



Complex Numbers Ex 13.2 Q1(v)

$$\begin{aligned}
 \frac{(2+i)^3}{2+3i} &= \frac{2^3 + i^3 + 3 \times 2 \times i(2+i)}{2+3i} & \left[\because (a+b)^3 = a^3 + b^3 + 3ab(a+b) \right] \\
 &= \frac{(8-i+6i(2+i))}{2+3i} \times \frac{(2-3i)}{2-3i} & \text{(On rationalising the denominator)} \\
 &= \frac{(8-i+12i+6i^2)(2-3i)}{2^2+3^2} \\
 &= \frac{(8-6+11i)(2-3i)}{4+9} & \left[\because i^2 = -1 \right] \\
 &= \frac{(2+11i)(2-3i)}{13} \\
 &= \frac{4-6i+22i+33}{13} \\
 &= \frac{37+16i}{13} \\
 &= \frac{37}{13} + \frac{16}{13}i
 \end{aligned}$$

$$\therefore \frac{(2+i)^3}{2+3i} = \frac{37}{13} + \frac{16}{13}i$$

Complex Numbers Ex 13.2 Q1(vi)

$$\begin{aligned}
 \frac{(1+i)(1+\sqrt{3}i)}{1-i} &= \frac{1(1+\sqrt{3}i)+i(1+\sqrt{3}i)}{1-i} \\
 &= \frac{(1+\sqrt{3}i+i-\sqrt{3})}{1-i} & \left[\because i^2 = -1 \right] \\
 &= \frac{(1-\sqrt{3})+i(1+\sqrt{3})}{1-i} \times \frac{(1+i)}{1+i} & \text{(Rationalising the denominator)} \\
 &= \frac{(1-\sqrt{3})(1+i)+i(1+\sqrt{3})(1+i)}{1^2+1^2} \\
 &= \frac{1+i-\sqrt{3}(1+i)+i(1+i+\sqrt{3}(1+i))}{2} \\
 &= \frac{1+i-\sqrt{3}-\sqrt{3}i+i(1+i+\sqrt{3}+\sqrt{3}i)}{2} \\
 &= \frac{1-\sqrt{3}+i-\sqrt{3}i+i-1+\sqrt{3}i-\sqrt{3}}{2} \\
 &= \frac{-2\sqrt{3}+2i}{2} \\
 &= -\sqrt{3}+i
 \end{aligned}$$

$$\therefore \frac{(1+i)(1+\sqrt{3}i)}{1-i} = -\sqrt{3}+i$$

Complex Numbers Ex 13.2 Q1(vii)

$$\begin{aligned}
 \frac{2+3i}{4+5i} &= \frac{2+3i}{4+5i} \times \frac{(4-5i)}{(4-5i)} && \text{(rationalising the denominator)} \\
 &= \frac{2(4-5i) + 3i(4-5i)}{4^2 + 5^2} \\
 &= \frac{8-10i+12i+15}{16+25} && (\because i^2 = -1) \\
 &= \frac{23+2i}{41} \\
 &= \frac{23}{41} + \frac{2}{41}i
 \end{aligned}$$

$$\therefore \frac{2+3i}{4+5i} = \frac{23}{41} + \frac{2}{41}i$$

Complex Numbers Ex 13.2 Q1(viii)

$$\begin{aligned}
 \frac{(1-i)^3}{1-i^3} &= \frac{1^3 - i^3 - 3 \times 1 \times i(1-i)}{1 - (-i)} && \left[\begin{array}{l} \because (a-b)^3 = a^3 - b^3 - 3ab(a-b) \\ \text{and } i^3 = -i \end{array} \right] \\
 &= \frac{1 - (-i) - 3i(1-i)}{1+i} \\
 &= \frac{1+i-3i-3}{1+i} \\
 &= \frac{-2-2i}{1+i} \\
 &= \frac{-2(1+i)}{1+i} \\
 &= -2 \\
 &= -2 + 0i
 \end{aligned}$$

$$\therefore \frac{(1-i)^3}{1-i^3} = -2 + 0i$$

***** END *****