Complex Numbers Ex 13.2 Q1(v)

$$\frac{(2+i)^3}{2+3i} = \frac{2^3+i^3+3\times 2\times i\,(2+i)}{2+3i} \qquad \left[\because (a+b)^3 = a^3+b^3+3ab\,(a+b)\right]$$

$$= \frac{\left(8-i+6i\,(2+i)\right)}{2+3i}\times\frac{(2-3i)}{2-3i} \qquad \text{(On rationalising the denominator)}$$

$$= \frac{\left(8-i+12i+6i^2\right)(2-3i)}{2^2+3^2}$$

$$= \frac{(8-6+11i)(2-3i)}{4+9} \qquad \left(\because i^2=-1\right)$$

$$= \frac{(2+11i)(2-3i)}{13}$$

$$= \frac{4-6i+22i+33}{13}$$

$$= \frac{37+16i}{13}$$

$$= \frac{37}{13}+\frac{16}{13}i$$

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

Complex Numbers Ex 13.2 Q1(vi)

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

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

$$= \frac{\left(1-\sqrt{3}\right)+i\left(1+\sqrt{3}\right)}{1-i}\times\frac{(1+i)}{1+i} \qquad \text{(Rationalising the denominator)}$$

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

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

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

$$= \frac{1-\sqrt{3}+i-\sqrt{3}i+i-1+\sqrt{3}i-\sqrt{3}}{2}$$

$$= \frac{-2\sqrt{3}+2i}{2}$$

$$= -\sqrt{3}+i$$

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

Complex Numbers Ex 13.2 Q1(vii)

$$\frac{2+3i}{4+5i} = \frac{2+3i}{4+5i} \times \frac{(4-5i)}{(4-5i)} \qquad \text{(rationalising the denominator)}$$

$$= \frac{2(4-5i)+3i(4-5i)}{4^2+5^2}$$

$$= \frac{8-10i+12i+15}{16+25} \qquad (\because i^2=-1)$$

$$= \frac{23+2i}{41}$$

$$= \frac{23}{41} + \frac{2}{41}i$$

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

Complex Numbers Ex 13.2 Q1(viii)

$$\frac{(1-i)^3}{1-i^3} = \frac{1^3-i^3-3\times1\times i(1-i)}{1-(-i)} \qquad \left[\begin{array}{l}\because (a-b)^3 = a^3-b^3-3ab(a-b) \\ \text{and } i^3=-i\end{array}\right]$$

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

$$= \frac{1+i-3i-3}{1+i}$$

$$= \frac{-2-2i}{1+i}$$

$$= \frac{-2(1+i)}{1+i}$$

$$= -2$$

$$= -2+0i$$

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

*********** END **********