Polar Coordinates

$r^2 = x^2 + y^2$ or $r = \sqrt{x^2 + y^2}$

$\tan\theta = \frac{y}{x}$

$x = r\cos\theta$

$y = r\sin\theta$

polar form of a complex number

$r(\cos\theta + i\sin\theta)$

$z_1 \bullet z_2 =$

$r_1 r_2 \left[\cos(\theta_1 + \theta_2) + i\sin(\theta_1 + \theta_2)\right]$

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

DeMoivre's Theorem

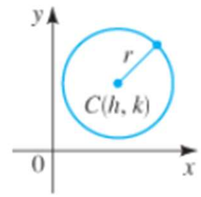
$\left[r(\cos\theta + i\sin\theta)\right]^n$

$= r^n(\cos n\theta + i\sin n\theta)$

Conic Sections

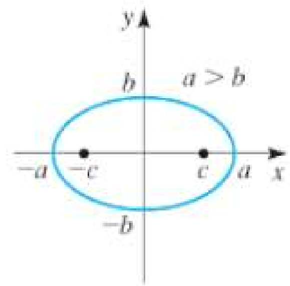
Circles

$(x-h)^2 + (y-k)^2 = r^2$



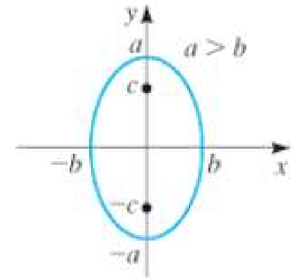
Ellipses

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



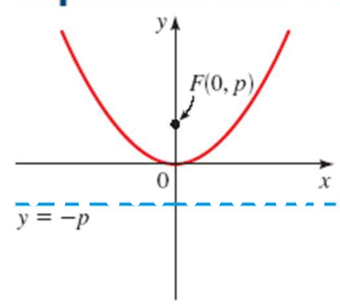
Foci $(\pm c, 0)$, $c^2 = a^2 - b^2$

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

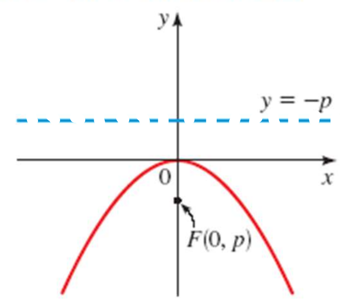


Foci $(0, \pm c)$, $c^2 = a^2 - b^2$

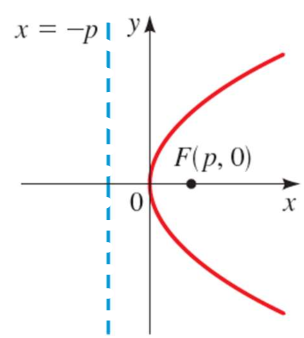
Equations and Graphs of Parabolas



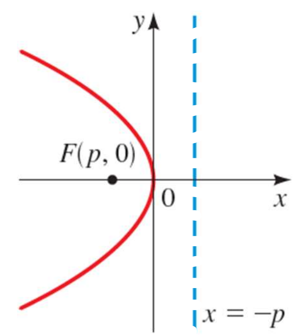
$x^2 = 4py$ with $p > 0$



$x^2 = 4py$ with $p < 0$



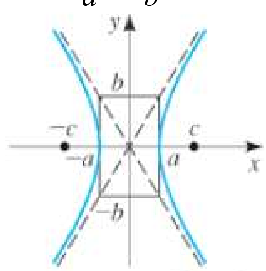
$y^2 = 4px$ with $p > 0$



$y^2 = 4px$ with $p < 0$

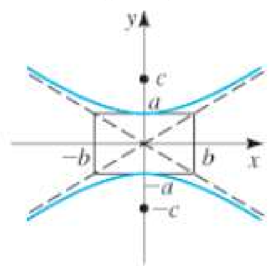
Hyperbolas

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



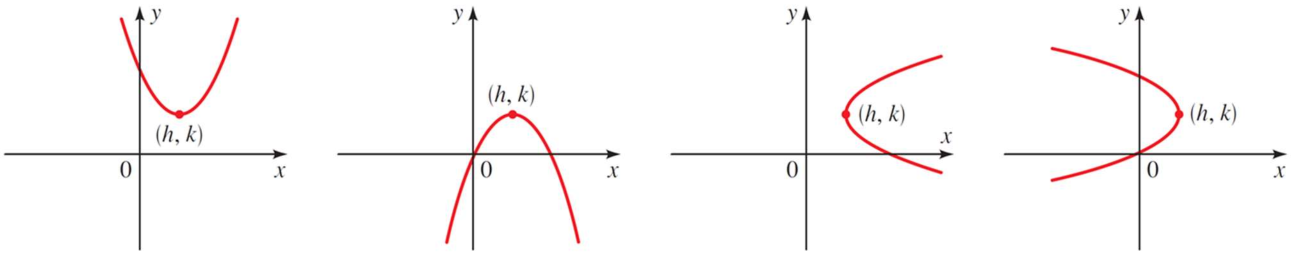
Foci $(\pm c, 0)$, $c^2 = a^2 + b^2$

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



Foci $(0, \pm c)$, $c^2 = a^2 + b^2$

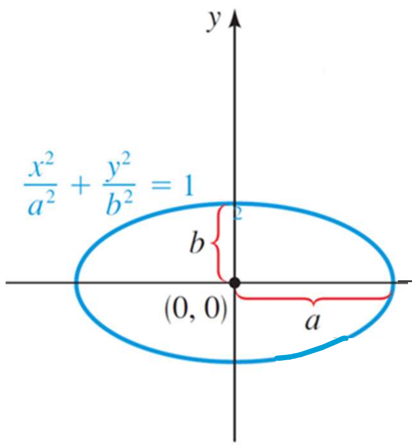
Shifted Parabolas

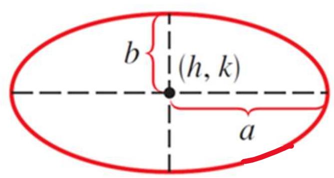


(a) $(x-h)^2 = 4p(y-k)$, $p > 0$
(b) $(x-h)^2 = 4p(y-k)$, $p < 0$
(c) $(y-k)^2 = 4p(x-h)$, $p > 0$
(d) $(y-k)^2 = 4p(x-h)$, $p < 0$

Shifted Ellipses

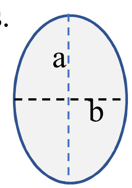
$$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$$





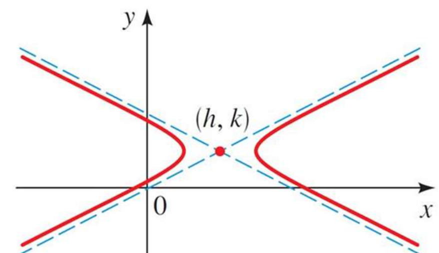
Horizontal orientation since the largest denominator a^2 aligns with the x values.

NOTE: the ellipse will have vertical orientation if the largest denominator a^2 aligns with the y values.

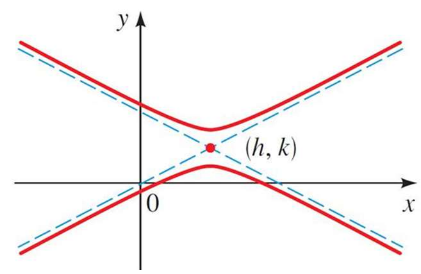


$$\frac{(x-h)^2}{b^2} + \frac{(y-k)^2}{a^2} = 1$$

Shifted Hyperbolas



$$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$$



$$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$$