfrac{d^2y}{dx^2} = \dfrac{2x(x^2-12)}{(4+x^2)^3}$, or otherwise,

(b) determine the nature of each of the turning points.

(3)

(c) Sketch the curve C.

(3)

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8. The equations of the lines l_1 and l_2 are given by

$$l_1: \quad \mathbf{r} = \mathbf{i} + 3\mathbf{j} + 5\mathbf{k} + \lambda(\mathbf{i} + 2\mathbf{j} - \mathbf{k}),$$

$$l_2: \quad \mathbf{r} = -2\mathbf{i} + 3\mathbf{j} - 4\mathbf{k} + \mu(2\mathbf{i} + \mathbf{j} + 4\mathbf{k}),$$

where λ and μ are parameters.

(a) Show that l_1 and l_2 intersect and find the coordinates of Q, their point of intersection.

(6)

(b) Show that l_1 is perpendicular to l_2.

(2)

The point P with x-coordinate 3 lies on the line l_1 and the point R with x-coordinate 4 lies on the line l_2.

(c) Find, in its simplest form, the exact area of the triangle PQR.

(6)

END