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

Friday 13 January 2012 – 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 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 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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PEARSON

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1. Given that $y = x^4 + 6x^{\frac{1}{2}}$, find in their simplest form

(a) $\dfrac{dy}{dx}$

(3)

(b) $\int y \, dx$

(3)

a/ $\dfrac{dy}{dx} = \underline{4x^3 + 3x^{-1/2}}$

b/ $\int y \, dx = \dfrac{x^5}{5} + \dfrac{6x^{3/2}}{3/2} + c$

$= \underline{\frac{1}{5}x^5 + 4x^{3/2} + c}$

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2. (a) Simplify

$$\sqrt{32}+\sqrt{18}$$

giving your answer in the form $a\sqrt{2}$, where a is an integer.

(2)

(b) Simplify

$$\frac{\sqrt{32}+\sqrt{18}}{3+\sqrt{2}}$$

giving your answer in the form $b\sqrt{2}+c$, where b and c are integers.

(4)

a) $\sqrt{16}\sqrt{2} + \sqrt{9}\sqrt{2}$

$4\sqrt{2} + 3\sqrt{2}$

$7\sqrt{2}$

b) $\frac{7\sqrt{2}\,(3-\sqrt{2})}{(3+\sqrt{2})(3-\sqrt{2})}$

$\frac{21\sqrt{2} - 14}{7}$

$3\sqrt{2} - 2$

Leave blank

3. Find the set of values of x for which

(a) $4x - 5 > 15 - x$ **(2)**

(b) $x(x-4) > 12$ **(4)**

a) $4x - 5 > 15 - x$

$5x - 5 > 15$

$5x > 20$

$x > 4$

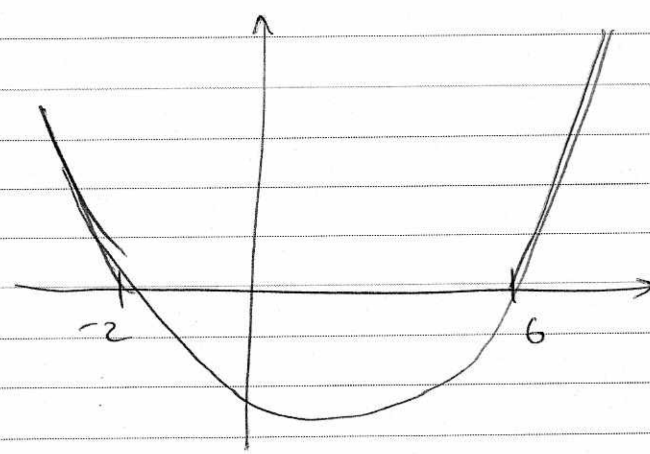
b) $x(x-4) > 12$

$x^2 - 4x > 12$

$x^2 - 4x - 12 > 0$

$(x-6)(x+2) > 0$

$x = 6 \quad x = -2$



$x < -2$ or $x > 6$

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4. A sequence $x_1, x_2, x_3, \ldots$ is defined by

$$x_1 = 1$$

$$x_{n+1} = ax_n + 5, \qquad n \geqslant 1$$

where a is a constant.

(a) Write down an expression for x_2 in terms of a.

(1)

(b) Show that $x_3 = a^2 + 5a + 5$

(2)

Given that $x_3 = 41$

(c) find the possible values of a.

(3)

a) $x_2 = a(x_1) + 5$

$x_1 = 1$ $\quad = a(1) + 5$

$= a + 5$

b) $x_3 = a(x_2) + 5$

$= a(a+5) + 5$

$= a^2 + 5a + 5$

c) $a^2 + 5a + 5 = 41$

$a^2 + 5a - 36 = 0$

$(a+9)(a-4) = 0$

$a = -9 \quad a = 4$

Leave blank

5. The curve C has equation $y = x(5-x)$ and the line L has equation $2y = 5x + 4$

$2y = 2x(5-x)$ $\quad\quad$ $y = \frac{5}{2}x + 2$

(a) Use algebra to show that C and L do not intersect.

