Paper Reference(s)

6663/01

Edexcel GCE

Core Mathematics C1

Advanced Subsidiary

Wednesday 18 May 2011 – Morning

Time: 1 hour 30 minutes

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

Calculators may NOT be used in this examination.

Instructions to Candidates

Write the name of the examining body (Edexcel), your centre number, candidate number, the unit title (Core Mathematics C1), the paper reference (6663), 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 10 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.

P38157A

1. Find the value of

(*a*) $25^{\frac{1}{2}}$,

(1)

(*b*) $25^{-\frac{3}{2}}$.

(2)

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2. Given that $y = 2x^5 + 7 + \frac{1}{x^3}$, $x \neq 0$, find, in their simplest form,

(*a*) $\frac{dy}{dx}$,

(3)

(*b*) $\int y \, dx$.

(4)

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3. The points P and Q have coordinates (–1, 6) and (9, 0) respectively.

The line l is perpendicular to PQ and passes through the mid-point of PQ.

Find an equation for l, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(5)

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4. Solve the simultaneous equations

$$x + y = 2$$
$$4y^2 - x^2 = 11$$

(7)

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5. A sequence a_1, a_2, a_3, …, is defined by

$$a_1 = k,$$

$$a_{n+1} = 5a_n + 3, \quad n \geq 1,$$

where k is a positive integer.

(*a*) Write down an expression for a_2 in terms of k.

(1)

(*b*) Show that $a_3 = 25k + 18$.

(2)

(*c*) (i) Find $\sum_{r=1}^{4} a_r$ in terms of k, in its simplest form.

(ii) Show that $\sum_{r=1}^{4} a_r$ is divisible by 6.

(4)

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6. Given that $\dfrac{6x + 3x^{\frac{5}{2}}}{\sqrt{x}}$ can be written in the form $6x^p + 3x^q$,

(*a*) write down the value of p and the value of q.

(2)

Given that $\dfrac{dy}{dx} = \dfrac{6x + 3x^{\frac{5}{2}}}{\sqrt{x}}$ and that $y = 90$ when $x = 4$,

(*b*) find y in terms of x, simplifying the coefficient of each term.

(5)

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7. $$f(x) = x^2 + (k + 3)x + k,$$

where k is a real constant.

(*a*) Find the discriminant of $f(x)$ in terms of k.

(2)

(*b*) Show that the discriminant of $f(x)$ can be expressed in the form $(k + a)^2 + b$, where a and b are integers to be found.

(2)

(*c*) Show that, for all values of k, the equation $f(x) = 0$ has real roots.

(2)

8.

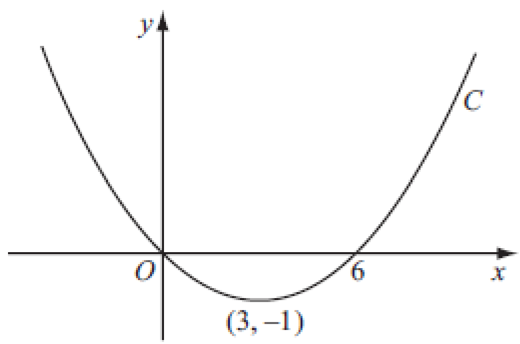

Figure 1

Figure 1 shows a sketch of the curve C with equation $y = f(x)$.
The curve C passes through the origin and through (6, 0).
The curve C has a minimum at the point (3, –1).

On separate diagrams, sketch the curve with equation

(*a*) $y = f(2x)$,

(3)

(*b*) $y = -f(x)$,

(3)

(*c*) $y = f(x + p)$, where p is a constant and $0 < p < 3$.

(4)

On each diagram show the coordinates of any points where the curve intersects the x-axis and of any minimum or maximum points.

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9. (*a*) Calculate the sum of all the even numbers from 2 to 100 inclusive,

$$2 + 4 + 6 + ... + 100.$$

(3)

(*b*) In the arithmetic series

$$k + 2k + 3k + ... + 100,$$

k is a positive integer and k is a factor of 100.

(i) Find, in terms of k, an expression for the number of terms in this series.

