C1 - May 08

Q6 (a) 5.

$y = \frac{3}{x}$ ① when $x=3$ $y = \frac{3}{3} = 1$ $(3,1)$

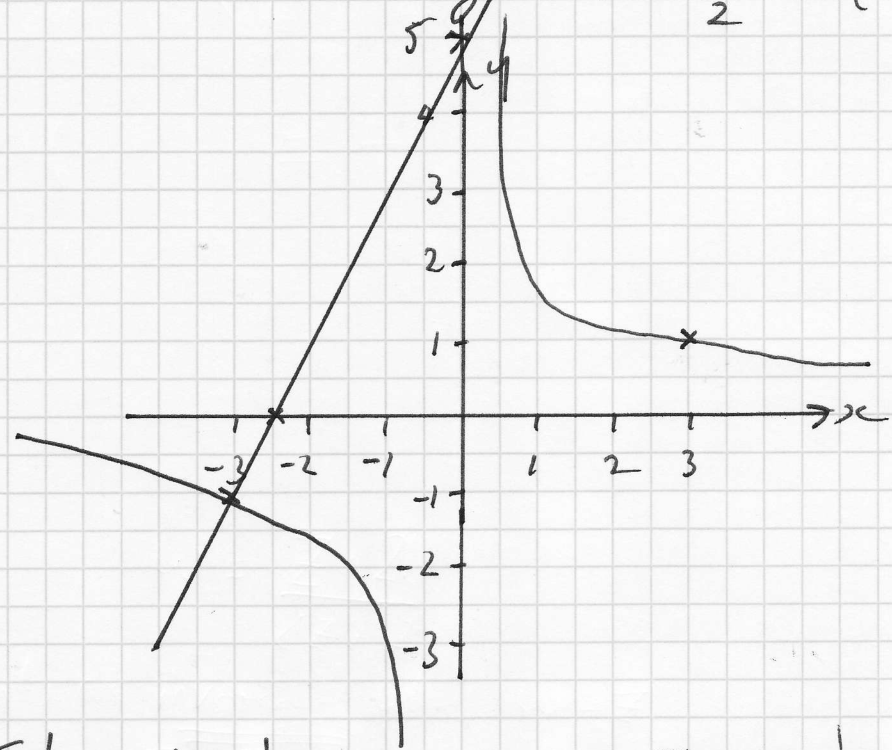
when $x=-3$ $y = \frac{3}{-3} = -1$ $(-3,-1)$