(4)

(b) In the space on page 11, sketch C and L on the same diagram, showing the coordinates of the points at which C and L meet the axes.

(4)

a) $2x(5-x) = 5x+4$

$10x - 2x^2 = 5x + 4$

$10x = 2x^2 + 5x + 4$

$0 = 2x^2 - 5x + 4$

no solutions $\therefore$ $b^2 - 4ac$ will be negative

$a = 2 \quad b = -5 \quad c = 4$

$(-5)^2 - 4(2)(4)$

$25 - 32$

$\underline{\underline{-7}}$

b) $2y = 5x + 4$ crosses x when $y = 0$

$0 = 5x + 4$

$-4 = 5x$

$x = -4/5$

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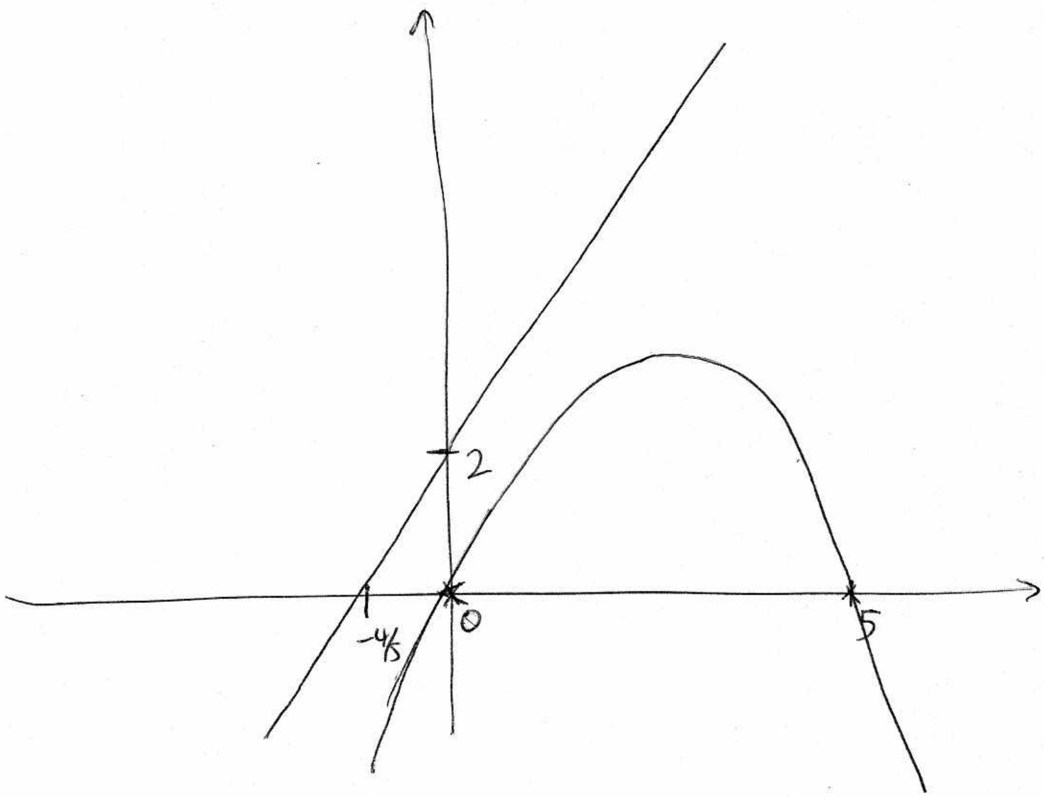
Question 5 continued



Q5

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6.

