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 13 May 2013 – Afternoon

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 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 11 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. Simplify

$$\frac{7+\sqrt{5}}{\sqrt{5}-1}$$

giving your answer in the form $a + b\sqrt{5}$, where a and b are integers.

(4)

1)
$$\frac{7+\sqrt{5}}{\sqrt{5}-1}$$

$$\frac{(7+\sqrt{5})(\sqrt{5}+1)}{(\sqrt{5}-1)(\sqrt{5}+1)}$$

$$\frac{7\sqrt{5}+7+5+\sqrt{5}}{5+\sqrt{5}-\sqrt{5}-1}$$

$$\frac{8\sqrt{5}+12}{4}$$

$$2\sqrt{5}+3$$

$$\underline{3+2\sqrt{5}}$$

Q1

(Total 4 marks)

Leave blank

2. Find

$$\int\left(10x^4 - 4x - \frac{3}{\sqrt{x}}\right)\mathrm{d}x$$

giving each term in its simplest form.

(4)

2) $\int\left(10x^4 - 4x - \frac{3}{\sqrt{x}}\right) dx$

$\int 10x^4 - 4x - 3x^{-\frac{1}{2}} \, dx$

$\frac{10x^5}{5} - \frac{4x^2}{2} - \frac{3x^{\frac{1}{2}}}{1/2} + C$

$\underline{2x^5 - 2x^2 - 6x^{\frac{1}{2}} + C}$

Q2

(Total 4 marks)

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3. (a) Find the value of $8^{\frac{5}{3}}$

(2)

(b) Simplify fully $\dfrac{\left(2x^{\frac{1}{2}}\right)^3}{4x^2}$

(3)

3a) $8^{\frac{5}{3}} = 2^5 = \underline{\underline{32}}$

3b) $\dfrac{\left(2x^{\frac{1}{2}}\right)^3}{4x^2}$

$\dfrac{8x^{\frac{3}{2}}}{4x^2}$

$\underline{\underline{2x^{-\frac{1}{2}}}}$

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Question 3 continued

(Total 5 marks)

Q3

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

$$a_1 = 4$$
$$a_{n+1} = k(a_n + 2), \qquad \text{for } n \geqslant 1$$

where k is a constant.

(a) Find an expression for a_2 in terms of k.
(1)

Given that $\sum_{i=1}^{3} a_i = 2$,

(b) find the two possible values of k.
(6)

4a) $a_{n+1} = k(a_n + 2)$

$a_2 = k(a_1 + 2)$

$a_1 = 4$ $\quad a_2 = k(4+2)$

$\underline{a_2 = 6k}$

4b) $a_3 = k(a_2 + 2)$

$= k(6k+2)$

$= 6k^2 + 2k$

$\sum_{i=1}^{3} a_i = 2 \qquad \therefore \quad 4 + 6k + 6k^2 + 2k = 2$

$6k^2 + 8k + 4 = 2$

$6k^2 + 8k + 2 = 0$

$3k^2 + 4k + 1 = 0$

$(3k+1)(k+1) = 0$

$\underline{k = -1/3} \quad \underline{k = -1}$

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Question 4 continued

Q4

(Total 7 marks)

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5. Find the set of values of x for which

(a) $2(3x + 4) > 1 - x$

(2)

(b) $3x^2 + 8x - 3 < 0$

(4)

