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

Monday 10 January 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	
11	
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 to 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 11 questions in this question paper. The total mark for this paper is 75.
There are 24 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. (a) Find the value of $16^{-\frac{1}{4}}$

(2)

(b) Simplify $x\left(2x^{-\frac{1}{4}}\right)^4$

(2)

a) $16^{-1/4}$

$\frac{1}{16^{1/4}}$

$\frac{1}{2}$

b) $x(16x^{-1})$

16

Q1

(Total 4 marks)

Leave blank

2. Find

$$\int (12x^5 - 3x^2 + 4x^{\frac{1}{3}})\, dx$$

giving each term in its simplest form.

(5)

$$\frac{12x^6}{6} - \frac{3x^3}{3} + \frac{4x^{4/3}}{4/3} + C$$

$$2x^6 - x^3 + 3x^{4/3} + C$$

Q2

(Total 5 marks)

Leave blank

3. Simplify

$$\frac{5-2\sqrt{3}}{\sqrt{3}-1}$$

giving your answer in the form $p+q\sqrt{3}$, where p and q are rational numbers.

(4)

$$\frac{(5-2\sqrt{3})(\sqrt{3}+1)}{(\sqrt{3}-1)(\sqrt{3}+1)}$$

$$\frac{5\sqrt{3}+5-6-2\sqrt{3}}{3+\sqrt{3}-\sqrt{3}-1}$$

$$\frac{3\sqrt{3}-1}{2}$$

$$\frac{3}{2}\sqrt{3}-\frac{1}{2}$$

$$\underline{\underline{-\frac{1}{2}+\frac{3}{2}\sqrt{3}}}$$

Leave blank

4. A sequence a_1, a_2, a_3,... is defined by

$$a_1 = 2$$
$$a_{n+1} = 3a_n - c$$

where c is a constant.

(a) Find an expression for a_2 in terms of c.

(1)

Given that $\sum_{i=1}^{3} a_i = 0$

(b) find the value of c.

(4)

a) $a_2 = 3(a_1) - c$

$= 3(\overset{2}{a_1}) - c \qquad = \underline{6 - c}$

b) $a_3 = 3(a_2) - c$

$= 3(\overset{6}{\cancel{3a_1}} - c) - c$

$= \overset{18}{\cancel{9a_1}} - 3c - c$

$\cancel{= 9a_1 - 4c}$

$\cancel{= 9(2) - 4c}$

$= \underline{18 - 4c}$

$2 + 6 - c + 18 - 4c = 0$

$26 - 5c = 0$

$26 = 5c$

$c = \dfrac{26}{5}$

Leave blank

5.

