Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	6	6	3	/	0	1	Signature	

Paper Reference(s)

6663/01

Edexcel GCE

Core Mathematics C1

Advanced Subsidiary

Wednesday 18 May 2011 – Morning

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total	

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

Calculators may NOT be used in this examination.

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and signature.
Check that you have the correct question paper.
Answer ALL the questions.
You must write your answer for each question in the space following the question.

Information for Candidates

A booklet 'Mathematical Formulae and Statistical Tables' is provided.
Full marks may be obtained for answers to ALL questions.
The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 10 questions in this question paper. The total mark for this paper is 75.
There are 28 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You should show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.

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1. Find the value of

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

(1)

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

(2)

a) $25^{\frac{1}{2}} = \underline{\underline{5}}$

b) $25^{-\frac{3}{2}} = 25^{-3} = 125^{-1}$

$= \underline{\underline{\frac{1}{125}}}$

Q1

(Total 3 marks)

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

(a) $\frac{\mathrm{d}y}{\mathrm{d}x}$,

(3)

(b) $\int y \, \mathrm{d}x$.

(4)

2 a)

$y = 2x^5 + 7 + x^{-3}$

$\frac{dy}{dx} = 10x^4 - 3x^{-4}$

b) $y = 2x^5 + 7 + x^{-3}$

$\int y \, dx = \frac{2x^6}{6} + 7x + \frac{x^{-2}}{-2} + c$

$= \frac{1}{3}x^6 + 7x - \frac{1}{2}x^{-2} + c$

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Question 2 continued

Q2

(Total 7 marks)

P 3 8 1 5 7 A 0 5 2 8

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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)

3)

Midpoint $\left(\frac{-1+9}{2}, \frac{6+0}{2}\right)$

$(4, 3)$

$M_{PQ} = \frac{0-6}{9--1}$

$= \frac{-6}{10}$

$= -\frac{3}{5}$

$\therefore \ m = 5/3$

$y = 5/3 x + c$

$3 = 5/3(4) + c$

$3 = \frac{20}{3} + c$

$9/3 = 20/3 + c$

$-11/3 = c$

$y = 5/3 x - 11/3$

$3y = 5x - 11$

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Question 3 continued

$5x - 3y - 11 = 0$

Q3

(Total 5 marks)

P 3 8 1 5 7 A 0 7 2 8

Turn over

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4. Solve the simultaneous equations

$$x + y = 2$$

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

(7)

$y = 2 - x$

$4(2 - x)^2 - x^2 = 11$

$4(2-x)(2-x) - x^2 = 11$

$4(4 - 4x + x^2) - x^2 = 11$

$16 - 16x + 4x^2 - x^2 = 11$

$3x^2 - 16x + 16 = 11$

$3x^2 - 16x + 5 = 0$

$(3x - 1)(x - 5) = 0$

$x = 1/3 \qquad x = 5$

$y = 5/3 \qquad y = -3$

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Question 4 continued

Q4

(Total 7 marks)

P 3 8 1 5 7 A 0 9 2 8

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5. A sequence $a_1, a_2, a_3, \ldots$ is defined by

$$a_1 = k,$$
$$a_{n+1} = 5a_n + 3, \qquad n \geqslant 1,$$

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)**

5a) $a_1 = k$
$a_2 = 5(a_1) + 3$
$= 5k + 3$

b) $a_3 = 5(a_2) + 3$
$= 5(5k+3) + 3$
$= 25k + 15 + 3$
$= 25k + 18$

c) $a_4 = 5(a_3) + 3$
$= 5(25k+18) + 3$
$= 125k + 90 + 3$
$= 125k + 93$

$\sum_{r=1}^{4} k + 5k + 3 + 25k + 18 + 125k + 93$

$= 156k + 114$

d) $6(26k + 19)$

P 3 8 1 5 7 A 0 1 0 2 8

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Question 5 continued

Q5

(Total 7 marks)

P 3 8 1 5 7 A 0 1 1 2 8

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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)

6a) $\dfrac{6x + 3x^{5/2}}{x^{1/2}}$

$= 6x^{1/2} + 3x^2$

$p = 1/2 \quad q = 2$

b) $\dfrac{dy}{dx} = 6x^{1/2} + 3x^2$

$y = \dfrac{6x^{3/2}}{3/2} + \dfrac{3x^3}{3} + c$

$y = 4x^{3/2} + x^3 + c$

$(4, 90) \quad 90 = 4(4)^{3/2} + (4)^3 + c$

$90 = 32 + 64 + c$

$90 = 96 + c$

$c = -6$

$\underline{y = 4x^{3/2} + x^3 - 6}$

P 3 8 1 5 7 A 0 1 2 2 8

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Question 6 continued

Q6

(Total 7 marks)

P 3 8 1 5 7 A 0 1 3 2 8

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)

7a) $a = 1$ $b = k+3$ $c = k$

$b^2 - 4ac$

$(k+3)^2 - 4(k)$

$k^2 + 6k + 9 - 4k$

$k^2 + 2k + 9$

b) $(k+1)^2 - 1 + 9$

$(k+1)^2 + 8$

c) Minimum point $(-1, 8)$

$b^2 - 4ac$ is always positive $\therefore$ 2 real roots

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Question 7 continued

(Total 6 marks)

Q7

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8.

