Paper Reference(s)

6664/01

Edexcel GCE

Core Mathematics C2

Advanced Subsidiary Level

Monday 2 June 2008 – Morning
Time: 1 hour 30 minutes

Materials required for examination	**Items included with question papers**
Mathematical Formulae (Green)	Nil

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulas stored in them.

Instructions to Candidates

Write the name of the examining body (Edexcel), your centre number, candidate number, the unit title (Core Mathematics C2), the paper reference (6664), your surname, initials and signature.

Information for Candidates

A booklet 'Mathematical Formulae and Statistical Tables' is provided.
Full marks may be obtained for answers to ALL questions.
There are 9 questions in this question paper. The total mark for this paper is 75.

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 not gain full credit.

H30722A

1. $$f(x) = 2x^3 - 3x^2 - 39x + 20$$

(*a*) Use the factor theorem to show that $(x + 4)$ is a factor of f (x).

(2)

(*b*) Factorise f (x) completely.

(4)

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2. $$y = \sqrt{(5^x + 2)}$$

(*a*) Copy and complete the table below, giving the values of y to 3 decimal places.

x	0	0.5	1	1.5	2
y			2.646	3.630	

(2)

(*b*) Use the trapezium rule, with all the values of y from your table, to find an approximation for the value of $\int_0^2 \sqrt{(5^x + 2)}\ \mathrm{d}x$.

(4)

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3. (*a*) Find the first 4 terms, in ascending powers of x, of the binomial expansion of $(1 + ax)^{10}$, where a is a non-zero constant. Give each term in its simplest form.

(4)

Given that, in this expansion, the coefficient of x^3 is double the coefficient of x^2,

(*b*) find the value of a.

(2)

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4. (*a*) Find, to 3 significant figures, the value of x for which $5^x = 7$.

(2)

(*b*) Solve the equation $5^{2x} - 12(5^x) + 35 = 0$.

(4)

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5. The circle C has centre (3, 1) and passes through the point P(8, 3).

(*a*) Find an equation for C.

(4)

(*b*) Find an equation for the tangent to C at P, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(5)

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6. A geometric series has first term 5 and common ratio $\frac{4}{5}$.

Calculate

(*a*) the 20th term of the series, to 3 decimal places,

(2)

(*b*) the sum to infinity of the series.

(2)

Given that the sum to k terms of the series is greater than 24.95,

(*c*) show that $k > \frac{\log 0.002}{\log 0.8}$,

(4)

(*d*) find the smallest possible value of k.

(1)

7.

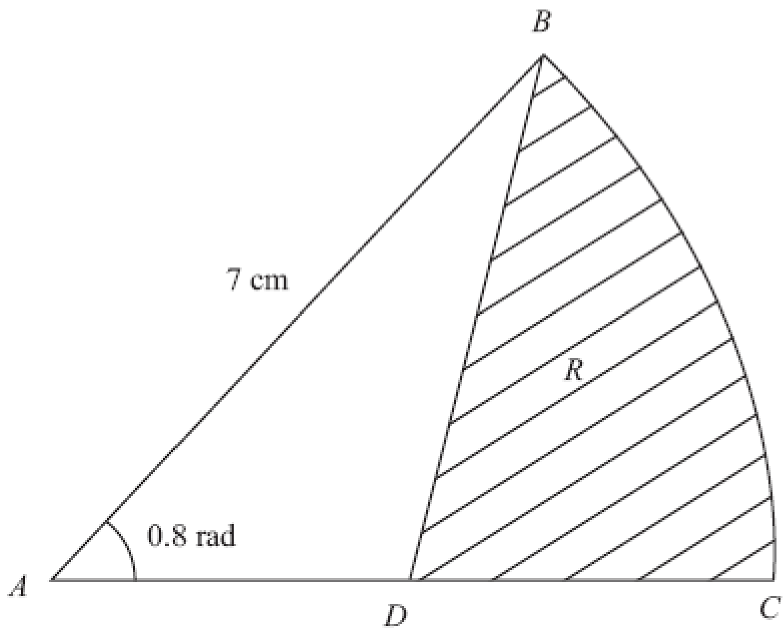

Figure 1

Figure 1 shows *ABC*, a sector of a circle with centre *A* and radius 7 cm.