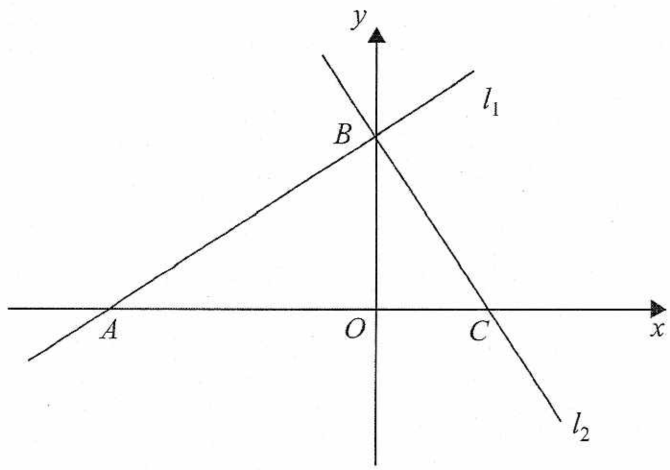

Figure 1

The line l_1 has equation $2x - 3y + 12 = 0$

(a) Find the gradient of l_1.

(1)

The line l_1 crosses the x-axis at the point A and the y-axis at the point B, as shown in Figure 1.

The line l_2 is perpendicular to l_1 and passes through B.

(b) Find an equation of l_2.

(3)

The line l_2 crosses the x-axis at the point C.

(c) Find the area of triangle ABC.

(4)

a) $2x - 3y + 12 = 0$

$2x + 12 = 3y$

$\frac{2}{3}x + 4 = y$

$\underline{m = 2/3}$

b/ perpendicular gradient $= -3/2$

crosses y when $x = 0$ $\quad y = 4$ $\quad \underline{(0,4)}$

Leave blank

Question 6 continued

$y = -\frac{3}{2}x + C$

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

c/ B: $(0,4)$

A: $2x - 3y + 12 = 0$

crosses x when $y=0$

$2x - 3(0) + 12 = 0$

$2x + 12 = 0$

$2x = -12$

$x = -6$

A: $(-6,0)$

C: $y = -\frac{3}{2}x + 4$

$0 = -\frac{3}{2}x + 4$

$-4 = -\frac{3}{2}x$

$-8 = -3x$

$x = 8/3$

C: $(8/3, 0)$

Area of triangle = ½ base x height

base = $6 + \frac{8}{3}$

$= \frac{18}{3} + \frac{8}{3} = \frac{26}{3}$

Area $= \frac{1}{2} \cdot \frac{26}{3} \cdot \cancel{6}\ 4$

$= 2 \times \frac{26}{3}$

$= \frac{52}{3}$ units^2

Leave blank

7. A curve with equation $y = f(x)$ passes through the point (2, 10). Given that

$$f'(x) = 3x^2 - 3x + 5$$

$\frac{dy}{dx}$

find the value of $f(1)$.

(5)

$f(x) = \frac{3x^3}{3} - \frac{3x^2}{2} + 5x + c$

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

(2, 10) $\quad 10 = (2)^3 - \frac{3}{2}(2)^2 + 5(2) + c$

$10 = 8 - \frac{3}{2}(4) + 10 + c$

$10 = 8 - 6 + 10 + c$

$10 = 12 + c$

$c = -2$

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

$f(1) = (1)^3 - \frac{3}{2}(1)^2 + 5(1) - 2$

$= 1 - \frac{3}{2} + 5 - 2$

$= 4 - \frac{3}{2}$

$= \frac{8}{2} - \frac{3}{2}$

$= \frac{5}{2}$

Leave blank

8. The curve C_1 has equation

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

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

(2)

(b) Sketch C_1, showing the coordinates of the points where C_1 meets the x-axis.

(3)

(c) Find the gradient of C_1 at each point where C_1 meets the x-axis.

(2)

The curve C_2 has equation

$$y = (x-k)^2(x-k+2)$$

where k is a constant and $k > 2$

(d) Sketch C_2, showing the coordinates of the points where C_2 meets the x and y axes.

