

1. a.

$$z = \frac{5 + i}{3 + i}$$

$$z = \frac{10}{3 + i} \times \frac{3 - i}{3 - i}$$

$$z = \frac{30 - 10i}{3^2 + 1^2}$$

$$z = \frac{30 - 10i}{10}$$

$$z = 3 - i$$

$$\operatorname{Re}(z) = 3$$

$$\operatorname{Im}(z) = -1$$

b. $z_1 = 3 + 4i$ $z_2 = 2 - i$

$$z = (z_1 + z_2)^{5+1}$$

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

$$z = (5 + 3i)^{10}$$

$$z = [5(1 + i)]^{10}$$

$$z = 5^{10} (1 + i)^{10}$$

$$z = 5^{10} [(1 + i)^2]^5$$

$$z = 9765625 \cdot (2i)^5$$

$$z = 9765625 \cdot 32i^5$$

$$z = 9765625 \cdot 32i$$

$$z = 312500000i$$

$$z = 50^5 i$$