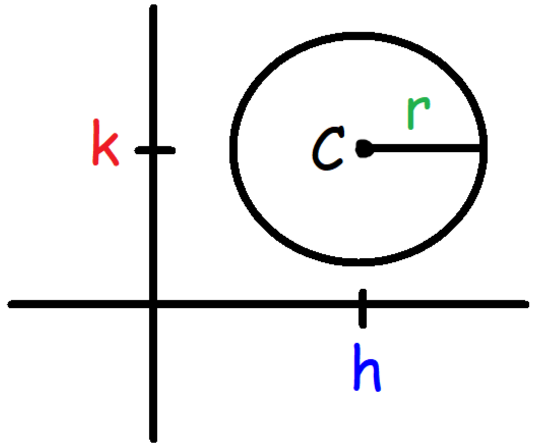
Conic Sections – Formula Sheet:

The Circle:



The Circle Equation:

$$(x-\boldsymbol{h})^2+(y-\boldsymbol{k})^2=\boldsymbol{r}^2$$

Center: $C(\boldsymbol{h},\boldsymbol{k})$
Radius: $\boldsymbol{r}$

Eccentricity:

$$e=0$$

Area of a Circle:

$$A=\pi r^2$$

Domain:

$$D[h-r,h+r]$$

Range:

$$R[k-r,k+r]$$

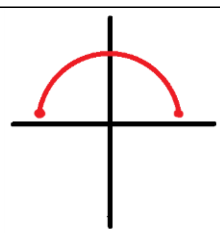
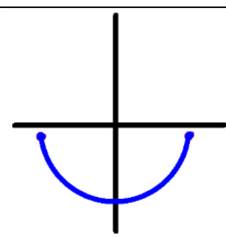
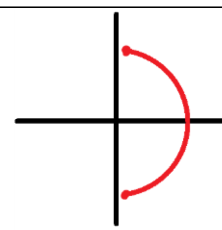
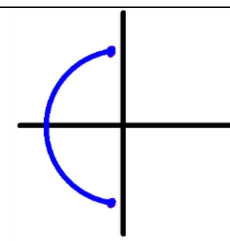
Circumference of a Circle:

$$C=2\pi r$$

Diameter:

$$d=2r$$

The Semicircle:

				
Equation:	$y=+\sqrt{r^2-(x-h)^2}+k$	$y=-\sqrt{r^2-(x-h)^2}+k$	$x=+\sqrt{r^2-(y-k)^2}+h$	$x=-\sqrt{r^2-(y-k)^2}+h$
Domain:	$D[h-r,h+r]$	$D[h-r,h+r]$	$D[h,h+r]$	$D[h-r,h]$
Range:	$R[k,k+r]$	$R[k-r,k]$	$R[k-r,k+r]$	$R[k-r,k+r]$

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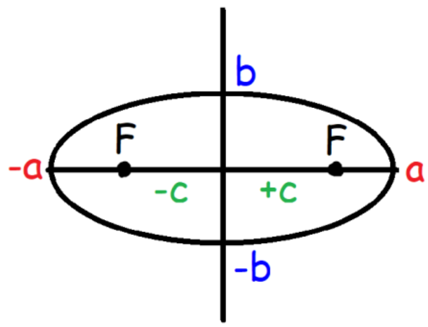
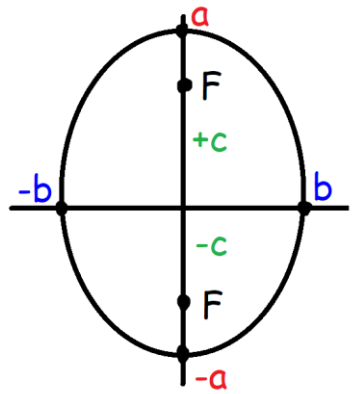
The Ellipse:

<table>
<tr>
<td>Pythagorean Relationship:

$c^2 = a^2 - b^2$

Eccentricity:

$e = \frac{c}{a} \qquad 0 < e < 1$

Area:
$A = \pi a b$</td>
<td>Horizontal Major Axis:

</td>
<td>Vertical Major Axis:

</td>
</tr>
<tr>
<td>Equation:
$a > b \quad a > c$

Center: $C(h, k)$</td>
<td>$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$</td>
<td>$\frac{(x-h)^2}{b^2} + \frac{(y-k)^2}{a^2} = 1$</td>
</tr>
<tr><td>The Foci:</td><td>$F(h \pm c, k)$</td><td>$F(h, k \pm c)$</td></tr>
<tr><td>Major Vertices:</td><td>$V(h \pm a, k)$</td><td>$V(h, k \pm a)$</td></tr>
<tr><td>Covertices:</td><td>$V(h, k \pm b)$</td><td>$V(h \pm b, k)$</td></tr>
<tr><td>Focal Axis:</td><td>$y = k$</td><td>$x = h$</td></tr>
<tr><td>Length of Major Axis:</td><td>$2a$</td><td>$2a$</td></tr>
<tr><td>Length of Minor Axis:</td><td>$2b$</td><td>$2b$</td></tr>
<tr><td>Domain:</td><td>$D[h-a, h+a]$</td><td>$D[h-b, h+b]$</td></tr>
<tr><td>Range:</td><td>$R[k-b, k+b]$</td><td>$R[k-a, k+b]$</td></tr>
<tr><td>X-intercept(s):</td><td>$x = \pm\frac{a}{b}\sqrt{b^2 - k^2} + h$</td><td>$x = \pm\frac{b}{a}\sqrt{a^2 - k^2} + h$</td></tr>
<tr><td>Y-intercept(s):</td><td>$y = \pm\frac{b}{a}\sqrt{a^2 - h^2} + k$</td><td>$y = \pm\frac{a}{b}\sqrt{b^2 - h^2} + k$</td></tr>
<tr><td>Circumference:

