

# *Factorising Into Complex Factors*

e.g. Given that  $P(x) = 4x^4 + 8x^3 + 5x^2 + x - 3$  has two rational zeros, find these zeros and factorise  $P(x)$  over the complex field.

$$\begin{aligned} P\left(\frac{1}{2}\right) &= 4\left(\frac{1}{16}\right) + 8\left(\frac{1}{8}\right) + 5\left(\frac{1}{4}\right) + \frac{1}{2} - 3 \\ &= 0 \quad \therefore (2x-1) \text{ is a factor} \end{aligned}$$

$$P(x) = (2x-1)(2x^3 + 5x^2 + 5x + 3)$$

$$P\left(-\frac{3}{2}\right) = 2\left(\frac{-27}{8}\right) + 5\left(\frac{9}{4}\right) + 5\left(-\frac{3}{2}\right) + 3$$

$$= 0 \quad \therefore (2x+3) \text{ is a factor}$$

$$\therefore \text{rational zeros are } \frac{1}{2} \text{ and } -\frac{3}{2}$$

$$1 \times 3 \times 2x = 6x$$

$$1 \times 2x \times -1 = -2x$$

$$4x$$

$$-1 \times 3 \times ?x = -3x$$

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

$$= (2x-1)(2x+3) \left[ \left(x + \frac{1}{2}\right)^2 + \frac{3}{4} \right]$$

$$= (2x-1)(2x+3) \left( x + \frac{1}{2} + \frac{\sqrt{3}}{2}i \right) \left( x + \frac{1}{2} - \frac{\sqrt{3}}{2}i \right)$$

**Exercise 5C; 1 to 15 odds, 16 to 20 all**