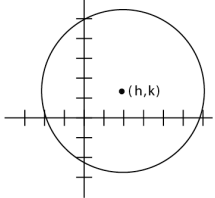
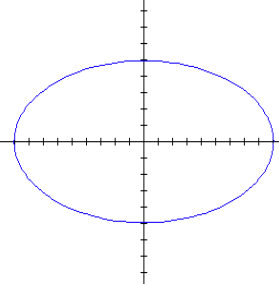
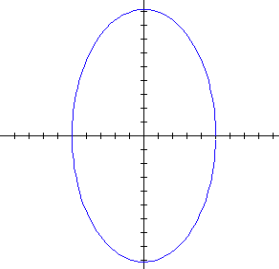
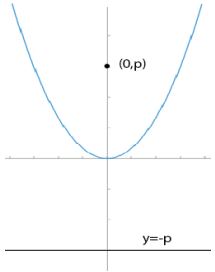
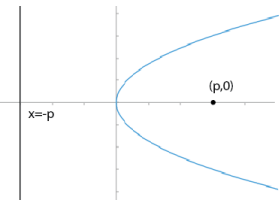


## Conics

Graph	Equation	Comments
<p>Decentered Circle</p> 	$x^2 + y^2 = r^2$ <p>Decentered:</p> $(x-h)^2 + (y-k)^2 = r^2$ $x^2 + y^2 - 2hx - 2ky + (h^2 + k^2 - r^2) = 0$	<p><math>r</math> is the radius of the circle.</p> <p><math>(h, k)</math> is the center of the circle.</p> <p>Find <math>h</math> and <math>k</math> by inspection, then <math>r</math>.</p>
<p>Horizontal Ellipse</p> 	$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ the ellipse is centered  $a^2 = b^2 + c^2$ <p>means <math>a &gt; b</math> and <math>a &gt; c</math></p> <p>Vertices: <math>(\pm a, 0)</math></p> <p>Foci: <math>(\pm c, 0)</math></p>	<p><math>a &gt; b</math>    <math>a^2</math> is under the <math>x^2</math>.</p> <p>The maximum value of <math>x</math> is <math>a</math></p> <p>The maximum value of <math>y</math> is <math>b</math></p> <p>So <math>x_{\max} &gt; y_{\max}</math> hence horizontal.</p> <p>The <math>y</math> values of the vertices and foci are all <math>0</math>.</p>
<p>Vertical Ellipse</p> 	$\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1$ the ellipse is centered  $a^2 = b^2 + c^2$ <p>means <math>a &gt; b</math> and <math>a &gt; c</math></p> <p>Vertices: <math>(0, \pm a)</math></p> <p>Foci: <math>(0, \pm c)</math></p>	<p><math>a &gt; b</math>    <math>a^2</math> is under the <math>y^2</math> now.</p> <p>The maximum value of <math>x</math> is <math>b</math></p> <p>The maximum value of <math>y</math> is <math>a</math></p> <p>So <math>y_{\max} &gt; x_{\max}</math> hence vertical.</p> <p>The <math>x</math> values of the vertices and foci are all <math>0</math>.</p>
<p>Vertical Parabola</p> 	$x^2 = 4py$ the parabola is centered  <p>Focus: <math>(0, p)</math></p> <p>Directrix: <math>y = -p</math></p>	<p>The parabola vertex is the origin.</p> <p>If <math>p &lt; 0</math> the parabola opens down.</p>
<p>Horizontal Parabola</p> 	$y^2 = 4px$ the parabola is centered  <p>Focus: <math>(p, 0)</math></p> <p>Directrix: <math>x = -p</math></p>	<p>The parabola vertex is the origin.</p> <p>If <math>p &lt; 0</math> the parabola opens to the left.</p>

## Derivatives

Rule	Rule Number
$\frac{dc}{dx} = 0$	1
$\frac{dx^n}{dx} = nx^{n-1}$ with $\frac{dx}{dx} = \frac{dx^1}{dx} = 1$ and recall that $\sqrt[n]{a} = a^{1/n}$	2
$\frac{d(cu)}{dx} = c \frac{du}{dx}$	3
$\frac{d(u+v)}{dx} = \frac{du}{dx} + \frac{dv}{dx}$ and $\frac{d(u-v)}{dx} = \frac{du}{dx} - \frac{dv}{dx}$	4
$\frac{d(uv)}{dx} = u \frac{dv}{dx} + v \frac{du}{dx}$	5
$\frac{d\left(\frac{u}{v}\right)}{dx} = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$	6
$\frac{du^n}{dx} = nu^{n-1} \frac{du}{dx}$	7
$\frac{d}{dx} \log(u) = \frac{1}{u} \log(e) \frac{du}{dx}$ also $\frac{d}{dx} \log(u) = \frac{1}{u \ln(10)} \frac{du}{dx}$	8
$\frac{d}{dx} \ln(u) = \frac{1}{u} \frac{du}{dx}$	9
$\frac{de^u}{dx} = e^u \frac{du}{dx}$	10
$\frac{d}{dx} \sin(u) = \cos(u) \frac{du}{dx}$	11
$\frac{d}{dx} \cos(u) = -\sin(u) \frac{du}{dx}$	12

**Note:** don't forget the  $\frac{du}{dx}$  in most of the rules!!!!!!