

# 10 Lec Multiplication and Division in polar form.

This will give us a "geometrical" understanding of multiplication, and division.

$$z_1 = r_1 (\cos \theta_1 + i \sin \theta_1)$$

$$z_2 = r_2 (\cos \theta_2 + i \sin \theta_2)$$

$$z_1 \cdot z_2 = r_1 r_2 \left[ (\cos \theta_1 \cos \theta_2 - \sin \theta_1 \sin \theta_2) + i (\sin \theta_1 \cos \theta_2 + \sin \theta_2 \cos \theta_1) \right]$$

$$\text{As } \cos(A+B) = \cos A \cos B - \sin A \sin B$$

$$\sin(A+B) = \sin A \cos B + \sin B \cos A$$

$$\Rightarrow z_1 \cdot z_2 = r_1 r_2 \left[ \cos(\theta_1 + \theta_2) + i \sin(\theta_1 + \theta_2) \right]$$

Taking absolute values and argument of ~~\*~~, we get

$$|z_1 \cdot z_2| = |z_1| |z_2|$$

$$\arg(z_1 \cdot z_2) = \arg(z_1) + \arg(z_2)$$