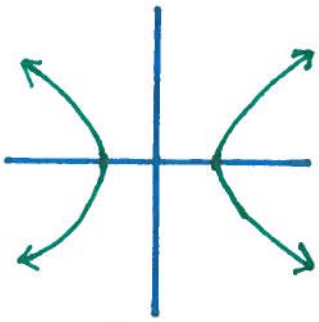
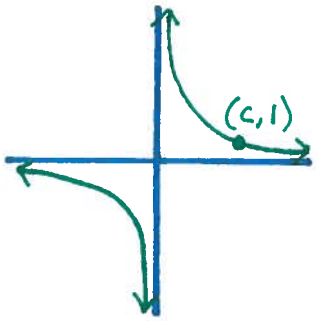
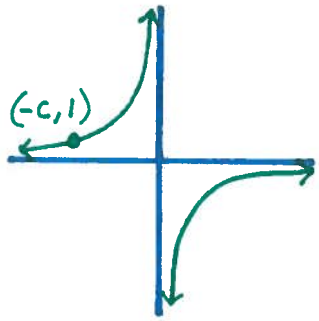
Equations in Two Variables



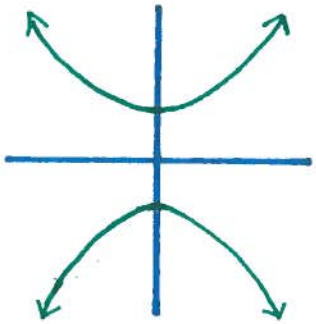
$x^2 - y^2 = 1$



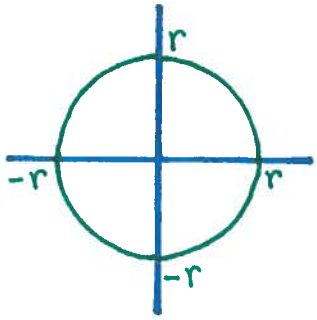
$xy = c \quad (c > 0)$



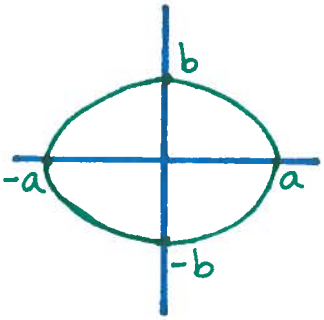
$xy = -c \quad (c > 0)$



$y^2 - x^2 = 1$

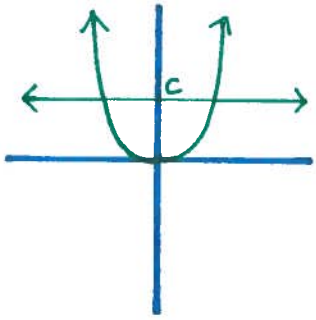


$x^2 + y^2 = r^2$

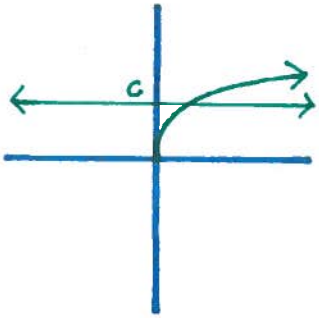


$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

Equations in One Variable



If $c \geq 0$ and $f(x)^2 = c$, then either $f(x) = \sqrt{c}$ or $f(x) = -\sqrt{c}$.



