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 14 January 2013 – 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 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 32 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. Factorise completely $x - 4x^3$

(3)

1) $x - 4x^3$

$x(1 - 4x^2)$

$\underline{x(1+2x)(1-2x)}$

Q1

(Total 3 marks)

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2. Express 8^{2x+3} in the form 2^y, stating y in terms of x.

(2)

2) 8^{2x+3}

$2^{3(2x+3)}$

2^{6x+9}

$y = 6x + 9$

Q2

(Total 2 marks)

P 4 1 4 8 8 A 0 3 3 2

3. (i) Express

$$\left(5-\sqrt{8}\right)\left(1+\sqrt{2}\right)$$

in the form $a + b\sqrt{2}$, where a and b are integers.

(3)

(ii) Express

$$\sqrt{80} + \frac{30}{\sqrt{5}}$$

in the form $c\sqrt{5}$, where c is an integer.

(3)

3 i) $(5-\sqrt{8})(1+\sqrt{2})$

$5+5\sqrt{2}-\sqrt{8}-\sqrt{16}$

$5+5\sqrt{2}-\sqrt{8}-4$

$1+5\sqrt{2}-\sqrt{8}$

$\sqrt{8}=2\sqrt{2}$ $\quad 1+5\sqrt{2}-2\sqrt{2}$

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

ii) $\sqrt{80} + \frac{30}{\sqrt{5}}$

$\sqrt{16}\sqrt{5} + \frac{30}{\sqrt{5}}$

$4\sqrt{5} + \frac{30}{\sqrt{5}}$

$4\sqrt{5} + \frac{30\sqrt{5}}{5}$

$4\sqrt{5} + 6\sqrt{5}$

$\underline{\underline{10\sqrt{5}}}$

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Question 3 continued

Q3

(Total 6 marks)

P 4 1 4 8 8 A 0 5 3 2

Turn over

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4. A sequence $u_1, u_2, u_3, \ldots$ satisfies

$$u_{n+1} = 2u_n - 1, \quad n \geqslant 1$$

Given that $u_2 = 9$,

(a) find the value of u_3 and the value of u_4,

(2)

(b) evaluate $\sum_{r=1}^{4} u_r$.

(3)

4) $U_{n+1} = 2U_n - 1$

$U_3 = 2U_2 - 1$

$U_3 = 2(9) - 1$

$\underline{U_3 = 17}$

$U_4 = 2U_3 - 1$

$U_4 = 2(17) - 1$

$\underline{U_4 = 33}$

b) $U_{n+1} = 2U_n - 1$

$U_2 = 2U_1 - 1$

$9 = 2U_1 - 1$

$10 = 2U_1$

$U_1 = 5$

$\sum_{r=1}^{4} U_r = 5 + 9 + 17 + 33$

$= \underline{64}$

P 4 1 4 8 8 A 0 6 3 2

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Question 4 continued

Q4

(Total 5 marks)

P 4 1 4 8 8 A 0 7 3 2

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5. The line l_1 has equation $y = -2x + 3$

The line l_2 is perpendicular to l_1 and passes through the point (5, 6).

(a) Find an equation for l_2 in the form $ax + by + c = 0$, where a, b and c are integers.
(3)

The line l_2 crosses the x-axis at the point A and the y-axis at the point B.

(b) Find the x-coordinate of A and the y-coordinate of B.
(2)

Given that O is the origin,

(c) find the area of the triangle OAB.
(2)

