

$$1. \quad m = -2, (x_1, y_1) = (3, 1)$$

$$y - y_1 = m(x - x_1)$$

$$y - 1 = -2(x - 3)$$

$$y - 1 = -2x + 6$$

$$y = -2x + 7$$

2

$$a = \frac{2}{3} b^2 c$$

$$3a = 2b^2 c$$

$$\frac{3a}{2c} = b^2$$

$$b = \pm \sqrt{\frac{3a}{2c}}$$

$$3. \quad i) \quad \left(\frac{1}{5}\right)^{-2} = \left(\frac{5}{1}\right)^2 = 25$$

$$ii) \quad \left(\frac{8}{27}\right)^{\frac{2}{3}} = \left(\sqrt[3]{\frac{8}{27}}\right)^2$$

$$= \left(\frac{2}{3}\right)^2 = \frac{4}{9}$$

4.

$$\frac{x^2 - 9}{x^2 + 5x + 6}$$

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

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

$$5. i) \quad \frac{10(\sqrt{6})^3}{\sqrt{24}} = \frac{10 \times 6\sqrt{6}}{\sqrt{4} \times \sqrt{6}}$$

$$= \frac{60\sqrt{6}}{2\sqrt{6}} = 30$$

$$5. ii) \quad \frac{1}{4 - \sqrt{5}} + \frac{1}{4 + \sqrt{5}}$$

$$= \frac{4 + \sqrt{5} + 4 - \sqrt{5}}{(4 - \sqrt{5})(4 + \sqrt{5})}$$

$$= \frac{8}{4^2 - \sqrt{5}^2} = \frac{8}{16 - 5}$$

$$= \frac{8}{11}$$

$$6. i) \quad {}^5C_3 = \frac{5!}{3!2!}$$

$$= \frac{5 \times 4}{2 \times 1} = 10$$

$$6. ii) \quad \text{Term in } x^3 \text{ given by}$$

$${}^5C_3 (3)^2 (-2x)^3$$

$$= 10 \times 9 \times (-8x^3)$$

$$= -720x^3$$

Coefficient = -720

7. Does not intersect x-axis

$$\text{when } x^2 + 2kx + 5 = 0$$

has no real roots

$$\text{ie when } b^2 - 4ac < 0$$

$$(2k)^2 - 20 < 0$$

$$4k^2 < 20$$

$$k^2 < 5$$

$$\Rightarrow -\sqrt{5} < k < \sqrt{5}$$

8. $f(x) = x^4 + bx + c$

$$f(2) = 0$$

$$\Rightarrow 2^4 + 2b + c = 0$$

$$16 + 2b + c = 0$$

$$\underline{2b + c = -16} \quad (1)$$

By remainder theorem

$$f(-3) = 85$$

$$\Rightarrow (-3)^4 - 3b + c = 85$$

$$81 - 3b + c = 85$$

$$\underline{-3b + c = 4} \quad (2)$$

$$(1) - (2) \quad 5b = -20$$

$$b = -4$$

Subst for b in (1)

$$-8 + c = -16$$

$$c = -16 + 8$$

$$c = -8$$

$$\text{Answer } b = -4, c = -8$$

9. $(n+3)^2 - n^2$

$$= (n+3+n)(n+3-n)$$

$$= 3(2n+3) = 6n+9$$

$6n$ is even for all n since it has a factor of 2

An even plus an odd is odd

so $6n+9$ is always odd for any integer n

If $(n+3)^2 - n^2$ is divisible by 9

then $6n+9$ is divisible by 9

$$\Rightarrow 6n \text{ is divisible by } 9$$

$$\Rightarrow n \text{ is divisible by } 3$$

Section B

- 10 i
- A(1, 5)
 - B(-1, 1)
 - C(3, -1)
 - D(11, 5)

$$|AB| = \sqrt{(1-(-1))^2 + (5-1)^2}$$

$$= \sqrt{4 + 16} = \sqrt{20}$$

$$|BC| = \sqrt{(-1-3)^2 + (1-(-1))^2}$$

$$= \sqrt{16 + 4} = \sqrt{20}$$

10i
Cont

$\therefore AB = BC$

10ii

gradient AC = $\frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - -1}{1 - 3}$
 $= \frac{6}{-2} = -3$