Given that the size of $\angle BAC$ is exactly 0.8 radians, find

(*a*) the length of the arc *BC*,

(2)

(*b*) the area of the sector *ABC*.

(2)

The point *D* is the mid-point of *AC*. The region *R*, shown shaded in Figure 1, is bounded by *CD*, *DB* and the arc *BC*.

Find

(*c*) the perimeter of *R*, giving your answer to 3 significant figures,

(4)

(*d*) the area of *R*, giving your answer to 3 significant figures.

(4)

8.

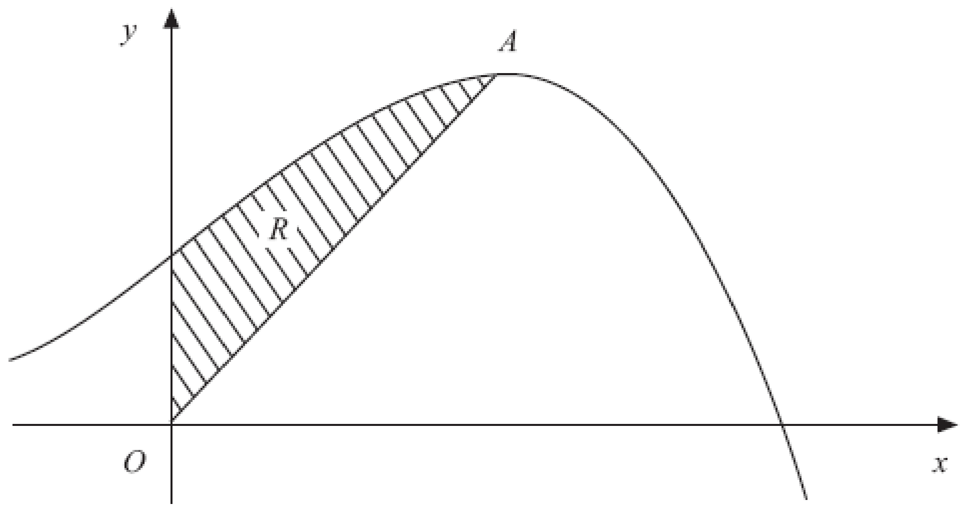

Figure 2

Figure 2 shows a sketch of part of the curve with equation $y = 10 + 8x + x^2 - x^3$.

The curve has a maximum turning point A.

(a) Using calculus, show that the x-coordinate of A is 2.

(3)

The region R, shown shaded in Figure 2, is bounded by the curve, the y-axis and the line from O to A, where O is the origin.

(b) Using calculus, find the exact area of R.

(8)

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9. Solve, for $0 \le x < 360°$,

(a) $\sin(x - 20°) = \dfrac{1}{\sqrt{2}}$,

(4)

(b) $\cos 3x = -\dfrac{1}{2}$.

(6)

TOTAL FOR PAPER: 75 MARKS

END

Question Number	Scheme	Marks
1. (*a*)	Attempt to find f(–4) or f(4). $\left(\text{f}(-4) = 2(-4)^3 - 3(-4)^2 - 39(-4) + 20\right)$	M1
	$(= -128 - 48 + 156 + 20)$ = 0, so (x + 4) is a factor.	A1 (2)
(*b*)	$2x^3 - 3x^2 - 39x + 20 = (x+4)(2x^2 - 11x + 5)$	M1 A1
	$.....(2x-1)(x-5)$ or equivalent	M1 A1 cso (4)
		(6 marks)
2. (*a*)	1.732, 2.058, 5.196 awrt	B1 B1 (2)
(*b*)	$\frac{1}{2} \times 0.5$	B1
	$......\{(1.732 + 5.196) + 2(2.058 + 2.646 + 3.630)\}$	M1 A1 ft
	= 5.899	A1 (4)
		(6 marks)
3. (*a*)	$(1+ax)^{10} = 1 + 10ax......$	B1
	$+\frac{10\times 9}{2}(ax)^2 + \frac{10\times 9\times 8}{6}(ax)^3$	M1
	$+45(ax)^2, +120(ax)^3$ or $+45a^2x^2, +120a^3x^3$	A1 A1 (4)
(*b*)	$120a^3 = 2 \times 45a^2$ $a = \frac{3}{4}$ or equiv. $\left(\text{e.g. } \frac{90}{120}, 0.75\right)$	M1 A1 (2)
		(6 marks)
4. (*a*)	$x = \frac{\log 7}{\log 5}$ or $x = \log_5 7$	M1
	1.21	A1 (2)
(*b*)	$(5^x - 7)(5^x - 5)$	M1 A1
	$(5^x = 7$ or $5^x = 5)$ x = 1.2 (awrt)	A1 ft
	x = 1	B1 (4)
		(6 marks)

