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6)

3) a) i) $\left(\frac{1+i}{1-i}\right)^3$

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

~~$$\frac{2i+2i^2}{2-2i^2-2i+2i}$$~~

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

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

$$= \frac{2-2-2i+2i^2}{2-2-4i}$$

~~$$= \frac{2i-2}{-4i}$$~~

~~$$= \frac{-2+2i}{-4-4i}$$~~

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

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

~~$$\frac{-1+i}{2-2i} \cdot \frac{2+2i}{2+2i}$$~~

~~$$= \frac{-2+2i^2-2i+2i}{4-4i+4i-2i^2}$$~~

~~$$= \frac{-4}{6} = -\frac{2}{3}$$~~

~~$$\frac{-1+i}{-2i} \cdot \frac{2i}{2i}$$~~

~~$$= \frac{i-2i}{-4i^2}$$~~

~~$$= \frac{-i}{4}$$~~

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

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

$$\underline{\underline{= -i}}$$

ii) $\frac{3}{(1+i)(2+i)}$

$$= \frac{3}{2+2i+i+i^2}$$

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