

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

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

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

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

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

$$\frac{3}{1+3i} \times \frac{3}{1-3i} = \frac{9}{1-3i+3i-9i^2} = \frac{9}{10} = \frac{9}{10} + 0i$$

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

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

$$(1+2i)(2+2i) = 2+2i+4i+4i^2 = 2+6i+4(-1) = -2+6i$$

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