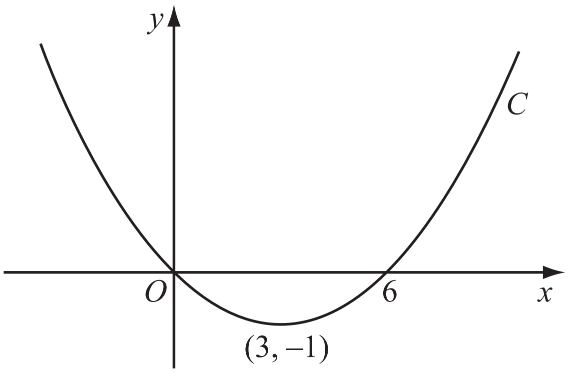


Figure 1

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

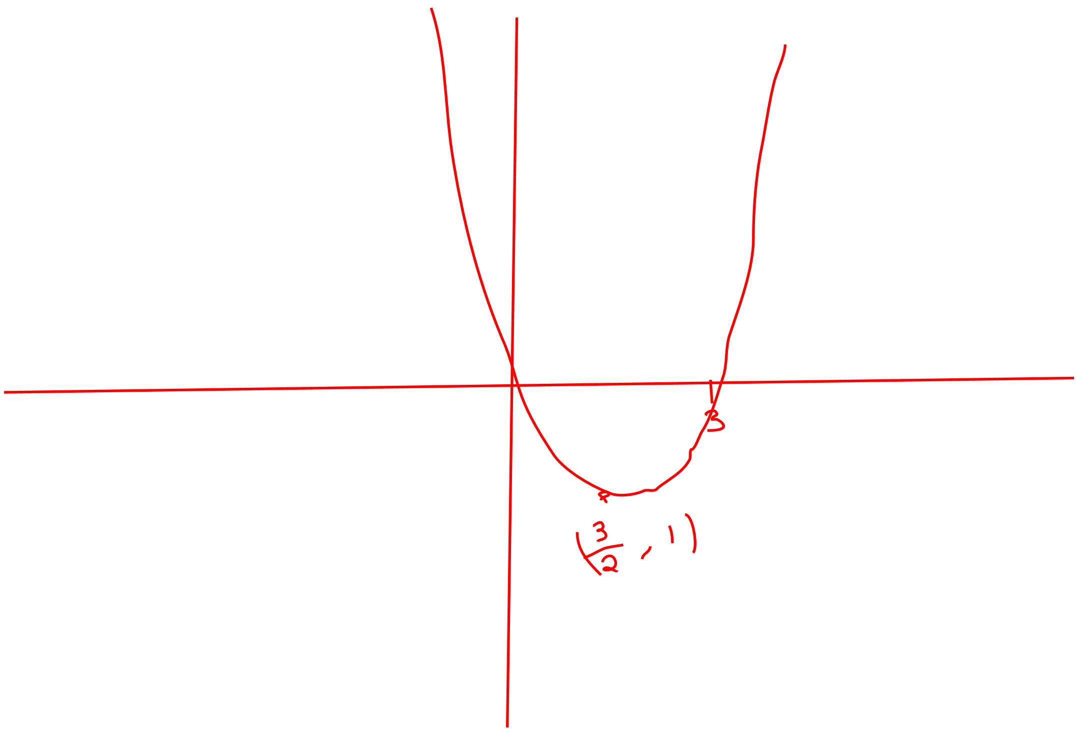
On separate diagrams, sketch the curve with equation