5a) $2(3x+4) > 1 - x$

$6x + 8 > 1 - x$

$7x + 8 > 1$

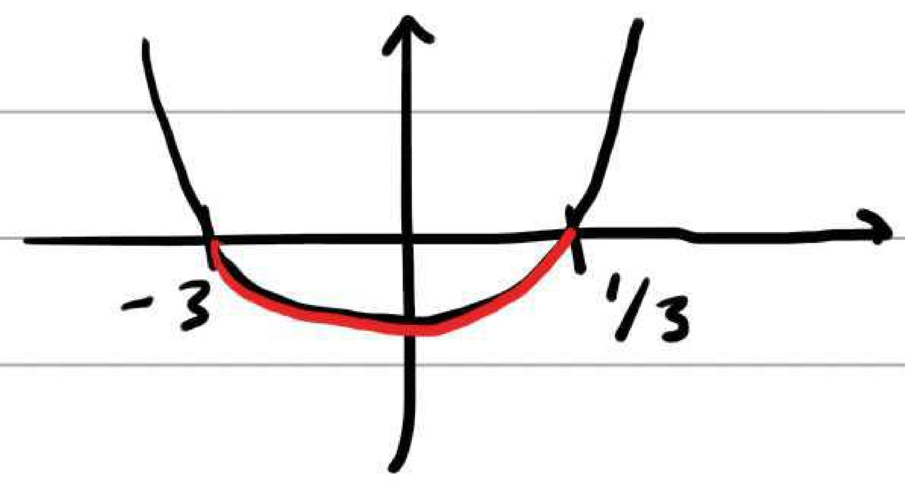
$7x > -7$

$\underline{\underline{x > -1}}$

5b) $3x^2 + 8x - 3 < 0$

$(3x-1)(x+3) < 0$

$f(x) = 0$ at $x = 1/3$ and $x = -3$



$\underline{\underline{-3 < x < 1/3}}$

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Question 5 continued

Q5

(Total 6 marks)

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6. The straight line L_1 passes through the points $(-1, 3)$ and $(11, 12)$.

(a) Find an equation for L_1 in the form $ax + by + c = 0$,

where a, b and c are integers.

(4)

The line L_2 has equation $3y + 4x - 30 = 0$.

(b) Find the coordinates of the point of intersection of L_1 and L_2.

(3)

6a) $(-1, 3)$ $(11, 12)$

x_1 y_1 x_2 y_2

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{12 - 3}{11 - -1} = \frac{9}{12} = \frac{3}{4}$$

$$y = \frac{3}{4}x + c$$

$(-1, 3)$ x y

$$3 = \frac{3}{4}(-1) + c$$
$$3 = -3/4 + c$$
$$3\,3/4 = c$$
$$c = \frac{15}{4}$$

$$y = \frac{3}{4}x + \frac{15}{4}$$
$$4y = 3x + 15$$
$$0 = 3x - 4y + 15$$

6b) $3x - 4y + 15 = 0$

$3y + 4x - 30 = 0$

$3x - 4y = -15$ $\times 4$

$4x + 3y = 30$ $\times 3$

$$12x - 16y = -60$$
$$12x + 9y = 90$$
$$-25y = -150$$
$$y = 6$$

P 4 1 8 0 2 A 0 1 0 2 8

Question 6 continued

$$4x + 3y = 30$$

$y = 6$ $\quad 4x + 3(6) = 30$

$$4x + 18 = 30$$

$$4x = 12$$

$$x = 3$$

The lines intersect at $(3, 6)$.

(Total 7 marks)

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Q6

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7. A company, which is making 200 mobile phones each week, plans to increase its production.

The number of mobile phones produced is to be increased by 20 each week from 200 in week 1 to 220 in week 2, to 240 in week 3 and so on, until it is producing 600 in week N.

(a) Find the value of N.

(2)

The company then plans to continue to make 600 mobile phones each week.

(b) Find the total number of mobile phones that will be made in the first 52 weeks starting from and including week 1.

(5)

7a) $a = 200 \quad d = 20$

$U_N = 600 \qquad U_n = a + (n-1)d$

$600 = 200 + (N-1)20$

$400 = (N-1)20$

$400 = 20N - 20$

$420 = 20N$

$N = 21$

7b) In the first 21 weeks:

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

$S_{21} = \frac{21}{2}(2(200) + 20(20))$

$= \frac{21}{2}(400 + 400)$

$= \frac{21}{2}(800)$

$= 21 \times 400$

$= 8400$

In the following 31 weeks: 31×600

$= 18600$

$$\begin{array}{r} 18600 \\ +\ 8400 \\ \hline 27000 \end{array}$$

27000 phones

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Question 7 continued

Q7

(Total 7 marks)

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8.