(ii) Show that the sum of this series is

$$50 + \frac{5000}{k}.$$

(4)

(*c*) Find, in terms of k, the 50th term of the arithmetic sequence

$$(2k + 1), \quad (4k + 4), \quad (6k + 7), \dots ,$$

giving your answer in its simplest form.

(2)

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10. The curve C has equation

$$y = (x + 1)(x + 3)^2.$$

(*a*) Sketch C, showing the coordinates of the points at which C meets the axes.

(4)

(*b*) Show that $\frac{dy}{dx} = 3x^2 + 14x + 15$.

(3)

The point A, with x-coordinate –5, lies on C.

(*c*) Find the equation of the tangent to C at A, giving your answer in the form $y = mx + c$, where m and c are constants.

(4)

Another point B also lies on C. The tangents to C at A and B are parallel.

(*d*) Find the x-coordinate of B.

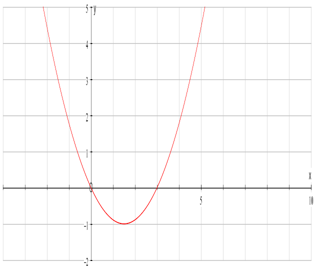
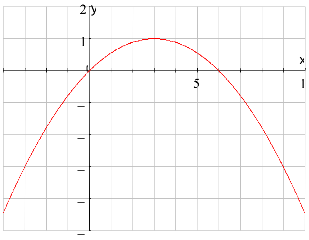
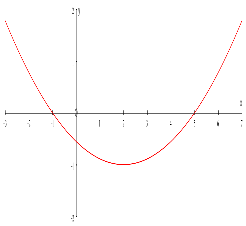
(3)

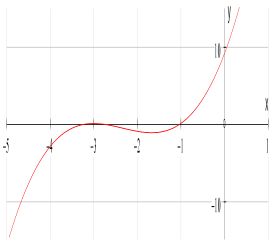
TOTAL FOR PAPER: 75 MARKS

END

Question Number	Scheme	Marks
1. (a)	5 (or ± 5)	B1 (1)
(b)	$25^{-\frac{3}{2}} = \frac{1}{25^{\frac{3}{2}}}$ **or** $25^{\frac{3}{2}}$ =125 or better	M1
	$\frac{1}{125}$ or 0.008 (or $\pm\frac{1}{125}$)	A1
		(2) **3**
2. (a)	$\frac{dy}{dx} = 10x^4 - 3x^{-4}$ or $10x^4 - \frac{3}{x^4}$	M1 A1 A1 (3)
(b)	$\left(\int =\right) \frac{2x^6}{6} + 7x + \frac{x^{-2}}{-2} = \frac{x^6}{3} + 7x - \frac{x^{-2}}{2}$	M1 A1 A1
	$+ C$	B1 (4) **7**
3.	Mid-point of PQ is (4, 3)	B1
	PQ: $m = \frac{0-6}{9-(-1)}, \left(= -\frac{3}{5}\right)$	B1
	Gradient perpendicular to PQ $= -\frac{1}{m}$ $(= \frac{5}{3})$	M1
	$y - 3 = \frac{5}{3}(x - 4)$	M1
	$5x - 3y - 11 = 0$ or $3y - 5x + 11 = 0$ or multiples e.g. $10x - 6y - 22 = 0$	A1 (5) **5**

Question Number	Scheme		Marks
4.	Either	Or	
	$y^2 = 4 - 4x + x^2$	$x^2 = 4 - 4y + y^2$	M1
	$4(4 - 4x + x^2) - x^2 = 11$ or $4(2-x)^2 - x^2 = 11$	$4y^2 - (4 - 4y + y^2) = 11$ or $4y^2 - (2-y)^2 = 11$	M1
	$3x^2 - 16x + 5 = 0$	$3y^2 + 4y - 15 = 0$ Correct 3 terms	A1
	$(3x-1)(x-5) = 0, \quad x = ...$	$(3y-5)(y+3) = 0, \quad y = ...$	M1
	$x = \frac{1}{3} \quad x = 5$	$y = \frac{5}{3} \quad y = -3$	A1
	$y = \frac{5}{3} \quad y = -3$	$x = \frac{1}{3} \quad x = 5$	M1 A1
			(7) **7**
5. (a)	$(a_2 =)\ 5k + 3$		B1 (1)
(b)	$(a_3 =)\ 5(5k+3) + 3$ $= 25k + 18$ (*)		M1 A1 cso (2)
(c) (i)	$a_4 = 5(25k+18) + 3 \quad (= 125k + 93)$		M1
	$\sum_{r=1}^{4} a_r = k + (5k+3) + (25k+18) + (125k+93)$		M1
	$= 156k + 114$		A1 cao
(ii)	$= 6(26k + 19)$ (or explain each term is divisible by 6)		A1 ft
			(4) **7**

