

$$① a) 5^5 \text{ cis } (5 \times 72)$$

$$= 3125 \text{ cis } 360$$

$$= 3125 \text{ cis } 0^\circ$$

$$b) (1-i)^{10}$$

$$= (\sqrt{2} \text{ cis } 315)^{10}$$

$$= 32 \text{ cis } 3150^\circ$$

$$= 32 \text{ cis } 270^\circ$$

$$= 32 \cos 270 + 32i \sin 270$$

$$= \boxed{-32i}$$

$$c) (1+i)^{11} (1-i)^{15}$$

$$= (\sqrt{2} \text{ cis } 45)^{11} (\sqrt{2} \text{ cis } 315)^{15}$$

$$= (32\sqrt{2} \text{ cis } 495) (128\sqrt{2} \text{ cis } 4725)$$

$$= 8192 \text{ cis } 5220$$

$$= 8192 \text{ cis } 180^\circ$$

$$= 8192 \cos 180 + 8192i \sin 180$$

$$= \boxed{-8192}$$

$$d) (\sqrt{3}-i)^4 (-1-i\sqrt{3})^5$$

$$= (2 \text{ cis } 330)^4 (2 \text{ cis } 240)^5$$

$$= (16 \text{ cis } 1320) (32 \text{ cis } 1200)$$

$$= (512 \text{ cis } 2520)$$

$$= 512 \text{ cis } 360$$

$$= \boxed{512}$$

$$e) \frac{(1+i)^9 (1-i\sqrt{3})^3}{(5\sqrt{3}+5i)^6}$$

$$= \frac{(\sqrt{2} \text{ cis } 45)^9 (2 \text{ cis } 300)^3}{(10 \text{ cis } 30)^6}$$

$$= \frac{(2 \text{ cis } 90)(8 \text{ cis } 900)}{(100 \text{ cis } 60)}$$

$$= \frac{16 \text{ cis } 990}{100 \text{ cis } 60}$$

$$= 0.16 \text{ cis } 930$$

$$= \boxed{0.16 \text{ cis } 210^\circ}$$

$$② a) (3+4i)(5+6i)$$

$$= \boxed{-9 + 38i}$$

$$b) \boxed{\frac{4}{29} + \frac{97}{29}i}$$

$$c) \boxed{\frac{-9}{41} + \frac{40}{41}i}$$

$$③ a) \boxed{10 \text{ cis } 150^\circ}$$

$$b) 3 \text{ cis } 270^\circ = \boxed{3i}$$

$$④ a) \boxed{2 + 3.46i}$$

$$b) \boxed{2.12 + 2.12i}$$

$$⑤ a) (4+i\sqrt{2})(4-i\sqrt{2})$$

$$= 16 - 4i\sqrt{2} + 4i\sqrt{2} - i^2(2)$$

$$= 16 + 2$$

$$= \boxed{18}$$

$$⑥ \begin{matrix} a=3 \\ b=4 \\ c=5 \end{matrix}$$

$$\frac{4 \pm \sqrt{16 - 4(3)(5)}}{6}$$

$$\frac{4 \pm \sqrt{-44}}{6}$$

$$\frac{4 \pm 2i\sqrt{11}}{6}$$

$$\boxed{\frac{2 \pm i\sqrt{11}}{3}}$$