5a) l_1: $y = -2x + 3$

gradient of l_1 = -2

perp. gradient = $1/2$

l_2: $m = \frac{1}{2}$ $\quad (5, 6)$ $\quad x \; y$

$y = mx + c$

$6 = \frac{1}{2}(5) + c$

$6 = \frac{5}{2} + c$

$6 = \frac{12}{2}$ $\quad \frac{7}{2} = c$

$y = \frac{1}{2}x + \frac{7}{2}$

$2y = x + 7$

$\underline{\underline{0 = x - 2y + 7}}$

b) crosses x when $y = 0$

$0 = x + 7$

$x = -7$

crosses y when $x = 0$

$0 = -2y + 7$

$-7 = -2y$

$y = 7/2$

x coordinate of A is -7

y coordinate of B is $7/2$

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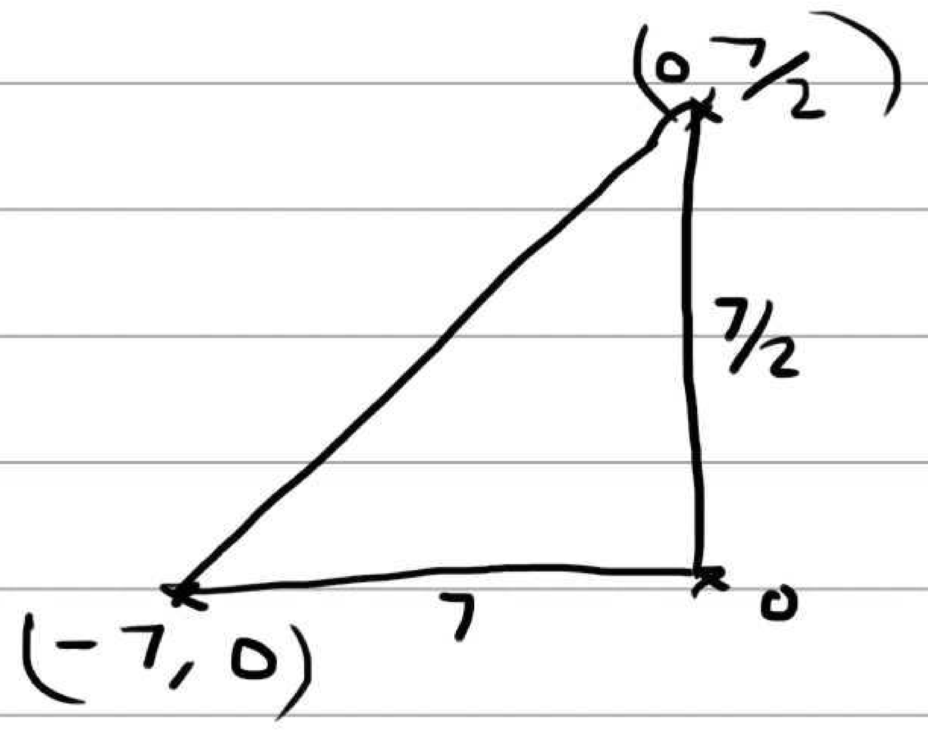
Question 5 continued

c)



Area of triangle $= \frac{1}{2} \times 7 \times \frac{7}{2}$

$= \frac{49}{4}$ units^2

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Question 5 continued

Leave blank

Question 5 continued

(Total 7 marks)

Q5

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6.

