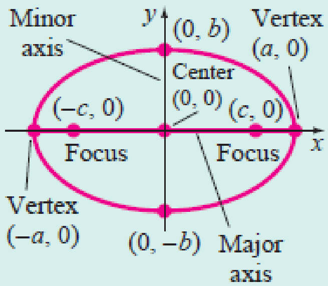
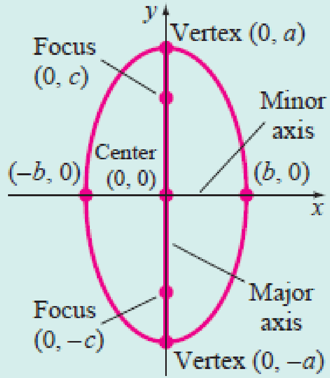
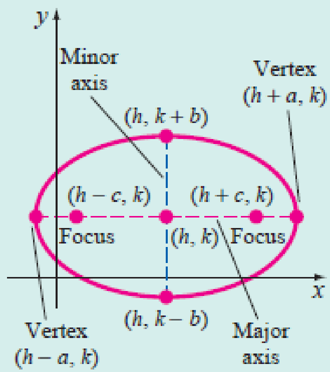
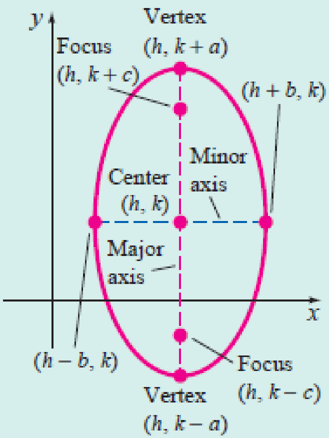
Ellipses with Center at the Origin

	Horizontal Major Axis	Vertical Major Axis
Graph	Figure 9.2.4 	Figure 9.2.5 
Equation	$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, a > b > 0$	$\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1, a > b > 0$
Center	$(0, 0)$	$(0, 0)$
Foci	$(-c, 0), (c, 0), c = \sqrt{a^2 - b^2}$	$(0, -c), (0, c), c = \sqrt{a^2 - b^2}$
Vertices	$(-a, 0), (a, 0)$	$(0, -a), (0, a)$
Major axis	Segment of x-axis from $(-a, 0)$ to $(a, 0)$	Segment of y-axis from $(0, -a)$ to $(0, a)$
Minor axis	Segment of y-axis from $(0, -b)$ to $(0, b)$	Segment of x-axis from $(-b, 0)$ to $(b, 0)$

Ellipses with Center at (h, k)

	Horizontal Major Axis	Vertical Major Axis
Graph	Figure 9.2.9 	Figure 9.2.10 
Equation	$\frac{(x-h)^2}{a^2}+\frac{(y-k)^2}{b^2}=1,\ a>b>0$	$\frac{(x-h)^2}{b^2}+\frac{(y-k)^2}{a^2}=1,\ a>b>0$
Center	(h, k)	(h, k)
Foci	$(h-c, k), (h+c, k), c=\sqrt{a^2-b^2}$	$(h, k-c), (h, k+c), c=\sqrt{a^2-b^2}$
Vertices	$(h-a, k), (h+a, k)$	$(h, k-a), (h, k+a)$
Major axis	Segment of the line $y=k$ from $(h-a, k)$ to $(h+a, k)$	Segment of the line $x=h$ from $(h, k-a)$ to $(h, k+a)$
Minor axis	Segment of the line $x=h$ from $(h, k-b)$ to $(h, k+b)$	Segment of the line $y=k$ from $(h-b, k)$ to $(h+b, k)$

▸ Ellipse with a horizontal major axis:

Equation	$\dfrac{(x-h)^2}{a^2}+\dfrac{(y-k)^2}{b^2}=1$
Center	(h, k)
Foci	$(h-c, k), (h+c, k), c=\sqrt{a^2-b^2}$
Vertices	$(h-a, k)$ and $(h+a, k)$
Major axis	Parallel to x-axis between $(h-a, k)$ and $(h+a, k)$
Minor axis	Parallel to y-axis between $(h, k-b)$ and $(h, k+b)$

If the center is at the origin, then $(h, k) = (0, 0)$.

▶ Ellipse with a vertical major axis:

Equation	$\dfrac{(x-h)^2}{b^2} + \dfrac{(y-k)^2}{a^2} = 1$
Center	(h, k)
Foci	$(h, k-c), (h, k+c), c = \sqrt{a^2 - b^2}$
Vertices	$(h, k-a)$ and $(h, k+a)$
Major axis	Parallel to y-axis between $(h, k-a)$ and $(h, k+a)$
Minor axis	Parallel to x-axis between $(h-b, k)$ and $(h+b, k)$

If the center is at the origin, then $(h, k) = (0, 0)$.