as $x \to \infty$ $y \to 0$

as $x \to -\infty$ $y \to 0$

$y = 2x+5$ when $x=0$ $y=5$ $(0,5)$

when $y=0$ $x = \frac{-5}{2}$ $(-2.5, 0)$



(b) Intersect when $\frac{3}{x} = 2x+5$

$3 = x(2x+5)$

$3 = 2x^2 + 5x$

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

$-6x$ $+6x, -x$

$2x^2 + 6x - x - 3 = 0$

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

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

$\therefore$ either $x+3=0$ or $2x-1=0$

$x=-3$ $x=\frac{1}{2}$

in ① when $x=-3$ $y = \frac{3}{-3} = -1$

when $x=\frac{1}{2}$ $y = \frac{3}{\frac{1}{2}} = 6$

$\therefore$ graphs intersect @

$(-3,-1)$

and $(\frac{1}{2}, 6)$

C1 - January 09

Q8 (a) $P(1, a)$

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

when $x=1$ $\quad y = (1+1)^2(2-1) = 2^2 \times 1 = 4$

$\therefore a = 4$

(b) $y = (x+1)^2(2-x)$

when $x=0$ $\quad y = (0+1)^2(2-0) = 1^2 \times 2 = 2$

$\therefore$ crosses ~~x~~ y axis @ $(0, 2)$

when $y=0$ $\quad (x+1)^2(2-x) = 0$

either $(x+1)^2 = 0$

$x+1 = 0$

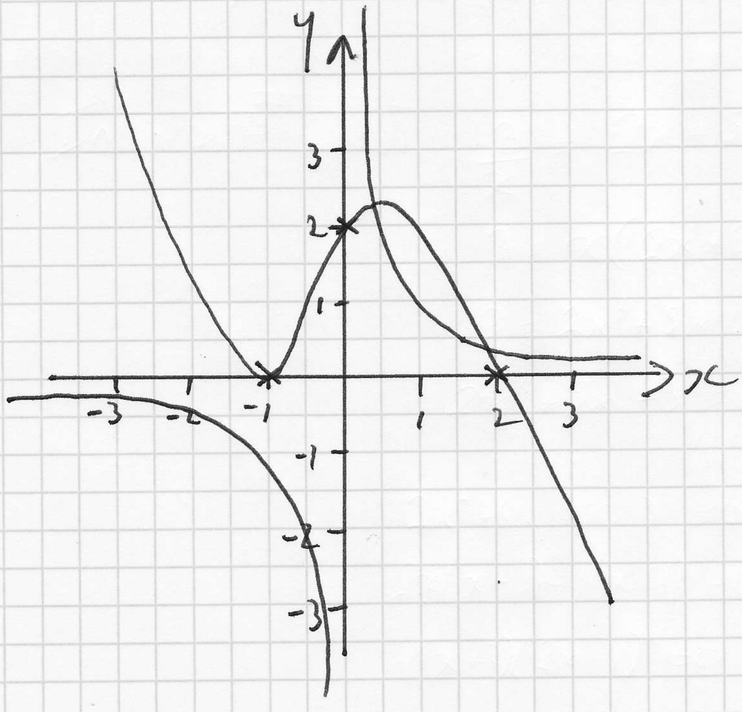
$x = -1$ $\quad$ Touches x axis @ $(-1, 0)$

or $2-x = 0$

$x = 2$ $\quad$ crosses x axis @ $(2, 0)$

$y = \frac{2}{x}$ $\quad$ as $x \to \infty$ $\quad y \to 0$

as $x \to -\infty$ $\quad y \to 0$



(c) Curves intersect in two places

$\therefore$ two real solutions to equation.

C1 - May 07

Q9 $f'(x) = 6x^2 - 10x - 12$

(a) $f(x) = \int 6x^2 - 10x - 12 \, dx$

$f(x) = \frac{6x^3}{3} - \frac{10x^2}{2} - 12x + c$

$f(x) = 2x^3 - 5x^2 - 12x + c$

When $y = f(x)$

$y = 2x^3 - 5x^2 - 12x + c$

passes thru' $(5, 65)$

$\therefore 65 = 2(5)^3 - 5(5)^2 - 12(5) + c$

$65 = 250 - 125 - 60 + c$

$65 = 65 + c$

$\therefore c = 0$

$\therefore f(x) = 2x^3 - 5x^2 - 12x$

(b) $f(x) = x(2x^2 - 5x - 12)$

$-24x^2 \qquad -8x + 3x$

$= x(2x^2 - 8x + 3x - 12)$

$= x(2x(x-4) + 3(x-4))$

$f(x) = x(2x+3)(x-4)$ As required

(c) $y = x(2x+3)(x-4)$

crosses y axis when $x = 0$ $\quad y = 0(0+3)(0-4) = 0$ $\quad \underline{(0,0)}$

crosses x axis when $y = 0$ $\quad x(2x+3)(x-4) = 0$

either $x = 0$ $\quad (0,0)$

or $2x + 3 = 0$ $\quad \underline{(-1.5, 0)}$

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

or $x - 4 = 0$

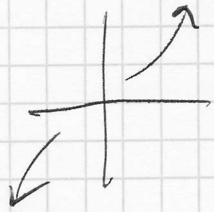
$x = 4$ $\quad \underline{(4, 0)}$

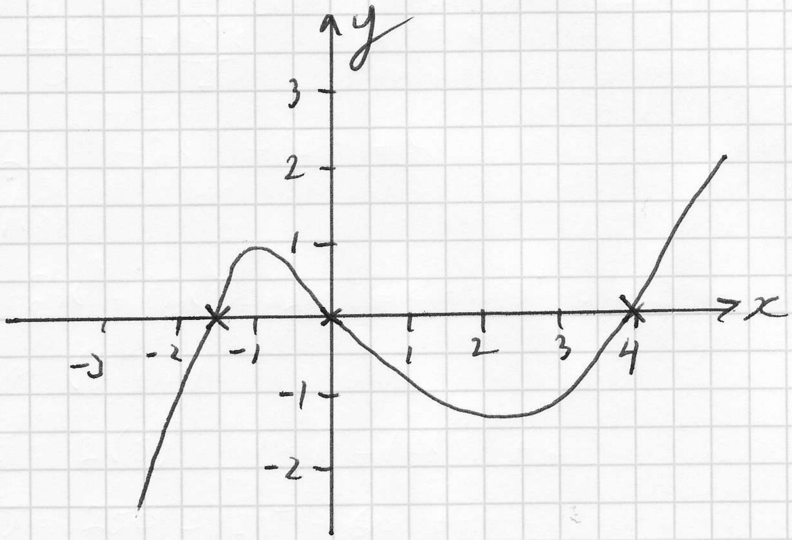
C1 – May 07

Q9 (c) cont'd

as $x \to +\infty$ $y = (+)(+)(+) = +$

as $x \to -\infty$ $y = (-)(-)(-) = -$





C1 – January 08

(10) (a) $y = (x+3)(x-1)^2$

crosses y axis when $x=0$ $\quad y = (0+3)(0-1)^2 = 3 \times 1 = 3$ $\quad (0,3)$