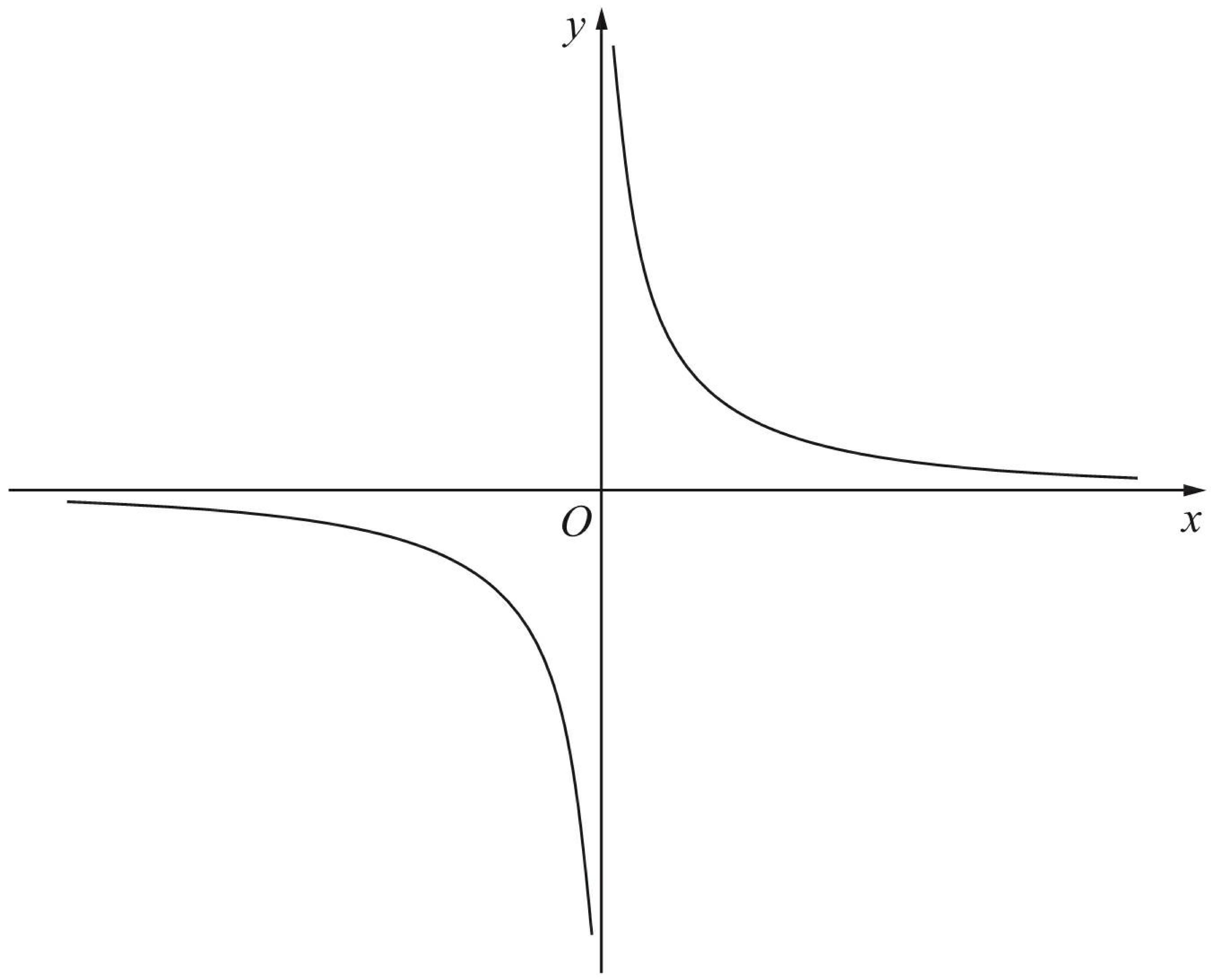

Figure 1

Figure 1 shows a sketch of the curve with equation $y = \frac{2}{x}, \quad x \neq 0$

The curve C has equation $y = \frac{2}{x} - 5, \quad x \neq 0$, and the line l has equation $y = 4x + 2$

(a) Sketch and clearly label the graphs of C and l on a single diagram.

On your diagram, show clearly the coordinates of the points where C and l cross the coordinate axes.

(5)

(b) Write down the equations of the asymptotes of the curve C.

(2)

(c) Find the coordinates of the points of intersection of $y = \frac{2}{x} - 5$ and $y = 4x + 2$

(5)

