$z = r(\cos\theta + i\sin\theta)$

$z^n = r^n(\cos n\theta + i\sin n\theta)$

In Exercises 31–38, use De Moivre's Theorem to find the indicated power of the complex number. Write your answer in standard form $a + bi$.

31. $\left(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}\right)^3$

HW **32.** $\left[3\left(\cos\frac{3\pi}{2} + i\sin\frac{3\pi}{2}\right)\right]^5$

31) $r = 1 \quad \theta = \frac{\pi}{4}$

$z^3 = 1^3\left(\cos\frac{3\pi}{4} + i\sin\frac{3\pi}{4}\right)$

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

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

33. $\left[2\left(\cos\frac{3\pi}{4} + i\sin\frac{3\pi}{4}\right)\right]^3$

HW **34.** $\left[6\left(\cos\frac{5\pi}{6} + i\sin\frac{5\pi}{6}\right)\right]^4$

35. $(1 + i)^5$

36. $(3 + 4i)^{20}$ → SKIP!

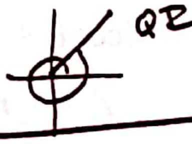
37. $(1 - \sqrt{3}i)^3$

HW **38.** $\left(\frac{1}{2} + i\frac{\sqrt{3}}{2}\right)^3$

33) $r = 2 \quad \theta = \frac{3\pi}{4}$

$z^3 = 2^3\left(\cos\frac{9\pi}{4} + i\sin\frac{9\pi}{4}\right)$

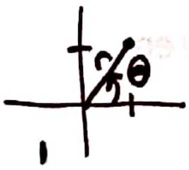
$= 8\left(\frac{\sqrt{2}}{2} + i\left(\frac{\sqrt{2}}{2}\right)\right)$



$z^3 = \boxed{4\sqrt{2} + 4\sqrt{2}i}$

35) $\underbrace{(1+i)}^5$

$r = ? \quad \theta = ?$



$r = \sqrt{(1)^2 + (1)^2}$

$r = \sqrt{2}$

$\theta = \tan^{-1}\left(\frac{1}{1}\right)$

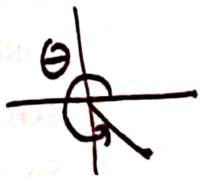
$\theta = \frac{\pi}{4}$

$\left(\sqrt{2}\left(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}\right)\right)^5$

$z^5 = (\sqrt{2})^5\left(\cos\frac{5\pi}{4} + i\sin\frac{5\pi}{4}\right)$

$4\sqrt{2}\left(-\frac{\sqrt{2}}{2} + i\left(-\frac{\sqrt{2}}{2}\right)\right) = \boxed{-4 - 4i} = z^5$

37) $(1 - \sqrt{3}i)^3$



$r = \sqrt{(1)^2 + (-\sqrt{3})^2}$

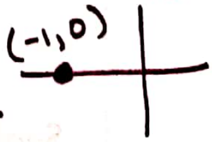
$\sqrt{1+3} = \sqrt{4} = 2$

$\theta = \tan^{-1}\left(-\frac{\sqrt{3}}{1}\right)$ (in Q IV)

$\theta = \frac{5\pi}{3}$

$z^3 = 2^3\left(\cos \cancel{3}\cdot\frac{5\pi}{\cancel{3}} + i\sin \cancel{3}\cdot\frac{5\pi}{\cancel{3}}\right)$

$= 8(-1 + i\cdot 0)$



$\boxed{-8}$

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