$C \approx \pi(a+b)$</td><td colspan="2">$C \approx \frac{2\pi\sqrt{\frac{a^2+b^2}{2}} + \pi(a+b)}{2} \qquad C = 4\int_0^{\frac{\pi}{2}} \sqrt{a^2 cos^2\theta + b^2 sin^2\theta}\, d\theta$</td></tr>
</table>

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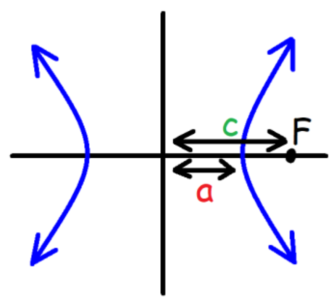
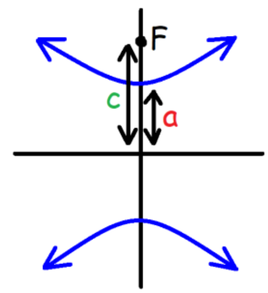
The Hyperbola:

Pythagorean Relationship:	Horizontal Transverse Axis:	Vertical Transverse Axis:
$c^2 = a^2 + b^2$ **Eccentricity:** $e = \frac{c}{a}$ $\quad e > 1$		
Equation: $c > a \quad c > b$ Center: $C(h, k)$	$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$	$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$
The Foci:	$F(h \pm c, k)$	$F(h, k \pm c)$
Vertices:	$V(h \pm a, k)$	$V(h, k \pm a)$
Focal Axis:	$y = k$	$x = h$
Asymptotes:	$y - k = \pm\frac{b}{a}(x - h)$	$y - k = \pm\frac{a}{b}(x - h)$
Domain:	$D(-\infty, h-a]U[h+a, \infty)$	$D(-\infty, \infty)$
Range:	$R(-\infty, \infty)$	$R(-\infty, k-a]U[k+a, \infty)$
X-intercept(s):	$x = \pm\frac{a}{b}\sqrt{k^2 + b^2} + h$	$x = \pm\frac{b}{a}\sqrt{k^2 - a^2} + h$
Y-intercept(s):	$y = \pm\frac{b}{a}\sqrt{h^2 - a^2} + k$	$y = \pm\frac{a}{b}\sqrt{h^2 + b^2} + k$

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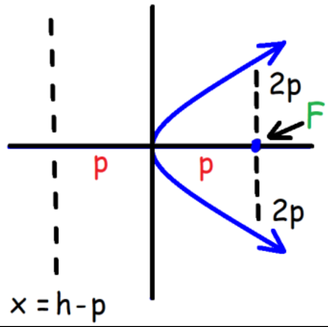
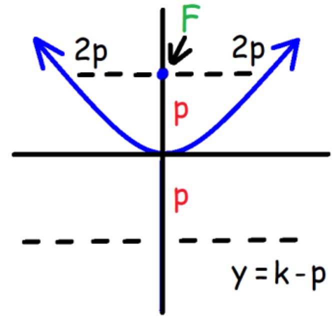
The Parabola:

Eccentricity: $\boldsymbol{e} = 1$ Vertex: $V(\boldsymbol{h}, \boldsymbol{k})$ Length of Latus Rectum: $4\boldsymbol{p}$	Horizontal Axis of Symmetry: 	Vertical Axis of Symmetry: 
Equation:	$(y - \boldsymbol{k})^2 = 4\boldsymbol{p}(x - \boldsymbol{h})$	$(x - \boldsymbol{h})^2 = 4\boldsymbol{p}(y - \boldsymbol{k})$
Focus:	$\boldsymbol{F}(\boldsymbol{h} + \boldsymbol{p}, \boldsymbol{k})$	$\boldsymbol{F}(\boldsymbol{h}, \boldsymbol{k} + \boldsymbol{p})$
Directrix:	$x = \boldsymbol{h} - \boldsymbol{p}$	$y = \boldsymbol{k} - \boldsymbol{p}$
Opens:	Right: $p = +$ Left: $p = -$	Up: $p = +$ Down: $p = -$
Axis of Symmetry:	$y = k$	$x = h$
Domain:	$D[h, \infty)\ when\ p = +$ $D(-\infty, h]\ when\ p = -$	$D(-\infty, \infty)$
Range:	$R(-\infty, \infty)$	$R[k, \infty)\ when\ p = +$ $R(-\infty, k]\ when\ p = -$
X-intercept(s):	$x = \frac{k^2}{4p} + h$	$x = \pm\sqrt{-4pk} + h$
Y-intercept(s):	$y = \pm\sqrt{-4ph} + k$	$y = \frac{h^2}{4p} + k$
Endpoints of Latus Rectum:	$E(h + p, k \pm 2p)$	$E(h \pm 2p, k + p)$