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Question 6 continued

l crosses x when $y=0$

$0 = 4x+2$

$-2 = 4x$

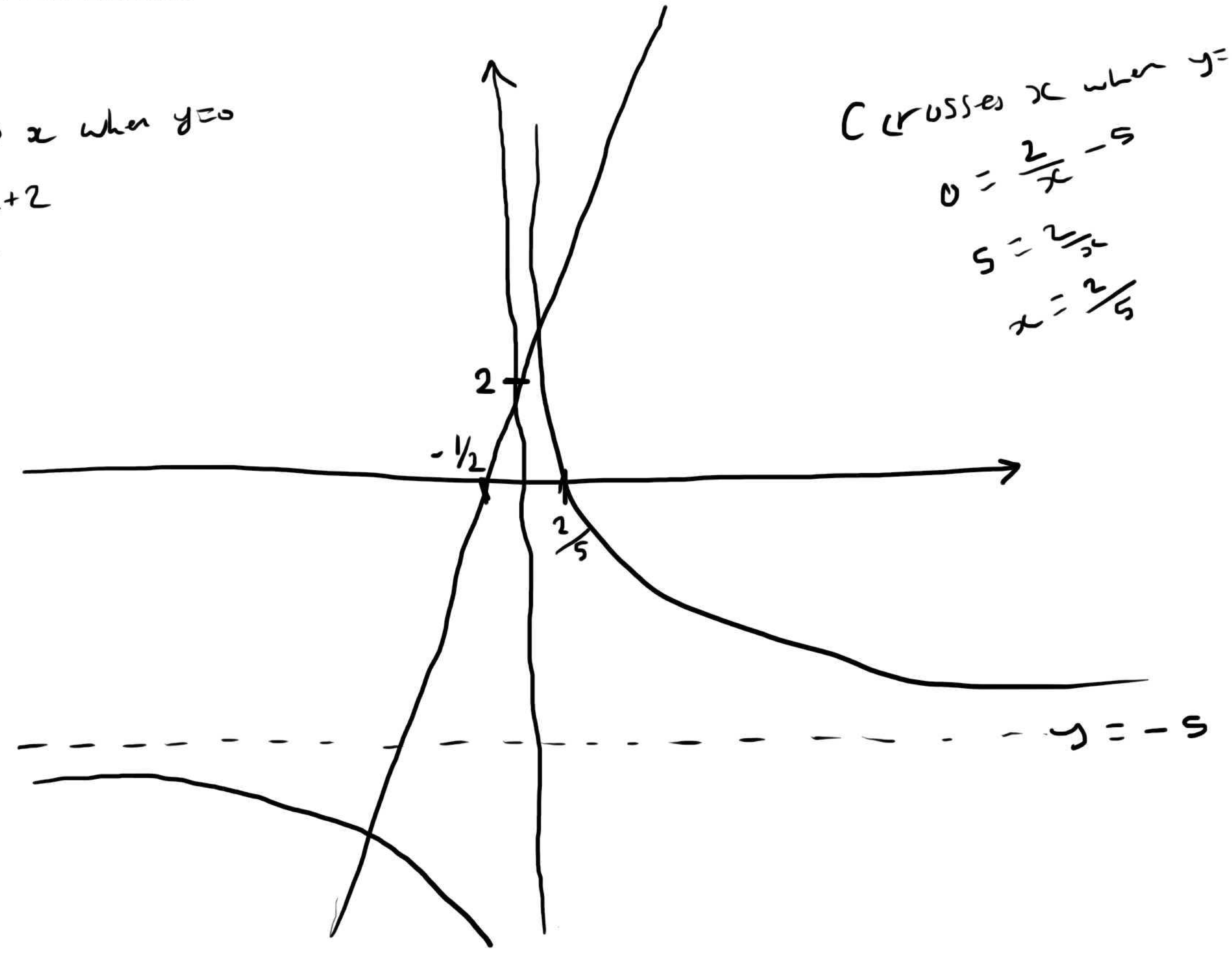
$-\frac{1}{2} = x$

C crosses x when $y=0$

$0 = \frac{2}{x} - 5$

$5 = 2/x$

$x = 2/5$



b) asymptotes at $y=-5$ and $x=0$

c) $y = 4x+2$

$y = \frac{2}{x} - 5$

$4x+2 = \frac{2}{x} - 5$

$4x^2 + 2x = 2 - 5x$

$4x^2 + 7x - 2 = 0$

$(4x-1)(x+2) = 0$

$x = 1/4 \quad x = -2$

Turn over

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Question 6 continued

$y = 4x + 2$

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

when $x = 1/4$ $\quad y = 4(\frac{1}{4}) + 2$

$= 3$

$(1/4, 3)$

when $x = -2$ $\quad y = 4(-2) + 2$

$y = -8 + 2$

$= -6$

$(-2, -6)$

Intersections at $\underline{\underline{(1/4, 3)}}$ and $\underline{\underline{(-2, -6)}}$

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Question 6 continued

(Total 12 marks)

Q6

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7. Lewis played a game of space invaders. He scored points for each spaceship that he captured.

Lewis scored 140 points for capturing his first spaceship.

He scored 160 points for capturing his second spaceship, 180 points for capturing his third spaceship, and so on.

The number of points scored for capturing each successive spaceship formed an arithmetic sequence.

(a) Find the number of points that Lewis scored for capturing his 20th spaceship.

(2)

(b) Find the total number of points Lewis scored for capturing his first 20 spaceships.

(3)

Sian played an adventure game. She scored points for each dragon that she captured. The number of points that Sian scored for capturing each successive dragon formed an arithmetic sequence.

Sian captured *n* dragons and the total number of points that she scored for capturing all *n* dragons was 8500.

Given that Sian scored 300 points for capturing her first dragon and then 700 points for capturing her *n*th dragon,

(c) find the value of *n*.

(3)

7a) $a = 140 \quad d = 20$

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

$U_{20} = 140 + 19(20)$

$= 140 + 380$

$= \underline{\underline{520}}$

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

$S_{20} = \frac{20}{2}(2(140) + 19(20))$

$= 10(280 + 380)$

$= 10(660)$

$= \underline{\underline{6600}}$

c) $S_n = 8500 \quad a = 300 \quad U_n = 700$

Leave blank

Question 7 continued

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

$8500 = \frac{n}{2}(2(300) + (n-1)d)$

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

$700 = 300 + (n-1)d$

$400 = (n-1)d$

$d = \left(\frac{400}{n-1}\right)$

sub into S_n ...