If $c \geq 0$ and $\sqrt{f(x)} = c$, then $f(x) = c^2$

Exponentials

① $a^x a^y = a^{x+y}$

② $a^x / a^y = a^{x-y}$

③ $(a^x)^y = a^{xy}$

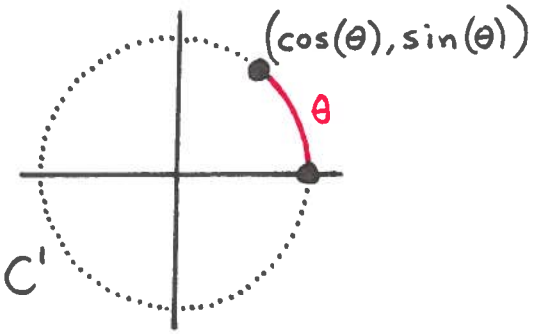
Logarithms

① $\log_a(x) + \log_a(y) = \log_a(xy)$

② $\log_a(x) - \log_a(y) = \log_a(x/y)$

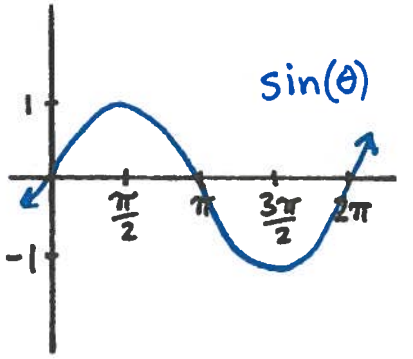
③ $z \log_a(x) = \log_a(x^z)$

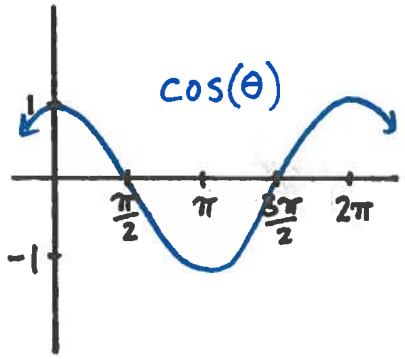
Trigonometric Functions

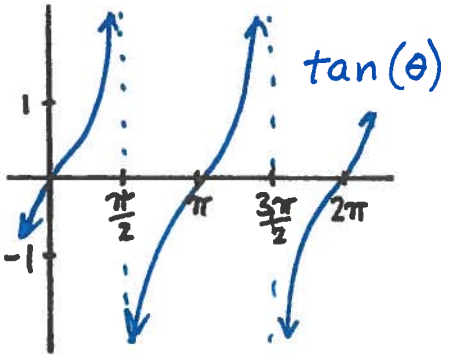


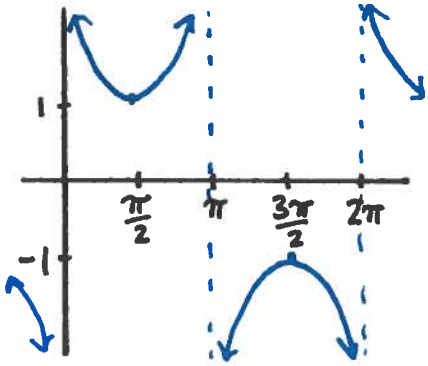
$$\csc(\theta) = \frac{1}{\sin(\theta)} \qquad \tan(\theta) = \frac{\sin(\theta)}{\cos(\theta)}$$

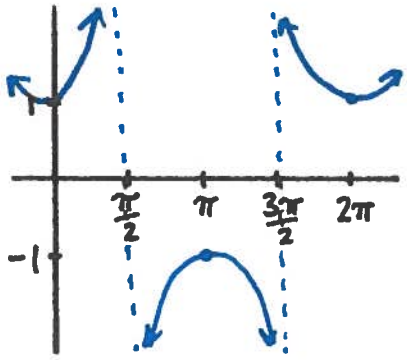
$$\sec(\theta) = \frac{1}{\cos(\theta)} \qquad \cot(\theta) = \frac{\cos(\theta)}{\sin(\theta)}$$