gradient BD = $\frac{1 - 5}{-1 - 11} = \frac{-4}{-12}$
 $= \frac{1}{3}$

\perp since $-3 \times \frac{1}{3} = -1$

$y = \frac{1}{3}x + \frac{4}{3}$

When $x = 2$, $y = \frac{2}{3} + \frac{4}{3} = \frac{6}{3} = 2$

$\therefore (2, 2)$ is on BD and so BD bisects AC

However, midpoint of BD is

$(\frac{11 + -1}{2}, \frac{5 + 1}{2})$

$= (5, 3)$ not $(2, 2)$

so AC does not bisect BD

10iii

midpoint = $(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2})$
 $= (\frac{1 + 3}{2}, \frac{5 - 1}{2})$
 $= (2, 2)$

Show $(2, 2)$ is on BD

Line BD

$\frac{y - y_1}{y_2 - y_1} = \frac{x - x_1}{x_2 - x_1}$

$\frac{y - 1}{5 - 1} = \frac{x - -1}{11 - -1}$

$\frac{y - 1}{4} = \frac{x + 1}{12}$

$y - 1 = \frac{4}{12}(x + 1)$

$y - 1 = \frac{1}{3}x + \frac{1}{3}$

11. i) $(x + \frac{1}{2}), (x + 2), (x - 5)$

$y = k(x + \frac{1}{2})(x + 2)(x - 5)$

If $y = 2x^3 + ax^2 + bx + c$

then $k = 2$

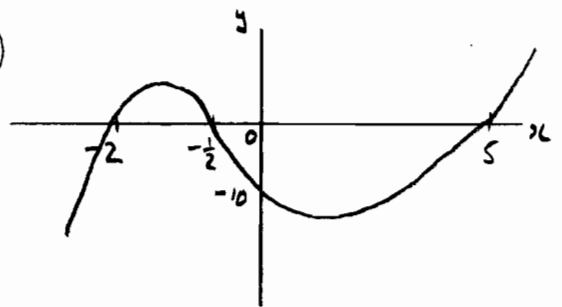
$y = (2x + 1)(x + 2)(x - 5)$

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

$= 2x^3 + x^2 - 6x^2 - 3x - 20x - 10$

$y = 2x^3 - 5x^2 - 23x - 10$

11 ii)



11iii) Translation by $\begin{pmatrix} 0 \\ -8 \end{pmatrix}$
 lowers curve by 8 units so
 crosses y-axis at $(0, -18)$

$$1 = x^3 - 4x^2 + x - 3x^2 + 12x - 3$$

$$1 = x^3 - 7x^2 + 13x - 3$$

$$0 = x^3 - 7x^2 + 13x - 4$$

11iv) Translation by $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$ moves
 curve 3 units to right
 So $f(x) = 2(x + \frac{1}{2})(x + 2)(x - 5)$

becomes

$$g(x) = 2(x - \frac{5}{2})(x - 1)(x - 8)$$

$$g(x) = (2x - 5)(x - 1)(x - 8)$$

(roots have all been increased
 by 3)

Cuts y-axis at y-coord

$$-5 \times -1 \times -8 = -40$$

So cuts at $(0, -40)$

12iii)

$$\begin{array}{r} x^2 - 3x + 1 \\ x - 4 \overline{) x^3 - 7x^2 + 13x - 4} \\ \underline{x^3 - 4x^2} \\ -3x^2 + 13x \\ \underline{-3x^2 + 12x} \\ x - 4 \\ \underline{x - 4} \end{array}$$

$$x^3 - 7x^2 + 13x - 4 = 0$$

$$\Rightarrow (x - 4)(x^2 - 3x + 1) = 0$$

Other roots when $x^2 - 3x + 1 = 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{3 \pm \sqrt{9 - 4}}{2}$$