Question Number	Scheme	Marks
5. (*a*)	$(8-3)^2+(3-1)^2$ or $\sqrt{(8-3)^2+(3-1)^2}$	M1 A1
	$(x\pm3)^2+(y\pm1)^2=k$ or $(x\pm1)^2+(y\pm3)^2=k$ (*k* a positive value)	M1
	$(x-3)^2+(y-1)^2=29$	A1 (4)
(*b*)	Gradient of radius = $\frac{2}{5}$ (or exact equivalent)	B1
	Gradient of tangent = $\frac{-5}{2}$	M1
	$y-3=\frac{-5}{2}(x-8)$	M1 A1 ft
	$5x+2y-46=0$ or equivalent	A1 (5)
		(9 marks)
6. (*a*)	$T_{20}=5\times\left(\frac{4}{5}\right)^{19}=0.072$	M1 A1 (2)
(*b*)	$S_\infty=\frac{5}{1-0.8}=25$	M1 A1 (2)
(*c*)	$\frac{5(1-0.8^k)}{1-0.8}>24.95$	M1
	$1-0.8^k>0.998$ or equivalent	A1
	$k\log0.8<\log0.002$ or $k>\log_{0.8}0.002$	M1
	$k>\frac{\log0.002}{\log0.8}$	A1 cso (4)
(*d*)	k = 28 (	B1
		(9 marks)

Question Number	Scheme	Marks
7. (*a*)	$r\theta = 7\times 0.8 = 5.6$ (cm)	M1 A1 (2)
(*b*)	$\frac{1}{2}r^2\theta = \frac{1}{2}\times 7^2\times 0.8 = 19.6$ (cm^2)	M1 A1 (2)
(*c*)	$BD^2 = 7^2 + (\text{their } AD)^2 - (2\times 7\times(\text{their } AD)\times\cos 0.8)$	M1
	$BD^2 = 7^2 + 3.5^2 - (2\times 7\times 3.5\times\cos 0.8)$ (or awrt 46° for the angle)	A1
	Perimeter = (their DC) + "5.6" + "5.21" = 14.3 (cm)	M1 A1 (4)
(*d*)	$\Delta ABD = \frac{1}{2}\times 7\times(\text{their } AD)\times\sin 0.8$ (ft their AD) (= 8.78…)	M1 A1 ft
	Area = "19.6" – "8.78…" = 10.8 (cm^2)	M1 A1 (4)
		(12 marks)
8. (*a*)	$\left(\frac{\mathrm{d}y}{\mathrm{d}x} =\right) 8 + 2x - 3x^2$	M1 A1
	$3x^2 - 2x - 8 = 0$ $(3x+4)(x-2) = 0$ $x = 2$	A1 cso (3)
(*b*)	Area of triangle = $\frac{1}{2}\times 2\times 22$	M1 A1
	$\int 10 + 8x + x^2 - x^3\,\mathrm{d}x = 10x + \frac{8x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4}$	M1 A1 A1
	$\left[10x + \frac{8x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4}\right]_0^2 = \ldots\ldots \left(= 20 + 16 + \frac{8}{3} - 4\right)$	M1
	Area of $R = 34\frac{2}{3} - 22 = \frac{38}{3}\left(= 12\frac{2}{3}\right)$ (Or $12.\dot{6}$)	M1 A1 (8)
		(11 marks)
9. (*a*)	45 (α)	B1
	$180 - \alpha$, Add 20 (for at least one angle)	M1 M1
	65 155	A1 (4)
(*b*)	120 or 240 (β):	B1
	$360 - \beta$, $360 + \beta$	M1 M1
	Dividing by 3 (for at least one angle)	M1
	40 80 160 200 280 320	A1 A1 (6)
		(10 marks)