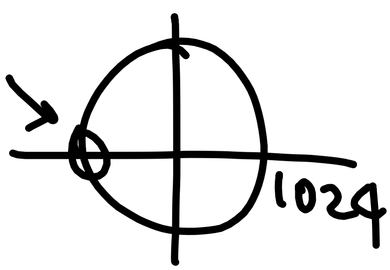
**65.** $(1 + i)^{20}$

$= (\sqrt{2} \text{ cis } 45^\circ)^{20}$

$= 1024 \text{ cis } 900$

$= 1024 \text{ cis } 180^\circ$

$= -1024$



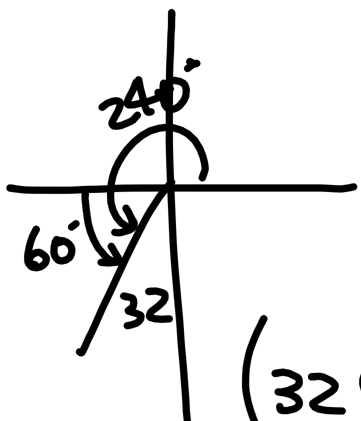

$(r_1 \text{ cis } \theta_1)(r_2 \text{ cis } \theta_2)$

$= r_1 r_2 \text{ cis}(\theta_1 + \theta_2)$

$r \text{ cis } \theta = r e^{\theta i}$

$(r e^{\theta i})^n = r^n e^{n\theta i} = r^n \text{ cis } n\theta$

**86.** The fifth roots of $-16 - 16\sqrt{3}i$




$$\left(32 \operatorname{cis} 240^\circ\right)^{\frac{1}{5}}$$

$$\boxed{\left(r \operatorname{cis} \theta\right)^{\frac{1}{n}} = r^{\frac{1}{n}} \operatorname{cis}\left(\frac{\theta}{n} + \frac{2\pi k}{n}\right)}$$

1. $2 \operatorname{cis} 48^\circ$
2. $2 \operatorname{cis} 120^\circ$

$2 \operatorname{cis} 192^\circ$

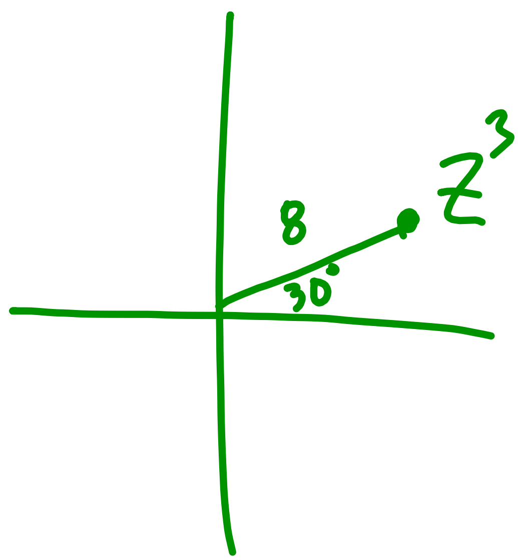
$2 \operatorname{cis} 264^\circ$

$2 \operatorname{cis} 336^\circ$

**89.** $z^3 - 4\sqrt{3} - 4i = 0$

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

$z = \sqrt[3]{4\sqrt{3} + 4i}$




$z_1 = 2 \text{ cis } 10°$

$z_2 = 2 \text{ cis } 130°$

$z_3 = 2 \text{ cis } 250° = 2\cos 250° + 2i\sin 250°$

$= -.68 - 1.88i$

**93.** **(a)** Let $w = \cos \frac{2\pi}{n} + i \sin \frac{2\pi}{n}$ where $n$ is a positive integer. Show that $1, w, w^2, w^3, \ldots, w^{n-1}$ are the $n$ distinct $n$th roots of 1.

$\times s$

**(b)** If $z \neq 0$ is any complex number and $s^n = z$, show that the $n$ distinct $n$th roots of $z$ are

$$s, sw, sw^2, sw^3, \ldots, sw^{n-1}$$

$n^{th}$ root of $1 = \sqrt[n]{1} = \sqrt[n]{1 \operatorname{cis} 0}$