

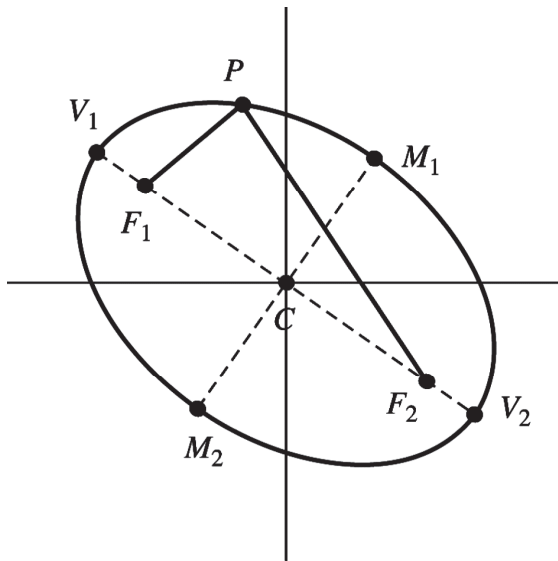
Section 10.3: The Ellipse

Key Topics: equations of an ellipse, foci, vertices, center, major axis, minor axis

Ellipse

An **ellipse** is the set of all points in the plane, the _____ of whose _____ from _____ is a _____. The fixed points are called the _____ (the plural of *focus*) of the ellipse.

The _____ of the ellipse with the line through the foci are called the _____ (plural of *vertex*). The line _____ connecting the _____ is the _____ of the ellipse. The _____ of the _____ axis is the _____ of the ellipse. The line _____ that is _____ to the major axis at the _____ and with endpoints on the ellipse is called the _____. See the following figure.



Points F_1 and F_2 are the foci.
 Points V_1 and V_2 are the vertices.
 Point C is the center.
 Segment $\overline{V_1 V_2}$ is the major axis.
 Segment $\overline{M_1 M_2}$ is the minor axis.
 The sum of the distances $PF_1 + PF_2$ from any point P on the ellipse to the foci is constant.

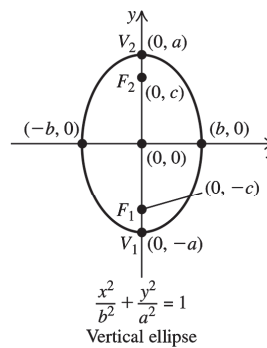
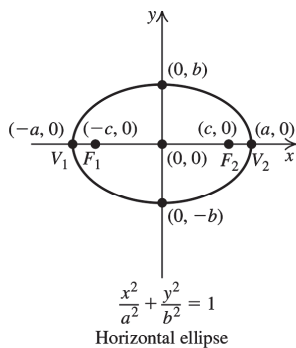
The equation $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is the **standard form of the equation of an ellipse** with _____ (0, 0) and foci _____ and _____, where $b^2 =$ _____.

SUMMARY OF **MAIN FACTS**

Main facts about an ellipse with center (0, 0)

Standard Equation	$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1; a > b > 0$	$\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1; a > b > 0$
	(Horizontal ellipse)	(Vertical ellipse)
Relationship between a , b , and c	$b^2 = a^2 - c^2$	$b^2 = a^2 - c^2$
Major axis along	_____ ($y = 0$)	_____ ($x = 0$)
Length of major axis	$2a$	$2a$
Minor axis along	_____ ($x = 0$)	_____ ($y = 0$)
Length of minor axis	$2b$	$2b$
Vertices	(____, 0)	(0, ____)
Foci	(____, 0)	(0, ____)
Endpoints of minor axis	(0, ____)	(____, 0)
Symmetry	The graph is _____ with respect to the x -axis, y -axis, and origin.	The graph is _____ with respect to the x -axis, y -axis, and origin.

Graph

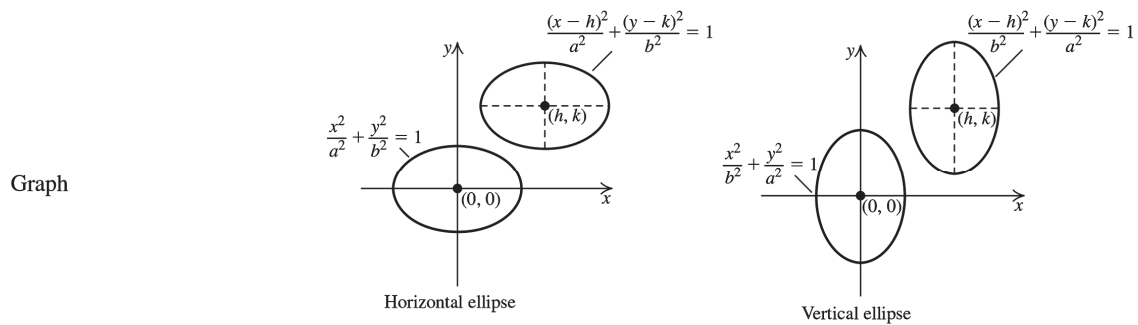


Find the standard form of the equation of the ellipse that has vertex (0,13) and foci (0,±5).

SUMMARY OF **MAIN FACTS**

Main facts about horizontal and vertical ellipses with center (h, k)

Standard Equation	$\frac{(y - k)^2}{b^2} = 1;$	$\frac{(x - h)^2}{b^2} + \frac{(y - k)^2}{a^2} = 1;$
	$a > b > 0$ (Horizontal ellipse)	$a > b > 0$ (Vertical ellipse)
Center	_____	_____
Major axis along the line	_____	_____
Length of major axis	$2a$	$2a$
Minor axis along the line	_____	_____
Length of minor axis	$2b$	$2b$
Vertices	$(\text{____}, k), (\text{____}, k)$	$(h, \text{____}), (h, \text{____})$
Endpoints of minor axis	$(h, \text{____}), (h, \text{____})$	$(\text{____}, k), (\text{____}, k)$
Foci	$(\text{____}, k), (\text{____}, k)$	$(h, \text{____}), (h, \text{____})$
Equation involving $a, b,$ and c	$c^2 = a^2 - b^2$	$c^2 = a^2 - b^2$
Symmetry	The graph is symmetric about the lines _____ and _____.	The graph is symmetric about the lines _____ and _____.



GENERAL EQUATION OF AN ELLIPSE

The graph of $Ax^2 + Cy^2 + Dx + Ey + F = 0$ is an ellipse if _____. That is, _____ A nor C is zero, and both have the _____.

Sketch a graph of the ellipse whose equation is $25x^2 + 16y^2 = 400$ and specify the foci.