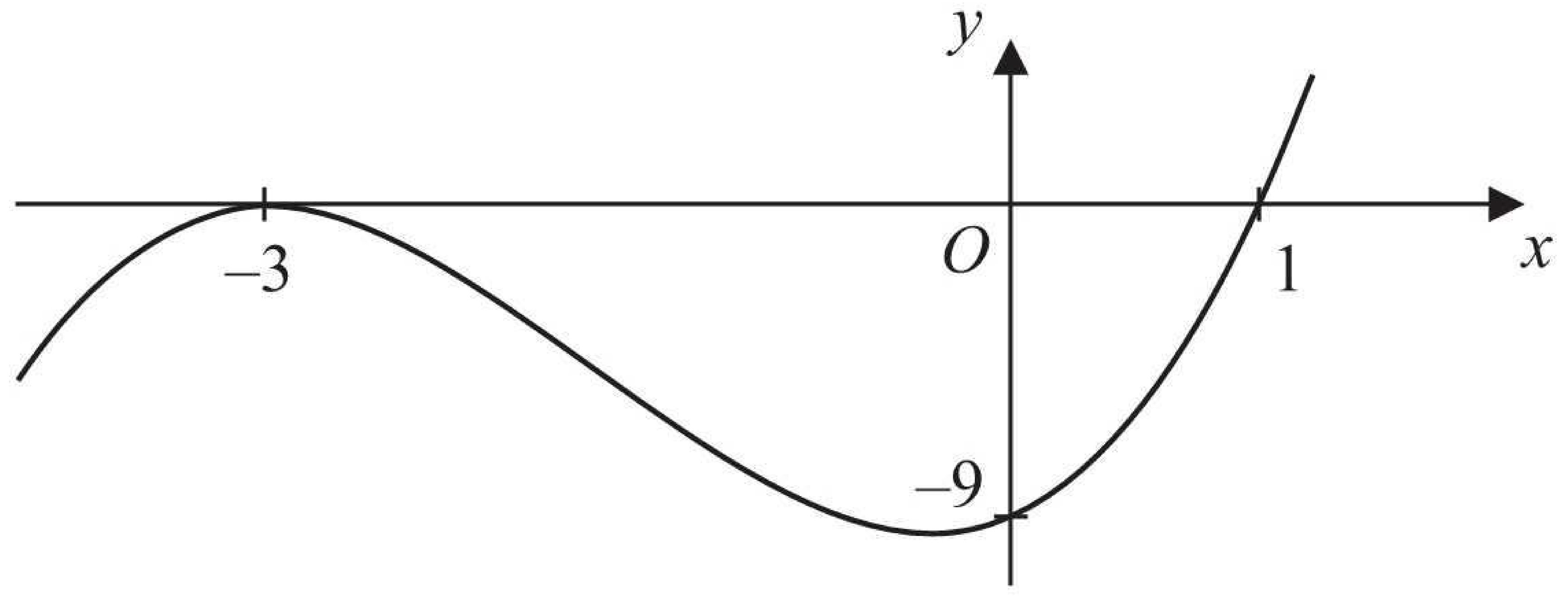


Figure 1

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

$$\mathrm{f}(x) = (x + 3)^2 (x - 1), \qquad x \in \mathbb{R}.$$

The curve crosses the x-axis at $(1, 0)$, touches it at $(-3, 0)$ and crosses the y-axis at $(0, -9)$

(a) In the space below, sketch the curve C with equation $y = \mathrm{f}(x + 2)$ and state the coordinates of the points where the curve C meets the x-axis.

(3)