(a) $y = \mathrm{f}(2x)$, **(3)**

(b) $y = -\mathrm{f}(x)$, **(3)**

(c) $y = \mathrm{f}(x + p)$, 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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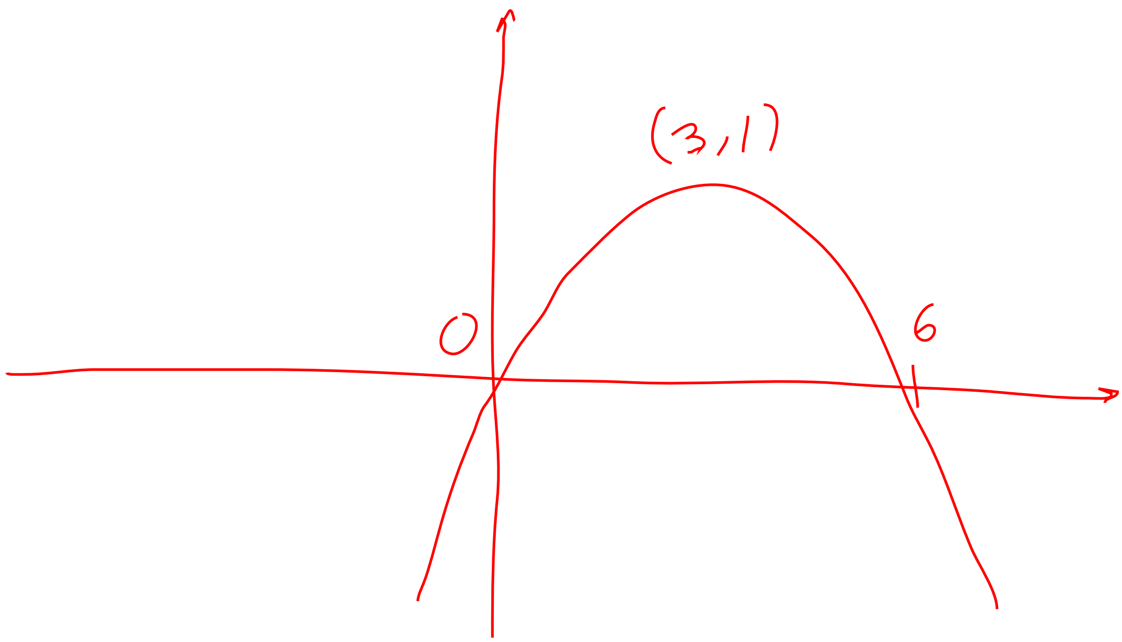
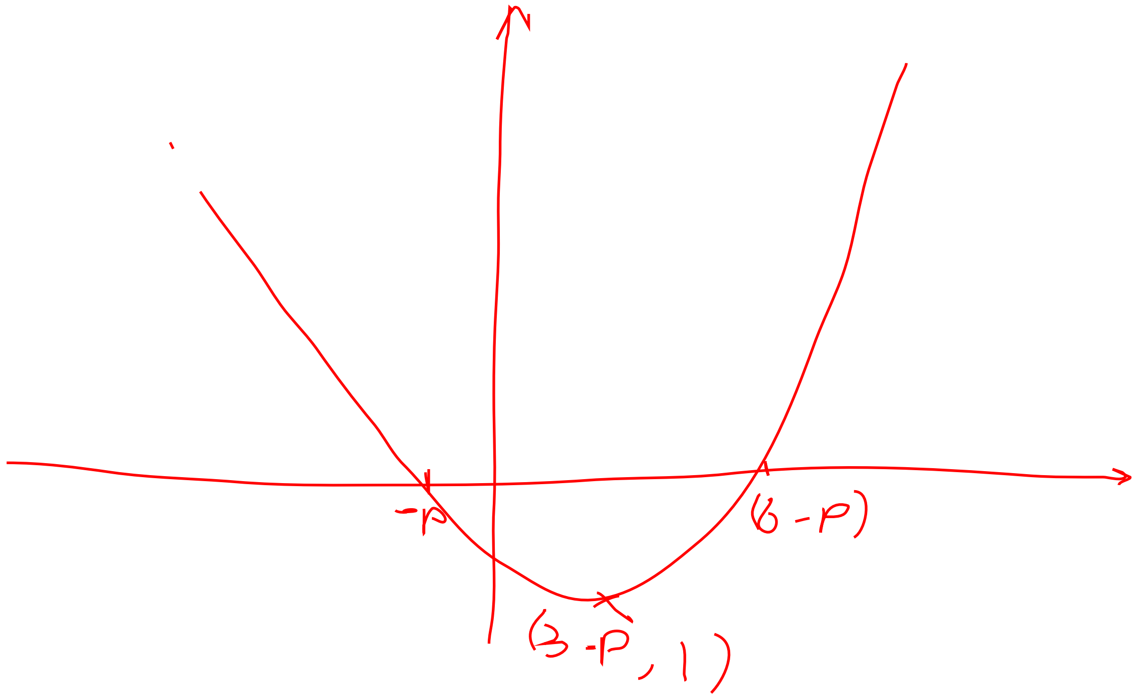
Question 8 continued





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Question 8 continued

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Question 8 continued

Q8

(Total 10 marks)

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

$$2 + 4 + 6 + \ldots\ldots + 100$$

(3)

(b) In the arithmetic series

$$k + 2k + 3k + \ldots\ldots + 100$$

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

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

giving your answer in its simplest form.