$8500 = \frac{n}{2}\left(600 + \cancel{(n-1)}\left(\frac{400}{\cancel{n-1}}\right)\right)$

$8500 = \frac{n}{2}(600 + 400)$

$8500 = \frac{n}{2}(1000)$

$8.5 = n/2$

$\underline{17 = n}$

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Question 7 continued

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Question 7 continued

Q7

(Total 8 marks)

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8. $$\frac{dy}{dx} = -x^3 + \frac{4x-5}{2x^3}, \qquad x \neq 0$$

Given that $y = 7$ at $x = 1$, find y in terms of x, giving each term in its simplest form.

(6)

8) $\frac{dy}{dx} = -x^3 + \frac{4x-5}{2x^3}$

$= -x^3 + 2x^{-2} - \frac{5}{2}x^{-3}$

$y = \frac{-x^4}{4} + \frac{2x^{-1}}{-1} - \frac{\frac{5}{2}x^{-2}}{-2} + c$

$y = -\frac{1}{4}x^4 - 2x^{-1} + \frac{5}{4}x^{-2} + c$

$(1,7)$ $7 = -\frac{1}{4}(1)^4 - 2(1)^{-1} + \frac{5}{4}(1)^{-2} + c$

$7 = -\frac{1}{4} - 2 + \frac{5}{4} + c$

$7 = -1 + c$

$c = 8$

$\underline{\underline{y = -\frac{1}{4}x^4 - 2x^{-1} + \frac{5}{4}x^{-2} + 8}}$

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Question 8 continued

Q8

(Total 6 marks)

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9. The equation

$$(k+3)x^2 + 6x + k = 5, \text{ where } k \text{ is a constant,}$$

has two distinct real solutions for x.

(a) Show that k satisfies

$$k^2 - 2k - 24 < 0$$

(4)

(b) Hence find the set of possible values of k.

(3)