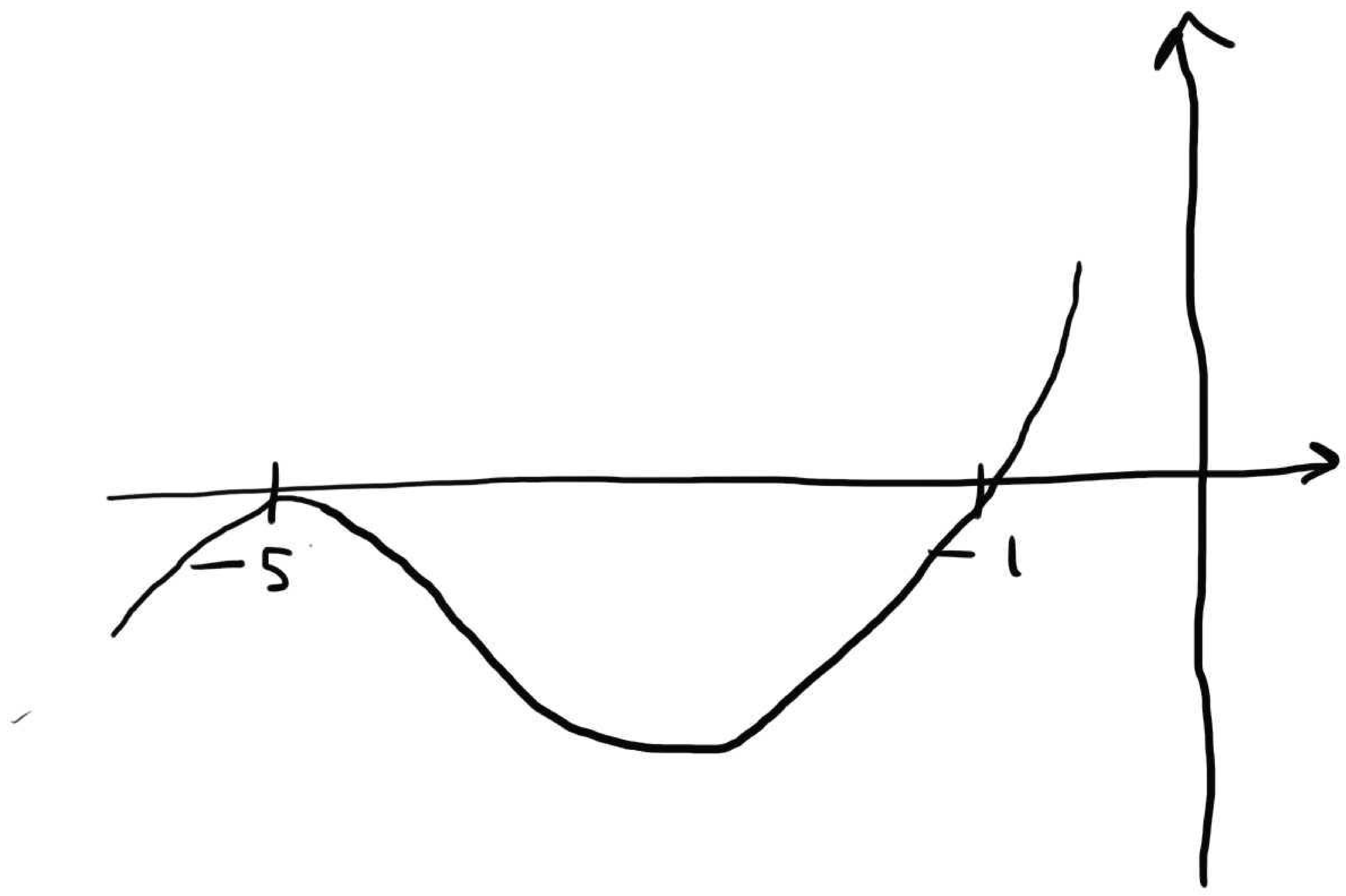
(b) Write down an equation of the curve C.

(1)

(c) Use your answer to part (b) to find the coordinates of the point where the curve C meets the y-axis.

(2)

8a)



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Question 8 continued

8b) $f(x) = (x+3)^2(x-1)$

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

$\underline{f(x+2) = (x+5)^2(x+1)}$

8c) curve crosses the y axis when $x=0$

$y = (5)^2(1)$

$y = \underline{25}$

$\underline{(0, 25)}$

Leave blank

Question 8 continued

Question 8 continued

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(Total 6 marks)

Q8

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9.

$$f'(x) = \frac{(3 - x^2)^2}{x^2}, \quad x \neq 0$$

(a) Show that $f'(x) = 9x^{-2} + A + Bx^2$,

where A and B are constants to be found.

(3)

(b) Find $f''(x)$.

(2)

Given that the point (–3, 10) lies on the curve with equation $y = f(x)$,

(c) find $f(x)$.

(5)

9a) $f'(x) = \frac{(3-x^2)^2}{x^2}$

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

$= \frac{9 - 3x^2 - 3x^2 + x^4}{x^2}$

$= \frac{9 - 6x^2 + x^4}{x^2}$

$= 9x^{-2} - 6 + x^2$

$A = -6 \quad B = 1$

9b) $f'(x) = 9x^{-2} - 6 + x^2$

$f''(x) = -18x^{-3} + 2x$

9c) $f'(x) = 9x^{-2} - 6 + x^2$

$f(x) = \frac{9x^{-1}}{-1} - 6x + \frac{x^3}{3} + c$

$y = -9x^{-1} - 6x + \frac{x^3}{3} + c$

$(\underset{x}{-3}, \underset{y}{10})$ $\quad 10 = -9(-3)^{-1} - 6(-3) + \frac{(-3)^3}{3} + c$

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Question 9 continued

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$$10 = \frac{-9}{-3} + 18 - \frac{27}{3} + c$$

$$10 = 3 + 18 - 9 + c$$

$$10 = 12 + c$$

$$c = -2$$

$$\therefore \quad f(x) = -9x^{-1} - 6x + \frac{x^3}{3} - 2$$

Q9

(Total 10 marks)

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10. Given the simultaneous equations

$$2x + y = 1$$
$$x^2 - 4ky + 5k = 0$$

where k is a non zero constant,

(a) show that

$$x^2 + 8kx + k = 0$$

(2)

Given that $x^2 + 8kx + k = 0$ has equal roots,

(b) find the value of k.