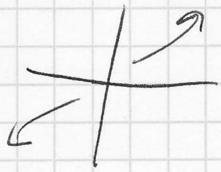
crosses x axis when $y=0$ $\quad (x+3)(x-1)^2 = 0$

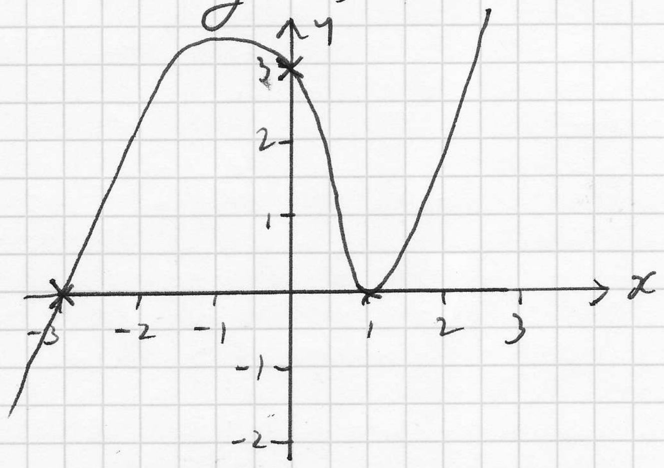
either $(x+3)=0$
$x = -3$ $\quad$ crosses @ $(-3,0)$

or $(x-1)^2 = 0$
$x-1=0$
$x=1$ $\quad$ touches @ $(1,0)$

as $x \to +\infty$ $\quad y = (+)(+)^2 = +$

as $x \to -\infty$ $\quad y = (-)(-)^2 = (-)(+) = -$





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

$y = x^3 - 2x^2 + x + 3x^2 - 6x + 3$

$y = x^3 + x^2 - 5x + 3$ $\quad \therefore k = 3$

(c) gradient equation of curve $\frac{dy}{dx} = 3x^2 + 2x - 5$

when $\frac{dy}{dx} = 3$ $\quad 3x^2 + 2x - 5 = 3$

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

$-24x^2 \quad +6x - 4x$

$3x^2 + 6x - 4x - 8 = 0$

$3x(x+2) - 4(x+2) = 0$

$(3x-4)(x+2) = 0$

$\therefore$ either $3x - 4 = 0$
$x = \frac{4}{3}$

or $x + 2 = 0$
$x = -2$

C1 - January 07

(16) (a)(i) $y = x^2(x-2)$

crosses y axis when $x=0$ $\quad y = 0^2(-2) = 0 \quad (0,0)$

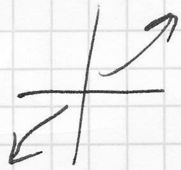
crosses x axis when $y=0$ $\quad x^2(x-2) = 0$

either $x^2 = 0$
$x = 0$ $\quad$ <u>touches</u> @ $(0,0)$

or $x-2=0$
$x=2$ $\quad$ <u>crosses</u> @ $(2,0)$

as $x \to +\infty \quad y = (+)^2(+) = +$

as $x \to -\infty \quad y = (-)^2(-) = (+)(-) = -$



(ii) $y = x(6-x)$

crosses y axis when $x=0$ $\quad y = 0(6) = 0 \quad (0,0)$

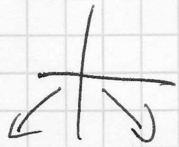
crosses x axis when $y=0$ $\quad x(6-x) = 0$