9a) Two real solutions $\therefore$ $b^2 - 4ac > 0$

$a = (k+3)$

$b = 6$

$c = k - 5$

$(6)^2 - 4(k+3)(k-5) > 0$

$36 - 4(k^2 - 5k + 3k - 15) > 0$

$36 - 4(k^2 - 2k - 15) > 0$

$36 - 4k^2 + 8k + 60 > 0$

$-4k^2 + 8k + 96 > 0$

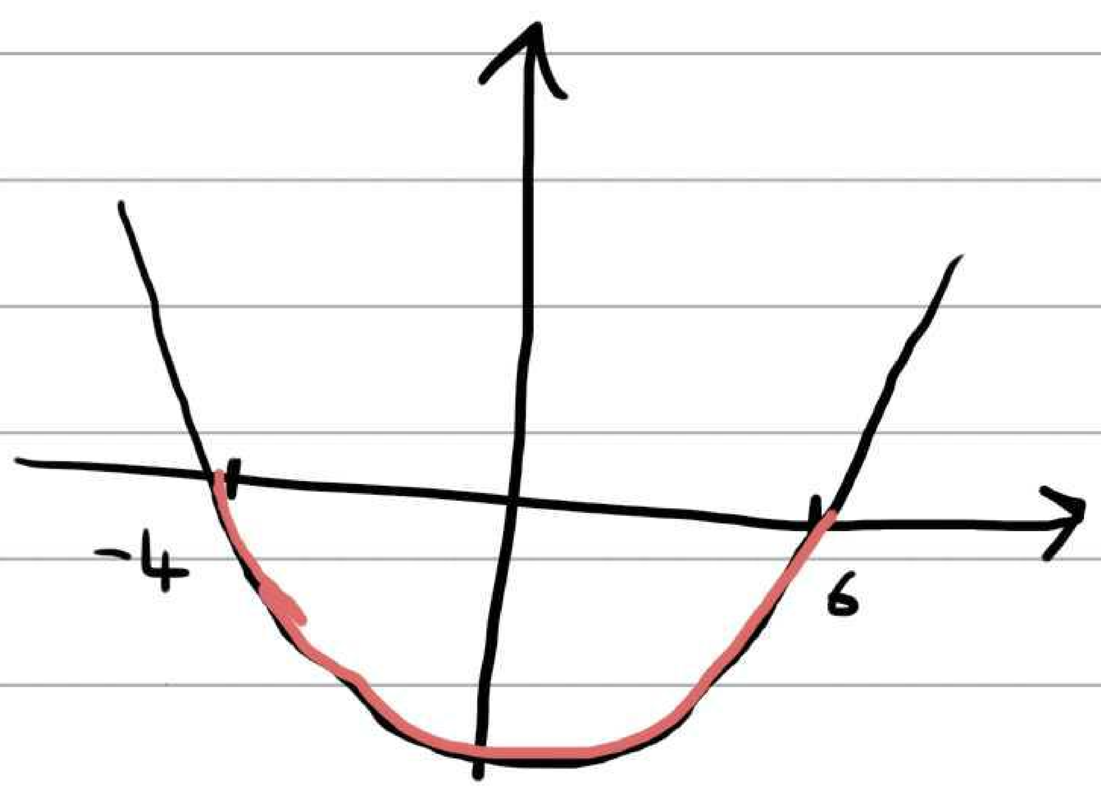
$-k^2 + 2k + 24 > 0$

$0 > k^2 - 2k - 24$

$\underline{k^2 - 2k - 24 < 0}$

b) $k^2 - 2k - 24 < 0$

$(k-6)(k+4) < 0$



$\underline{-4 < k < 6}$

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Question 9 continued

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Question 9 continued

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Question 9 continued

Q9

(Total 7 marks)

P 4 1 4 8 8 A 0 2 5 3 2

Turn over

10. $$4x^2 + 8x + 3 \equiv a(x+b)^2 + c$$

(a) Find the values of the constants a, b and c.

(3)

(b) On the axes on page 27, sketch the curve with equation $y = 4x^2 + 8x + 3$, showing clearly the coordinates of any points where the curve crosses the coordinate axes.

(4)