(3)

a) $y = x^2(x+2)$

$y = x^3 + 2x^2$

$\frac{dy}{dx} = 3x^2 + 4x$

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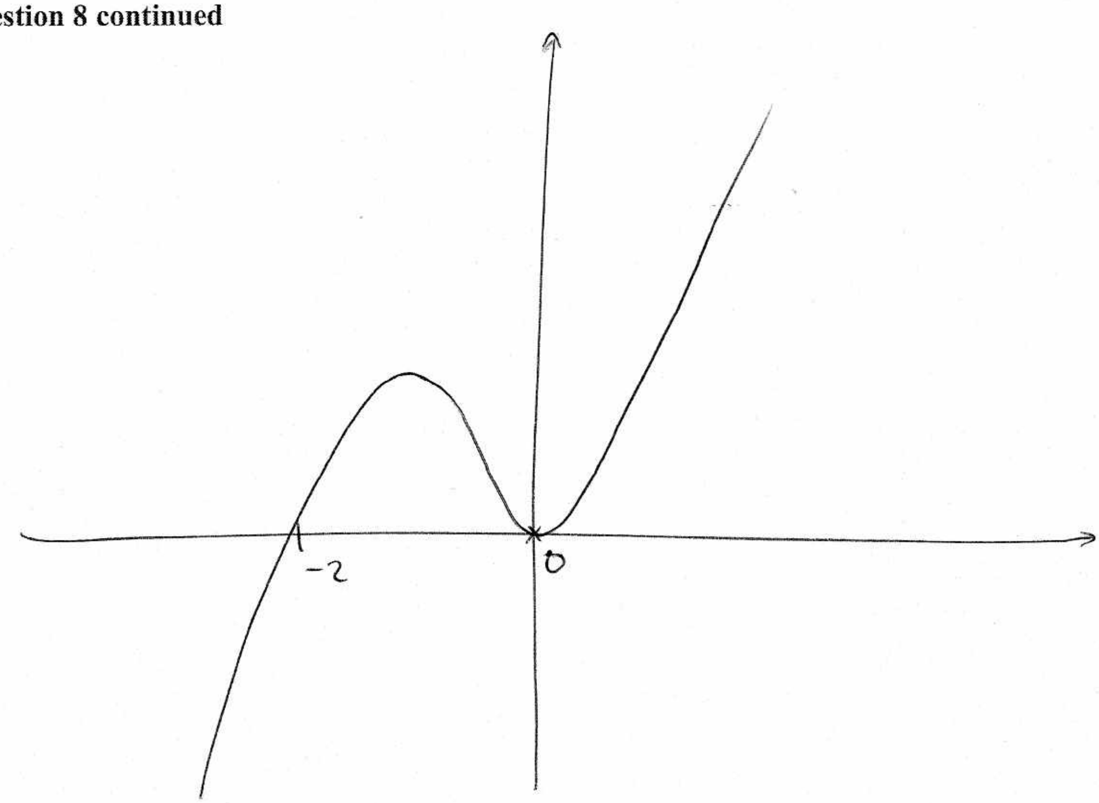
Question 8 continued