Question Number	Scheme	Marks
6. (a)	$p=\frac{1}{2},\ q=2$ or $6x^{\frac{1}{2}},\ 3x^2$	B1, B1 (2)
(b)	$\frac{6x^{\frac{3}{2}}}{\left(\frac{3}{2}\right)}+\frac{3x^3}{3}$ $\left(=4x^{\frac{3}{2}}+x^3\right)$ $x = 4,\ y = 90$: $32+64+C=90 \Rightarrow C=-6$ $y=4x^{\frac{3}{2}}+x^3+\text{"}their -6\text{"}$	M1 A1ft M1 A1 A1 (5) **7**
7. (a)	Discriminant: $b^2-4ac=(k+3)^2-4k$ or equivalent	M1 A1 (2)
(b)	$(k+3)^2-4k=k^2+2k+9=(k+1)^2+8$	M1 A1 (2)
(c)	For real roots, $b^2-4ac\geq 0$ or $b^2-4ac>0$ or $(k+1)^2+8>0$ $(k+1)^2\geq 0$ for all k, so $b^2-4ac>0$, so roots are real for all k (or equiv.)	M1 A1 cso (2) **6**
8. (a)	 Shape  through (0, 0) (3, 0) (1.5, –1)	B1 B1 B1 (3)
(b)	 Shape  (0, 0) and (6, 0) (3, 1)	B1 B1 B1 (3)
(c)	 Shape  , <u>not</u> through (0, 0) Minimum in 4th quadrant ($-p$, 0) and (6 – p, 0) (3 – p, –1)	M1 A1 B1 B1 (4) **10**

Question Number	Scheme	Marks
9. (a)	Series has 50 terms $S=\frac{1}{2}(50)(2+100)=2550$ or $S=\frac{1}{2}(50)(4+49\times 2)=2550$	B1 M1 A1 (3)
(b) (i) **(ii)**	$\frac{100}{k}$ Sum: $\frac{1}{2}\left(\frac{100}{k}\right)(k+100)$ or $\frac{1}{2}\left(\frac{100}{k}\right)\left(2k+\left(\frac{100}{k}-1\right)k\right)$ $=50+\frac{5000}{k}$ (*)	B1 M1 A1 A1 cso (4)
(c)	50^{th} term $=a+(n-1)d$ $=(2k+1)+49"(2k+3)"$ $=100k+148$ Or $2k+49(2k)+1+49(3)$ $=100k+148$	M1 A1 (2) **9**
10. (a)	 Shape (cubic in this orientation) **Touching** *x*-axis at **–3** **Crossing** at **–1** on *x*-axis Intersection at **9** on *y*-axis	B1 B1 B1 B1 (4)
(b)	$y=(x+1)(x^2+6x+9)=x^3+7x^2+15x+9$ or equiv. (possibly unsimplified) Differentiates their polynomial correctly – may be unsimplified $\frac{dy}{dx}=3x^2+14x+15$ **(*)**	B1 M1 A1 cso (3)
(c)	At $x=-5$: $\frac{dy}{dx}=75-70+15=20$ At $x=-5$: $y=-16$ $y-("-16")="20"(x-(-5))$ or y = "20x" + c with (-5, -"16") used to find c $y=20x+84$	B1 B1 M1 A1 (4)
(d)	Parallel: $3x^2+14x+15="20"$ $(3x-1)(x+5)=0$ $x=\ldots$ $x=\frac{1}{3}$	M1 M1 A1 (3) **14**