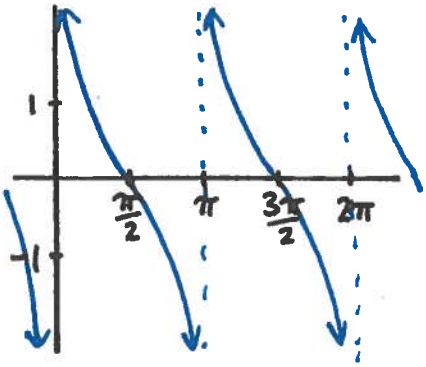


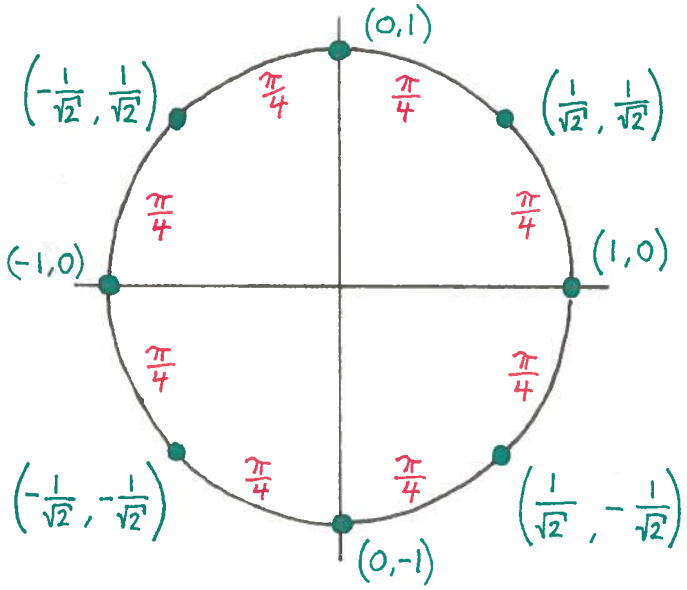


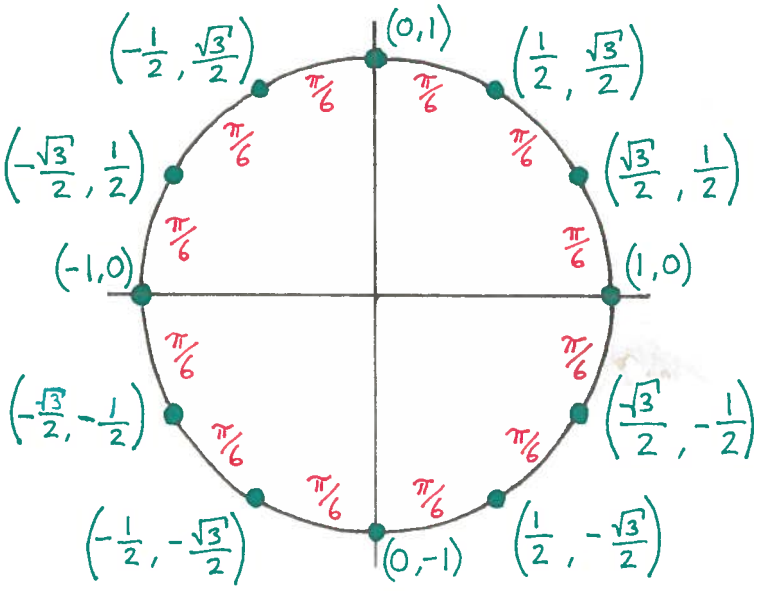






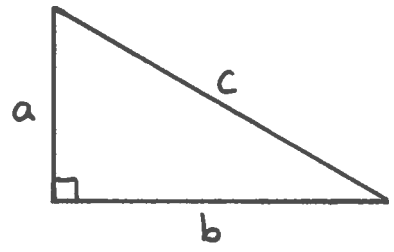






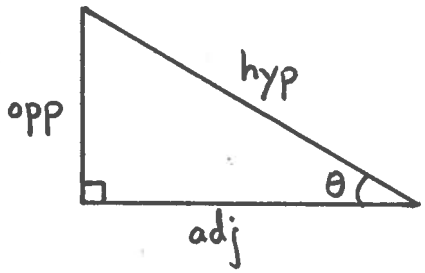
Triangles

Pythagorean Theorem



$$a^2 + b^2 = c^2$$

soh-cah-toa

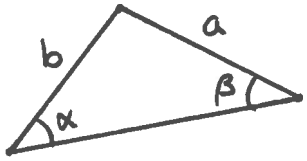


$$\sin(\theta) = \frac{opp}{hyp}$$

$$\cos(\theta) = \frac{adj}{hyp}$$

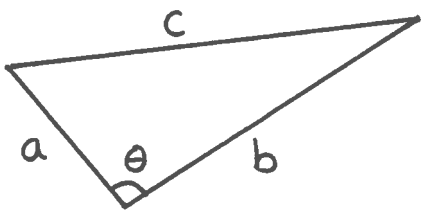
$$\tan(\theta) = \frac{opp}{adj}$$

Law of Sines



$$\frac{\sin(\alpha)}{a} = \frac{\sin(\beta)}{b}$$

Law of Cosines



$$c^2 = a^2 + b^2 - 2ab\cos(\theta)$$

Rotations of the Plane

Distance:

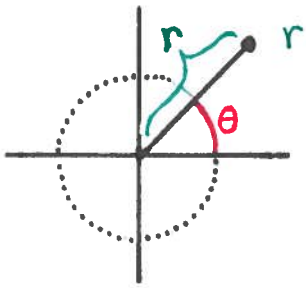
distance between (x_1, y_1) and (x_2, y_2) is $\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$

Norm:

norm of a vector is its distance from $(0,0)$.

$$\|(a,b)\| = \sqrt{a^2 + b^2}$$

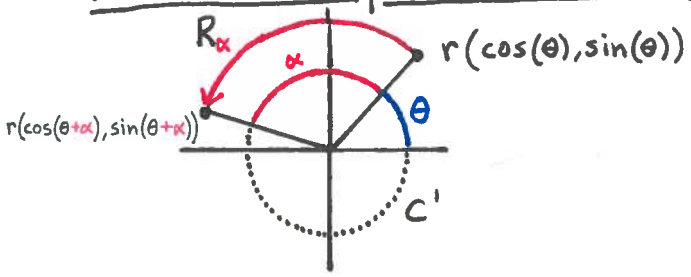
Polar coordinates:



$r(\cos(\theta), \sin(\theta))$

$$(a,b) = \|(a,b)\| \left(\frac{a}{\|(a,b)\|}, \frac{b}{\|(a,b)\|} \right)$$

Rotation in polar coordinates



$$R_\alpha\left(r(\cos(\theta), \sin(\theta))\right) = r\left(\cos(\theta+\alpha), \sin(\theta+\alpha)\right)$$

- counterclockwise if $\alpha > 0$.
- clockwise if $\alpha < 0$.

Rotation in Cartesian coordinates

$$R_\alpha = \begin{pmatrix} \cos(\alpha) & -\sin(\alpha) \\ \sin(\alpha) & \cos(\alpha) \end{pmatrix}$$

R_α is "rotation of the plane by angle α".