Paper Reference(s)

6674

Edexcel GCE

Pure Mathematics P4

Advanced/Advanced Subsidiary

Monday 19 January 2004 – Morning

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 use any calculator EXCEPT those with the facility for symbolic algebra, differentiation and/or integration. Thus candidates may NOT use calculators such as the Texas Instruments TI 89, TI 92, Casio CFX 9970G, Hewlett Packard HP 48G.

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 P4), the paper reference (6674), your surname, othernames 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 seven questions.

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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1. (*a*) Show that $(r+1)^3 - (r-1)^3 \equiv Ar^2 + B$, where A and B are constants to be found.

(2)

(*b*) Prove by the method of differences that $\sum_{r=1}^{n} r^2 = \frac{1}{6}n(n+1)(2n+1),\ n > 1$.

(6)

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2. $$\mathrm{f}(x) = \sin 3x - 2x + 1.$$

(*a*) Show by drawing a sketch that there is just one solution α of $\mathrm{f}(x) = 0$.

(3)

(*b*) Taking 0.8 as a first approximation to α, apply the Newton-Raphson procedure twice to $\mathrm{f}(x)$ to find a second and a third approximation to α. Give your answers to 4 significant figures.

(5)

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3. Given that $z = 2 - 2\mathrm{i}$ and $w = -\sqrt{3} + \mathrm{i}$,

(*a*) find the modulus and argument of wz^2.

(6)

(*b*) Show on an Argand diagram the points A, B and C which represent z, w and wz^2 respectively, and determine the size of angle BOC.

(4)

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4. $$\frac{\mathrm{d}y}{\mathrm{d}x} + y\left(1 + \frac{3}{x}\right) = \frac{1}{x^2}, \quad x > 0.$$

(*a*) Verify that $x^3\mathrm{e}^x$ is an integrating factor for the differential equation.

(3)

(*b*) Find the general solution of the differential equation.

(4)

(*c*) Given that $y = 1$ at $x = 1$, find y at $x = 2$.

(3)

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5. (*a*) Sketch, on the same axes, the graph of $y = |(x - 2)(x - 4)|$, and the line with equation $y = 6 - 2x$.

(4)

(*b*) Find the exact values of x for which $|(x - 2)(x - 4)| = 6 - 2x$.

(5)

(*c*) Hence solve the inequality $|(x - 2)(x - 4)| < 6 - 2x$.

(2)

6.

$$\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y = 65 \sin 2x, \quad x > 0.$$

(*a*) Find the general solution of the differential equation.

(9)

(*b*) Show that for large values of x this general solution may be approximated by a sine function and find this sine function.

(2)

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7. (*a*) Sketch the curve with polar equation

$$r = 3 \cos 2\theta, \quad -\frac{\pi}{4} \le \theta < \frac{\pi}{4}.$$

(2)

(*b*) Find the area of the smaller finite region enclosed between the curve and the half-line $\theta = \frac{\pi}{6}$.

(6)

(*c*) Find the exact distance between the two tangents which are parallel to the initial line.

(8)

END