(3)

(c) For this value of k, find the solution of the simultaneous equations.

(3)

10a) $2x + y = 1$

$y = 1 - 2x$

$y = 1 - 2x$ $\quad x^2 - 4ky + 5k = 0$

$x^2 - 4k(1-2x) + 5k = 0$

$x^2 - 4k + 8kx + 5k = 0$

$x^2 + k + 8kx = 0$

$x^2 + 8kx + k = 0$

10b) equal roots means $b^2 - 4ac = 0$

$a = 1 \quad b = 8k \quad c = k$

$(8k)^2 - 4(1)(k) = 0$

$64k^2 - 4k = 0$

$4k(16k - 1) = 0$

$k = 0 \quad k = 1/16$

k is non-zero $\therefore k = 1/16$

10c) $x^2 + 8kx + k = 0$

$k = \frac{1}{16}$ $\quad x^2 + 8(1/16)x + 1/16 = 0$

$16x^2 + 8x + 1 = 0$

$(4x+1)(4x+1) = 0$

Question 10 continued

$x = -\frac{1}{4}$

$y = 1 - 2x$

$x = -\frac{1}{4}$ $\quad y = 1 - 2(-\frac{1}{4})$

$y = 1 + \frac{1}{2}$

$y = \frac{3}{2}$

$\underline{x = -\frac{1}{4} \quad , \quad y = \frac{3}{2}}$

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Question 10 continued

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Question 10 continued

(Total 8 marks)

Q10

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11.