c/ $\frac{dy}{dx} = \cancel{x^3 + 2x^2}\ 3x^2 + 4x$

when $x = -2$

$\cancel{\frac{dy}{dx} = (-2)^3 + 2(-2)^2}$

$\cancel{= -8 +}$

$\frac{dy}{dx} = 3(-2)^2 + 4(-2)$

$= 12 - 8$

$= \underline{\underline{4}}$

when $x = 0$ $\quad \frac{dy}{dx} = \underline{\underline{0}}$

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Question 8 continued

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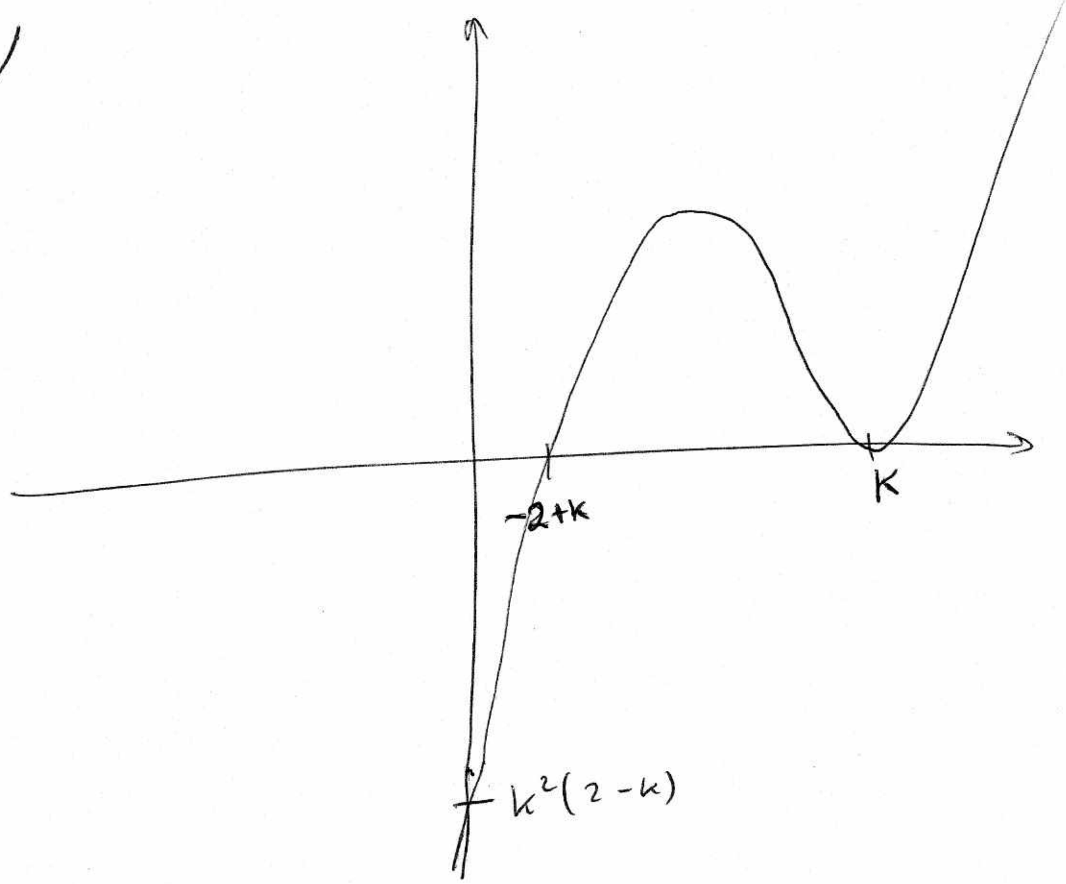
d)



crosses y when $x=0$

$y = (k)^2(-k+2)$

$= k^2(2-k)$

Q8

(Total 10 marks)

Leave blank

9. A company offers two salary schemes for a 10-year period, Year 1 to Year 10 inclusive.

Scheme 1: Salary in Year 1 is £P.
Salary increases by £$(2T)$ each year, forming an arithmetic sequence.

Scheme 2: Salary in Year 1 is £$(P + 1800)$.
Salary increases by £T each year, forming an arithmetic sequence.

(a) Show that the **total** earned under Salary Scheme 1 for the 10-year period is

$$£(10P + 90T)$$

(2)

For the 10-year period, the **total** earned is the same for both salary schemes.

(b) Find the value of T.

(4)

For this value of T, the salary in Year 10 under Salary Scheme 2 is £29 850

(c) Find the value of P.

(3)

a) $A = P \quad d = 2T$

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

$S_{10} = \frac{10}{2}(2P + (10-1)2T)$

$= 5(2P + 9(2T))$

$= 5(2P + 18T)$

$= \underline{10P + 90T}$

b) Scheme 2: $A = P + 1800$
$D = T$

$S_{10} = \frac{10}{2}(2(P + 1800) + (10-1)T)$

$= 5(2P + \cancel{1800}^{3600} + 9T)$

$= \cancel{5P + 9000} + 45T$

$10P + 18000 + 45T$

Amount earned is the same.