(2)

9a)

$S_n = \frac{n}{2}(a + l)$

$S_{50} = \frac{50}{2}(2 + 100)$

$= 25(102)$

$= \underline{2550}$

b) $\frac{100}{k}$

c) $a = k \quad d = k \quad n = \frac{100}{k}$

$l = 100$

$S_n = \frac{n}{2}(a + l)$

$= \frac{100}{2k}(k + 100)$

P 3 8 1 5 7 A 0 2 0 2 8

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Question 9 continued

$$= \frac{50}{k}(k + 100)$$

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

c) $a = 2k + 1$

$d = 2k + 3$

$U_{50} = ?$

d) $U_{50} = 2k+1 + (50-1)(2k+3)$

$= 2k+1 + 49(2k+3)$

$= 2k + 1 + 98k + 147$

$= 100k + 148$

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Question 9 continued

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Question 9 continued

Q9

(Total 9 marks)

P 3 8 1 5 7 A 0 2 3 2 8

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 $\dfrac{dy}{dx} = 3x^2 + 14x + 15$. **(3)**

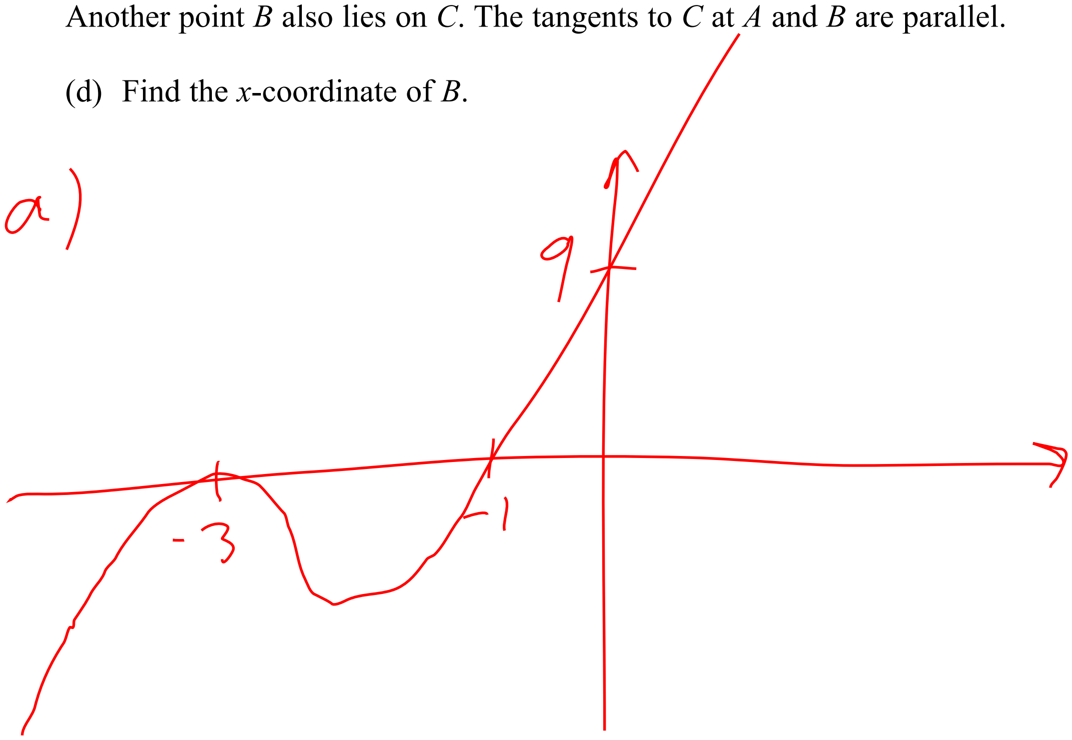
The point A, with x-coordinate -5, lies on C.

(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)**

a)



Question 10 continued

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

$= (x+1)(x^2+6x+9)$

$= x^3 + 6x^2 + 9x + x^2 + 6x + 9$

$= x^3 + 7x^2 + 15x + 9$

$\frac{dy}{dx} = 3x^2 + 14x + 15$

b) when $x = -5$

$\frac{dy}{dx} = 3(-5)^2 + 14(-5) + 15$

$= 75 - 70 + 15$

$= 20$

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

$= (-5+1)(-5+3)^2$

$= (-4)(4)$

$= -16$

$(-5, -16)$

$y = mx + c$

$-16 = 20(-5) + c$

$-16 = -100 + c$

$c = 84$

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Question 10 continued

$y = 20x + 84$

d) $\frac{dy}{dx} = 20$

$3x^2 + 14x + 15 = 20$

$3x^2 + 14x - 5 = 0$

$(3x - 1)(x + 5) = 0$

$x = 1/3 \quad x = -5$

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Question 10 continued

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Question 10 continued

Q10

(Total 14 marks)

TOTAL FOR PAPER: 75 MARKS

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