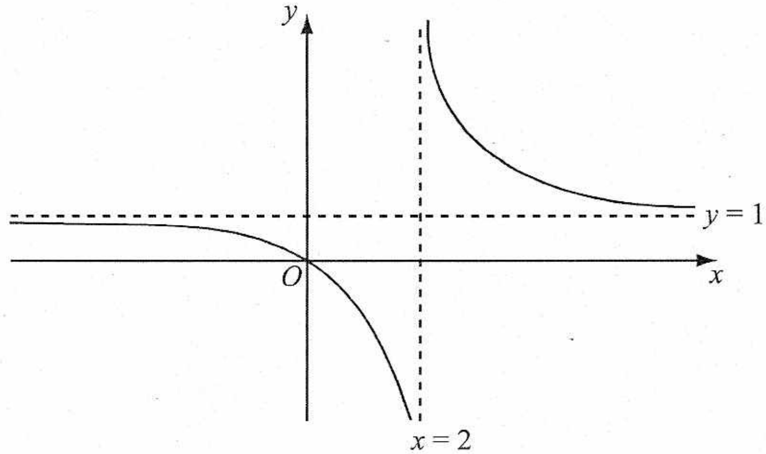


Figure 1

Figure 1 shows a sketch of the curve with equation $y = \mathrm{f}(x)$ where

$$\mathrm{f}(x) = \frac{x}{x-2}, \qquad x \neq 2$$

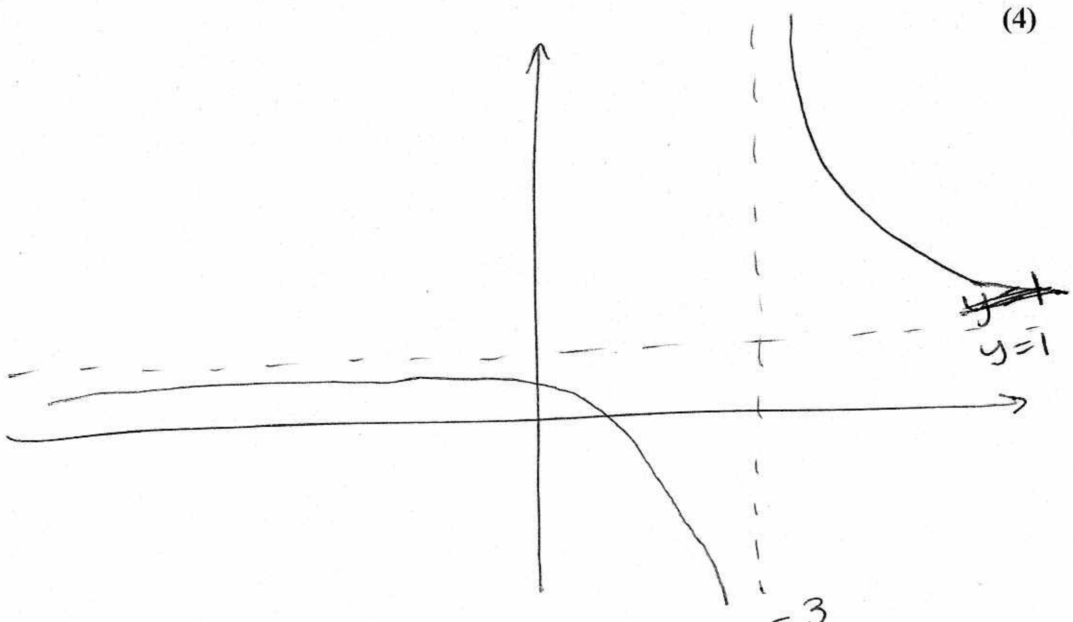
The curve passes through the origin and has two asymptotes, with equations $y = 1$ and $x = 2$, as shown in Figure 1.

(a) In the space below, sketch the curve with equation $y = \mathrm{f}(x-1)$ and state the equations of the asymptotes of this curve.

(3)

(b) Find the coordinates of the points where the curve with equation $y = \mathrm{f}(x-1)$ crosses the coordinate axes.

(4)



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Question 5 continued

b) $f(x-1) = \dfrac{x-1}{x-1-2}$

$y = \dfrac{x-1}{x-3}$

crosses y when $x=0$

$y = \dfrac{0-1}{0-3} = \dfrac{1}{3}$

$\underline{(0, 1/3)}$

crosses x when $y=0$

$0 = \dfrac{x-1}{x-3}$

$0 = x-1$

$x = 1$

$\underline{(1, 0)}$

Q5

(Total 7 marks)

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6. An arithmetic sequence has first term a and common difference d. The sum of the first 10 terms of the sequence is 162.

(a) Show that $10a + 45d = 162$

(2)

Given also that the sixth term of the sequence is 17,

(b) write down a second equation in a and d,

(1)

(c) find the value of a and the value of d.

(4)

a) $S_n = \frac{n}{2}(2a + (n-1)d)$

$162 = \frac{10}{2}(2a + ((10)-1)d)$

$162 = 5(2a + 9d)$

$162 = 10a + 45d$

b) $U_n = a + (n-1)d$

$17 = a + ((6)-1)d$

$17 = a + 5d$

c) $17 = a + 5d$ $\times 10$

$162 = 10a + 45d$

$170 = 10a + 50d$

$8 = 5d$

$d = 8/5$

$17 = a + 5(8/5)$

$17 = a + 8$

$a = 9$

Leave blank

7. The curve with equation $y = \mathrm{f}(x)$ passes through the point $(-1, 0)$.

Given that

$$\mathrm{f}'(x) = 12x^2 - 8x + 1$$

$\frac{dy}{dx}$

find $\mathrm{f}(x)$.

