9.2 Ellipses

Definition of an Ellipse

An ellipse is the set of all points \((x, y)\) in a plane, the sum of whose distances from two distinct fixed points (foci) is constant.

\(d_1 + d_2\) is constant.

The line through the foci intersects the ellipse at two points called the vertices. The chord joining the vertices is the major axis, and its midpoint is the center of the ellipse. The chord perpendicular to the major axis at the center is the minor axis.

Standard form of the equation of an ellipse

The coordinate of the right vertex is \((a,0)\). The coordinate of the left vertex is \((-a,0)\).
In a general ellipse
The coordinate of the top co-vertex is (0, b)
The coordinate of the bottom vertex is (0, -b)

Focus:
Focus: $c = \pm \sqrt{a^2 - b^2}$

Find the center, vertices, and foci of the ellipse given by
$9x^2 + 4y^2 = 36$

Find the standard form of the equation of the ellipse centered at the origin with major axis of length 10 and foci at (±3, 0).

Find the standard form of the equation of the ellipse with center at the origin.
$9x^2 + 4y^2 + 36x - 24y + 36 = 0$

Vertical
Center: $(a, b) = (3, 3)$
$a = 3, b = 2, c = \sqrt{5}$

Foci: $(a, b) = (3, 3)$

Equations:
- $9(x + 3)^2 + 4(y - 3)^2 = \frac{36}{5}$
- $(x + 3)^2 + \frac{(y - 3)^2}{9} = 1$
String Ellipse with measures.gsp