Leave blank

Question 9 continued

$$10P + 90T = \cancel{5P}^{10P} + 18000 + 45T$$

$$90T = 18000 + 45T$$

$$45T = 18000$$

$$T = \frac{18000}{45} = \frac{3600\cancel{0}}{9\cancel{0}}$$

$$\underline{T = 400} \qquad £400$$

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

$29850 = P + 1800 + 9T$

$29850 = P + 1800 + 9(400)$

$29850 = P + 1800 + 3600$

$29850 = P + 5400$

$\underline{24450 = P}$

£ 24 450

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10.

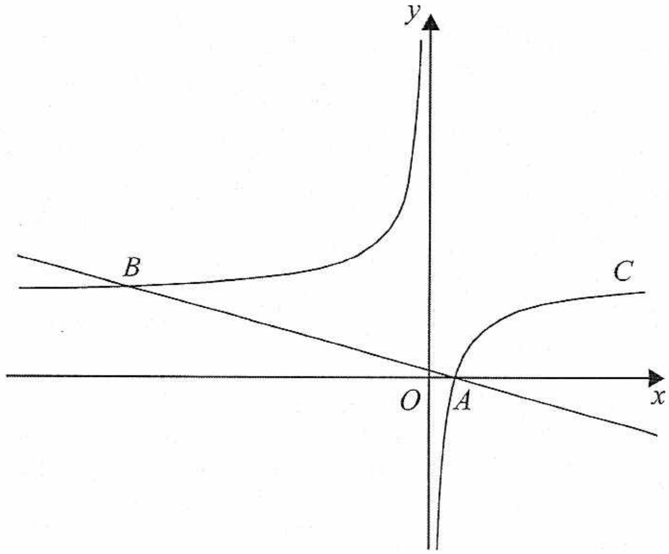

Figure 2

Figure 2 shows a sketch of the curve C with equation

$$y = 2 - \frac{1}{x}, \quad x \neq 0$$

The curve crosses the x-axis at the point A.

(a) Find the coordinates of A.

(1)

(b) Show that the equation of the normal to C at A can be written as

$$2x + 8y - 1 = 0$$

(6)

The normal to C at A meets C again at the point B, as shown in Figure 2.

(c) Find the coordinates of B.

(4)

a) Crosses x when $y=0$

$0 = 2 - \frac{1}{x}$

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

$1 = 2x$

$x = \frac{1}{2}$ $\quad (\frac{1}{2}, 0)$

Leave blank

Question 10 continued

b/ $y = 2 - x^{-1}$

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

when $x = ½$

$\frac{dy}{dx} = \frac{1}{(½)^2}$

$= \frac{1}{¼}$

$= 4$

gradient of normal $= -¼$

$y = -¼ x + c$ $(½, 0)$

$0 = -¼(½) + c$
$0 = -⅛ + c$
$c = ⅛$

$y = -¼ x + ⅛$

$8y = -2x + 1$

$\underline{\underline{2x + 8y - 1 = 0}}$

c/ $y = 2 - \frac{1}{x}$ $y = -¼ x + ⅛$

$2 - ½x = -¼ x + ⅛$
$16 - 8/x = -2x + 1$
$16x - 8 = -2x^2 + x$

Leave blank

Question 10 continued

$2x^2 + 16x - 8 = x$

$2x^2 + 15x - 8 = 0$

$(2x - 1)(x + 8) = 0$

$x = 1/2 \quad x = -8$

when $x = -8$

$y = 2 - \frac{1}{-8}$

$= 2 + 1/8$

$= \frac{16}{8} + 1/8$

$= \frac{17}{8}$

$\left(-8, \frac{17}{8}\right)$

Q10

(Total 11 marks)

TOTAL FOR PAPER: 75 MARKS

END