(5)

$$f(x) = \frac{12x^3}{3} - \frac{8x^2}{2} + x + c$$

$$= 4x^3 - 4x^2 + x + c$$

$x \quad y$

$(-1, 0) \qquad 0 = 4(-1)^3 - 4(-1)^2 - 1 + c$

$$0 = -4 - 4 - 1 + c$$

$$0 = -9 + c$$

$$c = 9$$

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

Leave blank

8. The equation $x^2+(k-3)x+(3-2k)=0$, where k is a constant, has two distinct real roots.

(a) Show that k satisfies

$$k^2+2k-3>0$$

(3)

(b) Find the set of possible values of k.

(4)

a) two roots $\therefore$ $b^2-4ac>0$

$a=1 \quad b=(k-3) \quad c=(3-2k)$

$(k-3)^2-4(1)(3-2k)>0$

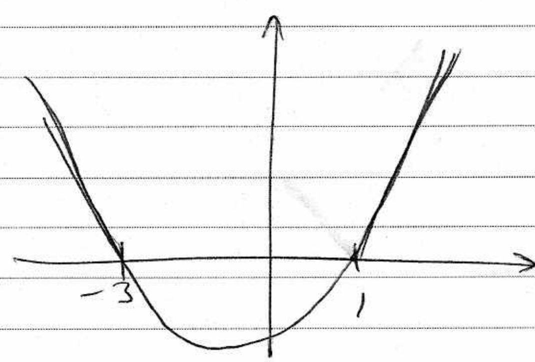
$(k-3)(k-3)-4(3-2k)>0$

$k^2-6k+9-12+8k>0$

$k^2+2k-3>0$

$(k+3)(k-1)$

$k=-3 \quad k=1$



$k<-3$ or $k>1$

Leave blank

9. The line L_1 has equation $2y - 3x - k = 0$, where k is a constant.

Given that the point A $(1, 4)$ lies on L_1, find

(a) the value of k,

(1)

(b) the gradient of L_1.

(2)

The line L_2 passes through A and is perpendicular to L_1.

(c) Find an equation of L_2 giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

The line L_2 crosses the x-axis at the point B.

(d) Find the coordinates of B.

(2)

(e) Find the exact length of AB.

(2)

a/ $2y - 3x - k = 0 \qquad (1, 4)$

$2(4) - 3(1) - k = 0$

$8 - 3 - k = 0$

$5 - k = 0$

$\underline{\underline{k = 5}}$

b/ $2y - 3x - 5 = 0$

$2y = 3x + 5$

$y = \frac{3}{2}x + 5/2$

$\underline{\underline{m = 3/2}}$

c/ perpendicular gradient $= -2/3$

$y = -2/3\,x + c \qquad (1, 4)$

$4 = -2/3(1) + c$

$4 = -2/3 + c$

$12 = -2 + 3c$

$14 = 3c$

Leave blank

Question 9 continued

$c = 14/3$

$y = -2/3\,x + 14/3$

$3y = -2x + 14$

$2x + 3y - 14 = 0$

d/ crosses x when $y=0$

$2x + 3(0) - 14 = 0$

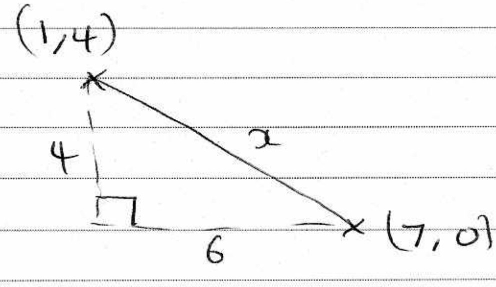
$2x - 14 = 0$

$2x = 14$

$x = 7$

$(7,0)$

e)