$$x = \frac{3 \pm \sqrt{5}}{2}$$

$$x = \frac{3 + \sqrt{5}}{2} \quad \text{and} \quad x = \frac{3 - \sqrt{5}}{2}$$

12i) See insert

12ii) $y = \frac{1}{x-3}$ ①

$y = x^2 - 4x + 1$ ②

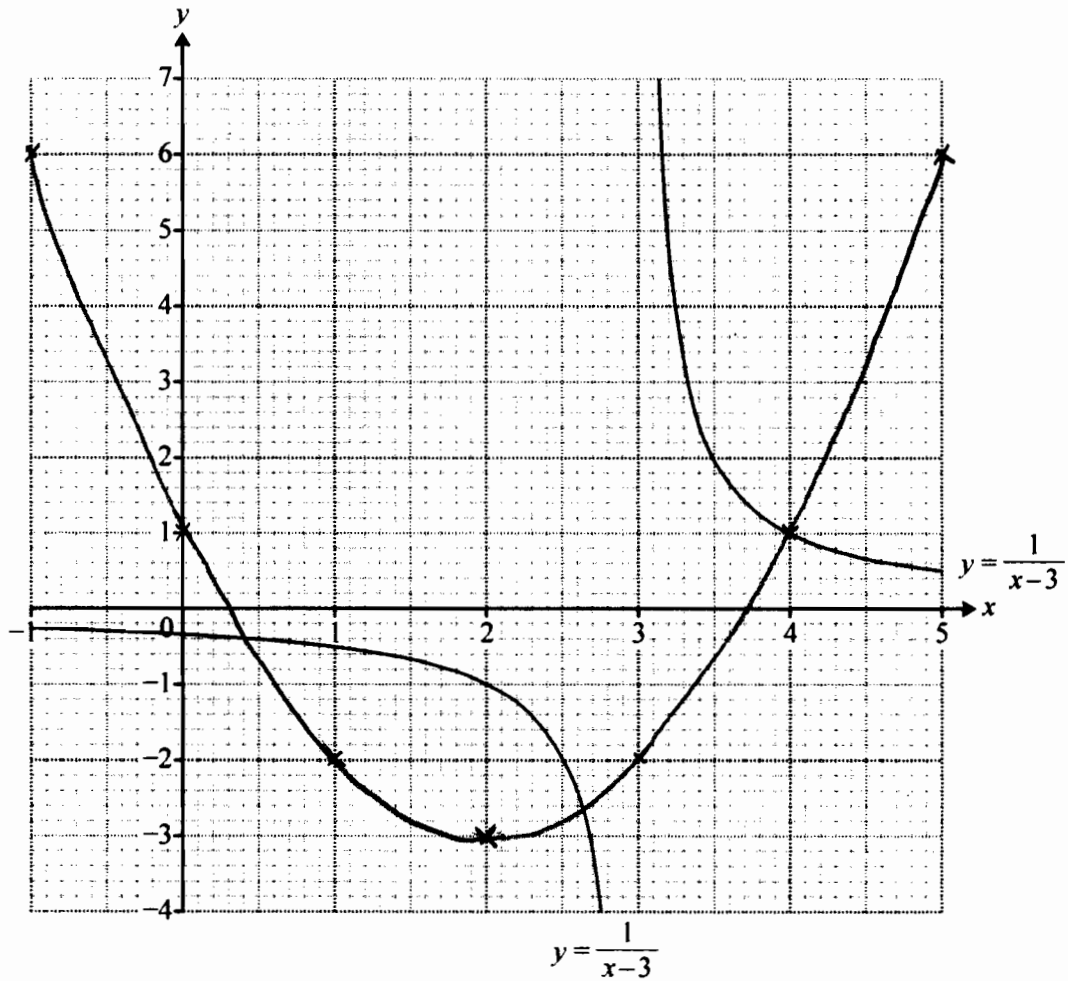
Subst for y in ②

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

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

H

Spare copy of Fig. 12 for question 12 (i).



x	-1	0	1	2	3	4	5
x^2	1	0	1	4	9	16	25
$-4x$	+4	0	-4	-8	-12	-16	-20
$+1$	+1	+1	+1	+1	+1	+1	+1
y	6	1	-2	-3	-2	1	6

i) Intersections at
 (4, 1) (0.4, -0.4)
 (2.6, -2.6)



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