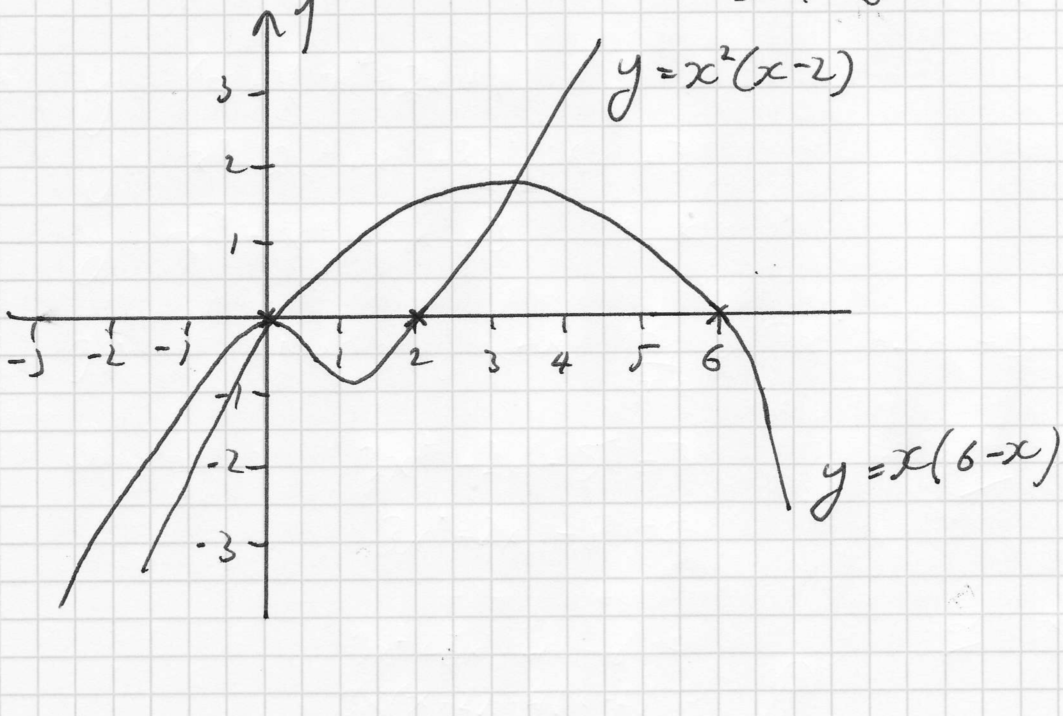
either $x=0 \quad (0,0)$

or $6-x=0$
$x=6 \quad (6,0)$.

as $x \to +\infty \quad y = (+)(-) = -$

as $x \to -\infty \quad y = (-)(+) = -$





C1 - January 07

(10) (b) $y = x^2(x-2)$ — (1)

$y = x(6-x)$ — (2)

equating (1)+(2) $x(6-x) = x^2(x-2)$

$6x - x^2 = x^3 - 2x^2$

$x^3 - 2x^2 + x^2 - 6x = 0$

$\cancel{x(2x)}$ $x^3 - x^2 - 6x = 0$

$x(x^2 - x - 6) = 0$

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

$\therefore$ either $x=0$ or $x-3=0$, $x=3$ or $x+2=0$, $x=-2$

in (2) when $x=0$ $y=0$

in (2) when $x=3$ $y = 3(6-3) = 3\times 3 = 9$

in (2) when $x=-2$ $y = -2(6--2) = -2\times 8 = -16$

$\therefore$ graphs intersect @ $(0,0)$, $(3,9)$ and $(-2,-16)$.

C1 - JANUARY 06

(10) (a) $x^2+2x+3 = (x+1)^2+2$

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

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

crosses y axis when $x=0$ $\quad y = (0+1)^2+2 = 1+2 = 3 \quad (0,3)$

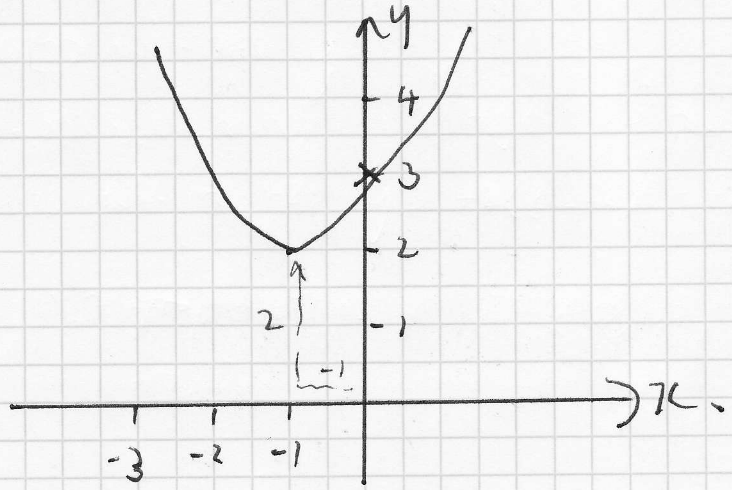
crosses x axis when $y=0$ $\quad (x+1)^2+2=0$

$(x+1)^2 = -2$ ∴ doesn't cross x axis

$x+1 = \pm\sqrt{-2}$

can't do

positive x^2 so V



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

transforms $y=x^2$

translation $\begin{pmatrix}-1\\2\end{pmatrix}$

(c) discriminant b^2-4ac $\quad 2^2-4\times1\times3 = 4-12 = -8$

discriminant <0 ∴ no real solutions ⇒ curve doesn't cross x-axis.

(d)

$x^2+kx+3=0$

discriminant <0

$k^2-4\times1\times3 = 0$

$k^2-12=0$

$k^2=12$

$k=\pm\sqrt{12}$

$k^2-12<0$

$-\sqrt{12}<k<\sqrt{12}$