$4^2 + 6^2 = x^2$

$16 + 36 = x^2$

$52 = x^2$

$x = \sqrt{52}$

$= \sqrt{4}\sqrt{13}$

$= 2\sqrt{13}$

Leave blank

10. (a) On the axes below, sketch the graphs of

(i) $y = x(x+2)(3-x)$

$x = 0 \quad x = -2 \quad x = 3$

(ii) $y = -\dfrac{2}{x}$

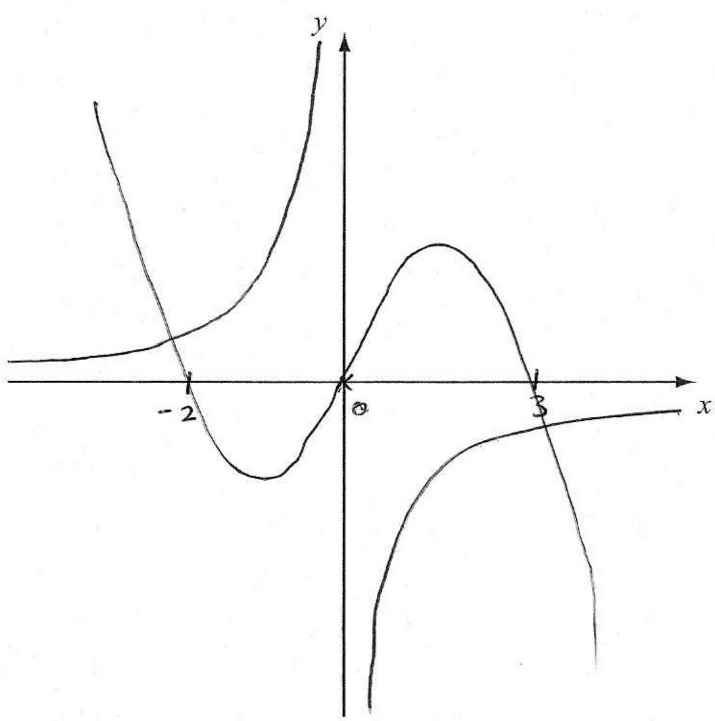
showing clearly the coordinates of all the points where the curves cross the coordinate axes.

(6)

(b) Using your sketch state, giving a reason, the number of real solutions to the equation

$$x(x+2)(3-x) + \frac{2}{x} = 0$$

(2)



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Question 10 continued

b/ The graphs intersect twice

$\therefore$ 2 solutions.

Q10

(Total 8 marks)

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11. The curve C has equation

$$y = \frac{1}{2}x^3 - 9x^{\frac{3}{2}} + \frac{8}{x} + 30, \qquad x > 0$$

(a) Find $\frac{dy}{dx}$.

(4)

(b) Show that the point $P(4, -8)$ lies on C.

(2)

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

(6)

a) $y = \frac{1}{2}x^3 - 9x^{3/2} + 8x^{-1} + 30$

$\frac{dy}{dx} = \frac{3}{2}x^2 - \frac{27}{2}x^{1/2} - 8x^{-2}$

b) $(4, -8)$

$-8 = \frac{1}{2}(4)^3 - 9(4)^{\frac{3}{2}} + \frac{8}{4} + 30$

$-8 = \frac{1}{2}(64) - 9(8) + 2 + 30$

$-8 = 32 - 72 + 2 + 30$

$-8 = 64 - 72$

$-8 = -8$

c) when $x = 4$

$\frac{dy}{dx} = \frac{3}{2}(4)^2 - \frac{27}{2}(4)^{1/2} - \frac{8}{(4)^2}$

$= \frac{3}{2}(16) - \frac{27}{2}(2) - \frac{8}{16}$

$= 24 - 27 - 1/2$

$= -3 - 1/2$

$= -\frac{6}{2} - \frac{1}{2}$

$= -7/2$

Leave blank

Question 11 continued

gradient of normal $= 2/7$

$y = \frac{2}{7}x + c$ $\quad (4, -8)$

$-8 = \frac{2}{7}(4) + c$

$-8 = \frac{8}{7} + c$

$-56 = 8 + 7c$

$-64 = 7c$

$c = \frac{-64}{7}$

$y = \frac{2}{7}x \cancel{+} - \frac{64}{7}$

$7y = 2x - 64$

$2x - 7y - 64 = 0$