PHYSICS PHOR PHUN
PASO ROBLES, CA

POLAR FUNCTIONS

MATH AND SCIENCE TUTORING
805-610-1725

Complex Trigonometry

Complex Coordinates

Complex numbers

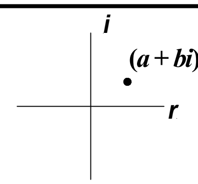
$z = a + bi$

$r(\cos\theta + i\sin\theta) = r\ cis\,\theta$

Axes

real axis: r

imaginary axis: i



Conversions

rectangular to polar

$r = \sqrt{x^2 + y^2},\ \tan\theta = \dfrac{y}{x}$

polar to rectangular

$x = r\cos\theta, \qquad y = r\sin\theta$

Complex polar arithmetic

products

$z_1 z_2 = r_1 r_2\ cis\,(\theta_1 + \theta_2)$

powers

$(r\ cis\,\theta)^n = r^n cis\,n\theta$

quotients

$\dfrac{z_1}{z_2} = \dfrac{r_1}{r_2} cis\,(\theta_1 - \theta_2)$

roots

$(r\ cis\,\theta)^{1/n} = r^{1/n} cis\left(\dfrac{\theta + 2\pi k}{n}\right),\ k = 0, 1, \ldots n-1$

Graphing

Test points

Symmetry tests

horizontal axis

$\cos\ \theta = \cos\ (-\theta)$

vetical axis

$\sin\ \theta = \sin\ (\pi - \theta)$

origin

$r \Rightarrow -r$

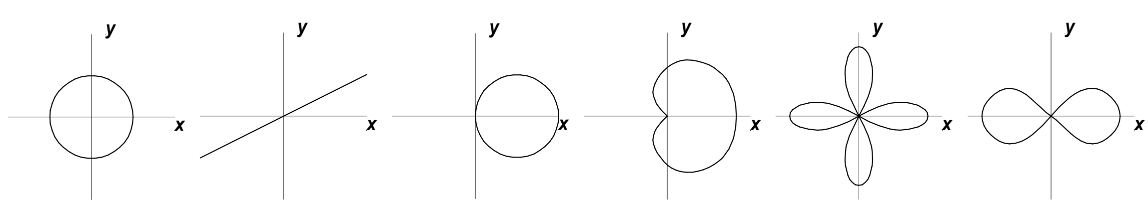
T-table

r-max, mins, zeros: deg*	rad*	special angles
0°	0	|sin 30| = 1/2
90°	π/2	|cos 60| = 1/2
180°	π	45° = π/4 rad
270°	3π/2	

*Sometimes in multiples of 1/n

Parent functions

*Symmetry rotates counterclockwise Q*I – *Q*IV*, as a function of cos, sin, -cos, -sin, respectively.*



$r = a$ **$\theta = m$**   **$r = 2a\cos\theta$**   **$r = a(1 + \cos\theta)$**   **$r = a\cos n\theta$**   **$r^2 = a^2\cos 2\theta$**

$n_{odd} = n$ petals
$n_{even} = 2n$ petals