10a) $4x^2 + 8x + 3$

$4(x^2 + 2x) + 3$

$4((x+1)^2 - 1) + 3$

$4(x+1)^2 - 4 + 3$

$\underline{4(x+1)^2 - 1}$

$a = 4 \quad b = 1 \quad c = -1$

10b) $y = 4x^2 + 8x + 3$

crosses x when $y = 0$

$0 = 4x^2 + 8x + 3$

$0 = (2x+1)(2x+3)$

$x = -1/2 \quad x = -3/2$

crosses y when $x = 0$

$y = 3$

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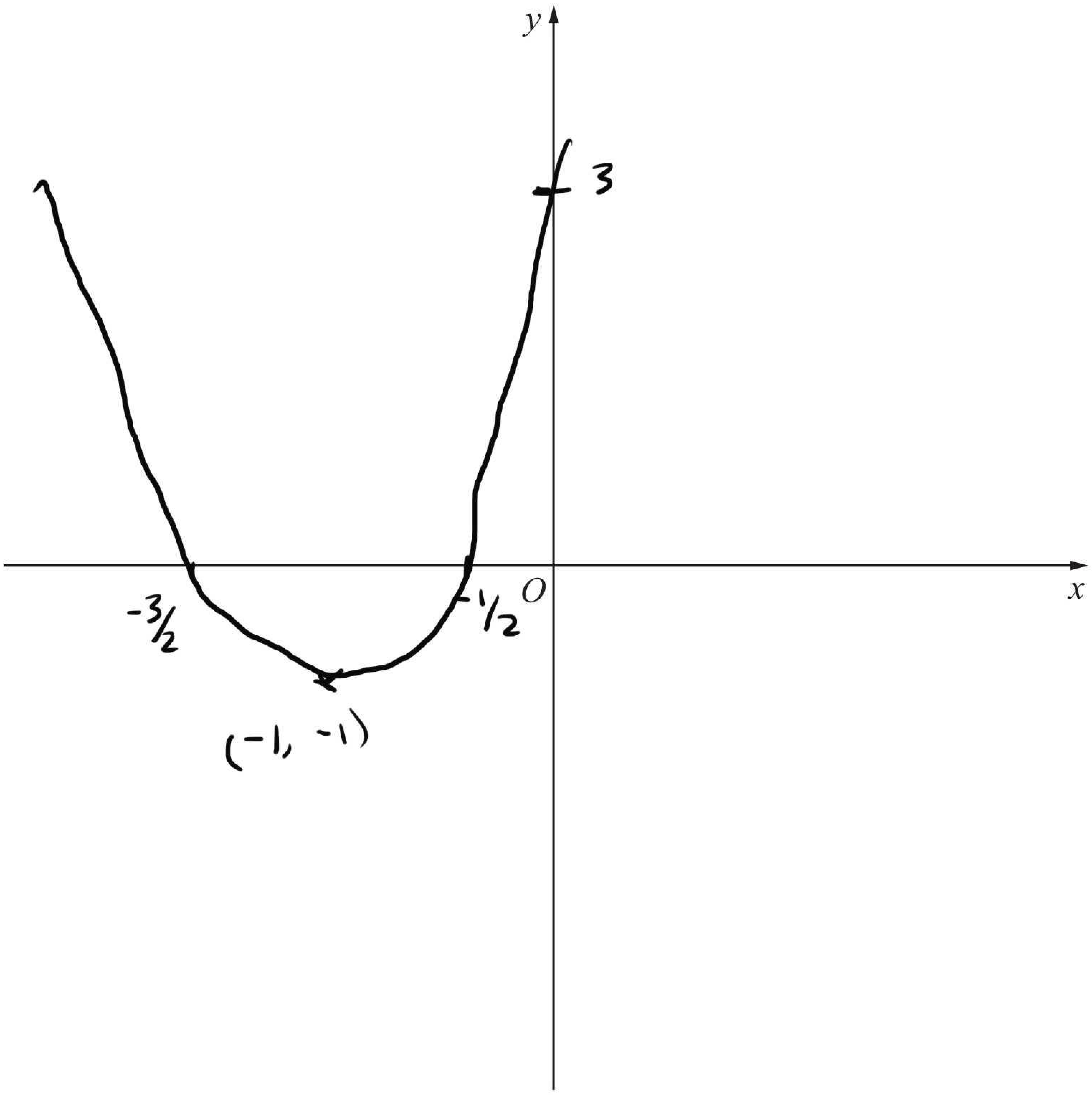
Question 10 continued



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Question 10 continued

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Question 10 continued

Q10

(Total 7 marks)

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11. The curve C has equation

$$y = 2x - 8\sqrt{x} + 5, \quad x \geqslant 0$$

(a) Find $\frac{dy}{dx}$, giving each term in its simplest form.

(3)

The point P on C has x-coordinate equal to $\frac{1}{4}$

(b) Find the equation of the tangent to C at the point P, giving your answer in the form $y = ax + b$, where a and b are constants.

(4)

The tangent to C at the point Q is parallel to the line with equation $2x - 3y + 18 = 0$

(c) Find the coordinates of Q.

(5)

a) $y = 2x - 8x^{1/2} + 5$

$\frac{dy}{dx} = 2 - 4x^{-1/2}$

b) $x = \frac{1}{4}$

$\frac{dy}{dx} = 2 - 4x^{-1/2}$

$x = 1/4$ $\quad = 2 - 4(1/4)^{-1/2}$

$= 2 - 8$

$= -6$

$y = 2x - 8x^{1/2} + 5$

$x = 1/4$ $\quad = 2(1/4) - 8(1/4)^{1/2} + 5$

$= 1/2 - 4 + 5$

$= 3/2$

$y = mx + c$

$3/2 = -6(1/4) + c$

$3/2 = -6/4 + c$

$3/2 = -3/2 + c$

$c = 3$

$\underline{y = -6x + 3}$

Leave blank

Question 11 continued

parallel to $2x - 3y + 18 = 0$

$2x + 18 = 3y$

$y = 2/3x + 6$

$m = 2/3$

$\frac{dy}{dx} = 2/3$

$2 - 4x^{-1/2} = 2/3$

$2 = 2/3 + 4x^{-1/2}$

$4/3 = 4x^{-1/2}$

$1/3 = x^{-1/2}$

$\frac{1}{3} = \frac{1}{\sqrt{x}}$

$\sqrt{x} = 3$

$x = 9$

$y = 2x - 8\sqrt{x} + 5$

$x = 9$ $\quad y = 2(9) - 8\sqrt{9} + 5$

$= 18 - 24 + 5$

$= -1$

$\underline{\underline{(9, -1)}}$

Leave blank

Question 11 continued

Q11

(Total 12 marks)

TOTAL FOR PAPER: 75 MARKS

END