Solomon Press
Core Mathematics C2
Paper J

(Question Paper)

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FOR EDEXCEL

GCE Examinations

Advanced Subsidiary

Core Mathematics C2

Paper J

Time: 1 hour 30 minutes

Instructions and Information

Candidates may use any calculator EXCEPT those with the facility for symbolic algebra, differentiation and / or integration.

Full marks may be obtained for answers to ALL questions.

Mathematical formulae and statistical tables are available.

This paper has nine questions.

Advice to Candidates

You must show sufficient working to make your methods clear to an examiner. Answers without working may gain no credit.

Written by Shaun Armstrong

1. During one day, a biological culure is allowed to grow under controlled conditions.

At 8 a.m. the culture is estimated to contain 20 000 bacteria. A model of the growth of the culture assumes that t hours after 8 a.m., the number of bacteria present, N, is given by

$$N = 20\,000 \times (1.06)^{t}.$$

Using this model,

(a) find the number of bacteria present at 11 a.m., **(2)**

(b) find, to the nearest minute, the time when the initial number of bacteria will have doubled. **(4)**

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2. The sides of a triangle have lengths of 7 cm, 8 cm and 10 cm.

Find the area of the triangle correct to 3 significant figures. **(6)**

3.

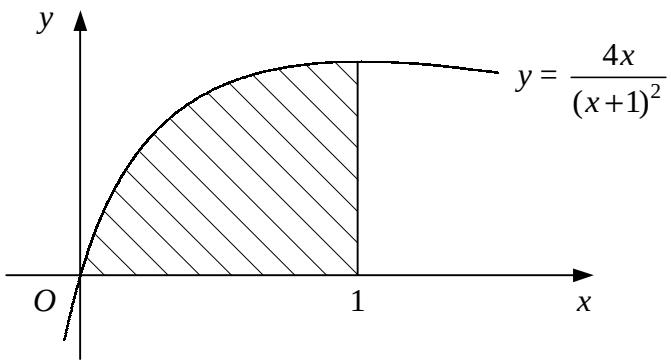

Figure 1

Figure 1 shows the curve with equation $y = \dfrac{4x}{(x+1)^2}$.

The shaded region is bounded by the curve, the x-axis and the line $x = 1$.

(a) Use the trapezium rule with four intervals of equal width to find an estimate for the area of the shaded region. **(5)**

(b) State, with a reason, whether your answer to part *(a)* is an under-estimate or an over-estimate of the true area. **(2)**

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4. The first three terms in the expansion in descending powers of x of

$$(x + \frac{k}{x^2})^{15},$$

where k is a constant, are

$$x^{15} + 30x^{12} + Ax^9.$$

(a) Find the values of k and A. **(5)**

(b) Find the value of the term independent of x in the expansion. **(3)**

5.

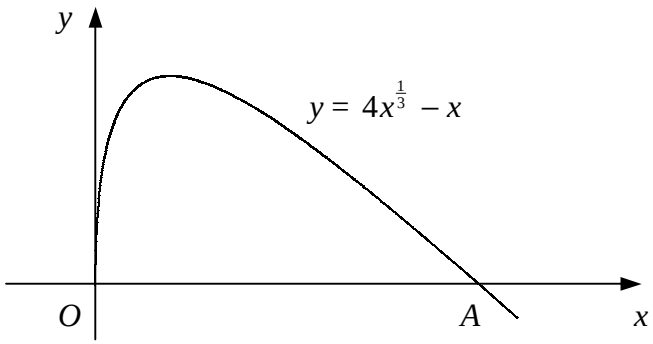

Figure 2

Figure 2 shows the curve with equation $y = 4x^{\frac{1}{3}} - x, \quad x \geq 0$.

The curve meets the x-axis at the origin and at the point A with coordinates $(a, 0)$.

(a) Show that $a = 8$. **(3)**

(b) Find the area of the finite region bounded by the curve and the positive x-axis. **(5)**

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6. $\mathrm{f}(x) = \cos 2x, \quad 0 \leq x \leq \pi.$

(a) Sketch the curve $y = \mathrm{f}(x)$. **(2)**

(b) Write down the coordinates of any points where the curve $y = \mathrm{f}(x)$ meets the coordinate axes. **(3)**

(c) Solve the equation $\mathrm{f}(x) = 0.5$, giving your answers in terms of π. **(4)**

Turn over

7. The points P and Q have coordinates $(-2, 6)$ and $(4, -1)$ respectively.

Given that PQ is a diameter of circle C,

(a) find the coordinates of the centre of C, **(2)**

(b) show that C has the equation

$$x^2 + y^2 - 2x - 5y - 14 = 0.$$ **(5)**

The point R has coordinates $(2, 7)$.

(c) Show that R lies on C and hence, state the size of $\angle PRQ$ in degrees. **(2)**

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8. The second and third terms of a geometric series are $\log_3 4$ and $\log_3 16$ respectively.

(a) Find the common ratio of the series. **(3)**

(b) Show that the first term of the series is $\log_3 2$. **(2)**

(c) Find, to 3 significant figures, the sum of the first six terms of the series. **(4)**

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9. $$\mathrm{f}(x) = x^3 - 4x^2 - 3x + 18.$$

(a) Show that $(x - 3)$ is a factor of $\mathrm{f}(x)$. **(2)**

(b) Fully factorise $\mathrm{f}(x)$. **(4)**

(c) Using your answer to part *(b)*, write down the coordinates of one of the turning points of the curve $y = \mathrm{f}(x)$ and give a reason for your answer. **(2)**

(d) Using differentiation, find the x-coordinate of the other turning point of the curve $y = \mathrm{f}(x)$. **(5)**

END