TOPIC: PRODUCTS AND QUOTIENTS OF COMPLEX NUMBERS

Products of Complex Numbers in Polar Form

◆ Multiply complex numbers (z_1 & z_2) in polar form by _____ the r's and _____ the θ's.

  ▸ The polar form of complex numbers, $r(\cos\theta + i\sin\theta)$, is often abbreviated $r \cdot$ _____ (θ).

EXAMPLE Find the product of the complex numbers.

> **New** **Multiply Complex Numbers in Polar Form**
>
> $$z_1 \cdot z_2 = r_1 \_\_ r_2\left[\cos(\theta_1 \_\_ \theta_2) + i\sin(\theta_1 \_\_ \theta_2)\right]$$
>
> $$[3(\cos 15° + i\sin 15°)] \cdot [2(\cos 30° + i\sin 30°)]$$

EXAMPLE Find the product of the complex numbers.

$$\left[4\left(\cos\frac{\pi}{6} + i\sin\frac{\pi}{6}\right)\right] \cdot \left[5\left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right)\right]$$

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PRACTICE Given $z_1 = 5(\cos\frac{\pi}{6} + i\sin\frac{\pi}{6})$ and $z_2 = 3(\cos\frac{3\pi}{4} + i\sin\frac{3\pi}{4})$, find the product $z_1 \cdot z_2$.
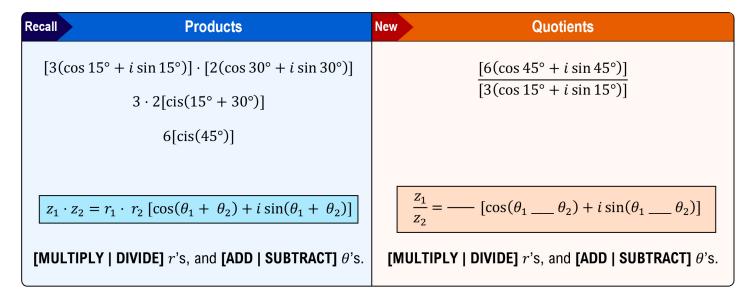
PRACTICE Given $z_1 = \frac{2}{3}(\cos 25° + i\sin 25°)$ and $z_2 = \frac{5}{2}(\cos 15° + i\sin 15°)$, find the product $z_1 \cdot z_2$.

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Quotients of Complex Numbers in Polar Form

◆ Dividing complex numbers is like multiplication, but with _____ operations.

EXAMPLE   Find the quotient.

Recall Products	New Quotients
$[3(\cos 15° + i \sin 15°)] \cdot [2(\cos 30° + i \sin 30°)]$ $3 \cdot 2[\text{cis}(15° + 30°)]$ $6[\text{cis}(45°)]$	$\dfrac{[6(\cos 45° + i \sin 45°)]}{[3(\cos 15° + i \sin 15°)]}$
$\boxed{z_1 \cdot z_2 = r_1 \cdot r_2 \left[\cos(\theta_1 + \theta_2) + i \sin(\theta_1 + \theta_2)\right]}$	$\boxed{\dfrac{z_1}{z_2} = \underline{} \left[\cos(\theta_1 \underline{} \theta_2) + i \sin(\theta_1 \underline{} \theta_2)\right]}$
[MULTIPLY | DIVIDE] r's, and **[ADD | SUBTRACT]** θ's.	**[MULTIPLY | DIVIDE]** r's, and **[ADD | SUBTRACT]** θ's.

EXAMPLE   Let $z_1 = 5\left(\cos\frac{\pi}{3} + i \sin\frac{\pi}{3}\right)$ and $z_2 = 4\left(\cos\frac{\pi}{9} + i \sin\frac{\pi}{9}\right)$. Find $\frac{z_1}{z_2}$.

Recall
$$\boxed{r(cos\theta + isin\theta) = rcis\theta}$$

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PRACTICE   Given $z_1 = \frac{1}{5}\left(\cos\frac{\pi}{2} + i\sin\frac{\pi}{2}\right)$ and $z_2 = 5\left(\cos\frac{\pi}{5} + i\sin\frac{\pi}{5}\right)$, find the quotient $\frac{z_1}{z_2}$.

PRACTICE   Given $z_1 = 12(\cos 30° + i\sin 30°)$ and $z_2 = 3(\cos 50° + i\sin 50°)$, find the quotient $\frac{z_1}{z_2}$.