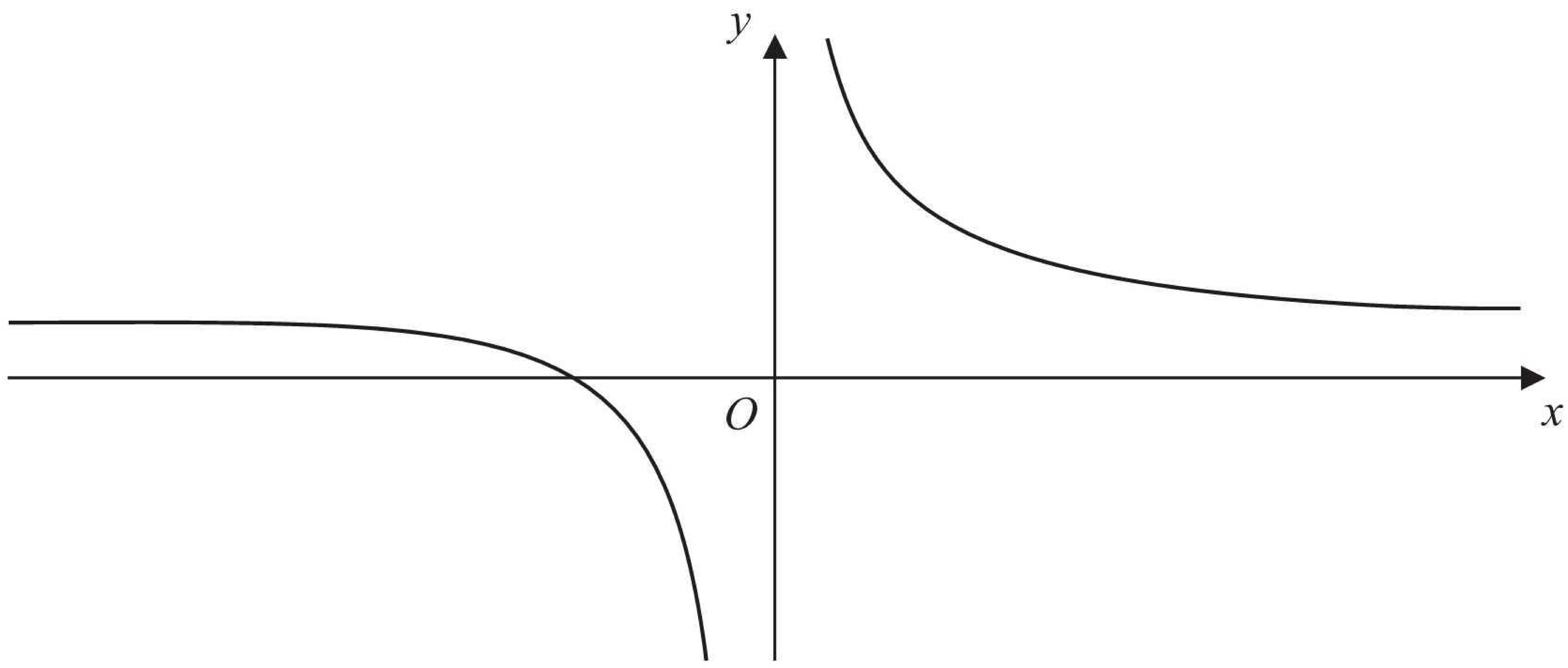

Figure 2

Figure 2 shows a sketch of the curve H with equation $y = \frac{3}{x} + 4, \; x \neq 0$.

(a) Give the coordinates of the point where H crosses the x-axis.
(1)

(b) Give the equations of the asymptotes to H.
(2)

(c) Find an equation for the normal to H at the point $P(-3, 3)$.
(5)

This normal crosses the x-axis at A and the y-axis at B.

(d) Find the length of the line segment AB. Give your answer as a surd.
(3)

11a) $y = \frac{3}{x} + 4$

crosses x axis when $y = 0$

$0 = \frac{3}{x} + 4$

$-4 = 3/x$

$x = -3/4$

11b) $x = 0$ $\quad y = 4$

11c) $y = 3x^{-1} + 4$

$\frac{dy}{dx} = -3x^{-2}$

$(-3, 3)$ when $x = -3$ $\quad \frac{dy}{dx} = -3(-3)^{-2} = \frac{-3}{9} = -\frac{1}{3}$

P 4 1 8 0 2 A 0 2 4 2 8

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Question 11 continued

$m = 3 \qquad (-3, 3)$

$\qquad\qquad\qquad\; x \;\; y$

$y = 3x + c$

$3 = 3(-3) + c$

$3 = -9 + c$

$c = 12$

Equation of normal : $\underline{\underline{y = 3x + 12}}$

11d) A/ crosses x axis when $y = 0$

$0 = 3x + 12$

$-12 = 3x$

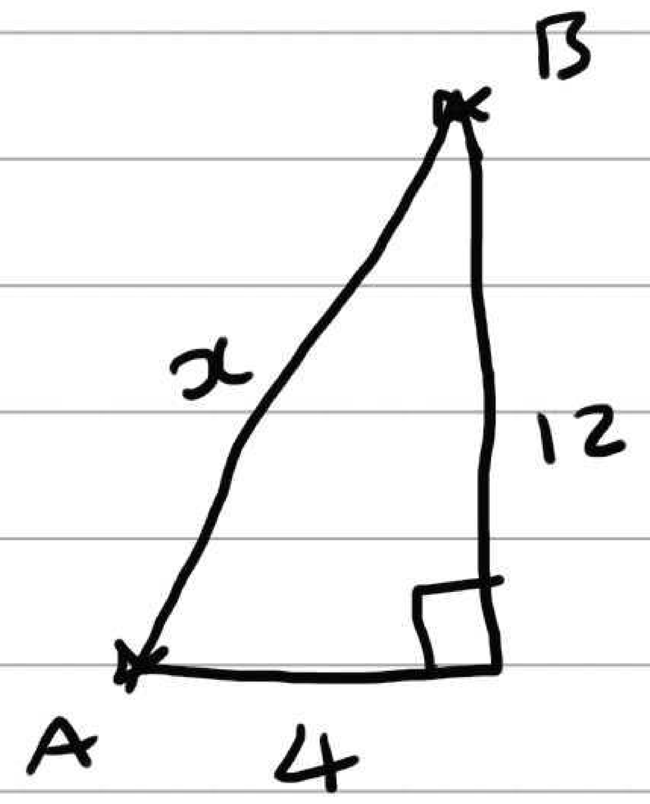
$-4 = x$

$(-4, 0)$

B/ crosses y axis when $x = 0$

$y = 12$

$(0, 12)$



Length of line segment.

$\sqrt{4^2 + 12^2}$

$\sqrt{16 + 144}$

$\sqrt{160}$

$\sqrt{16 \times 10}$

$\underline{\underline{4\sqrt{10}}}$

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Question 11 continued

Leave blank

Question 11 continued

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Question 11 continued

Q11

(Total 11 marks)

TOTAL FOR PAPER: 75 MARKS

END