9.6 Translate and Classify Conic Sections

TEKS 2A.5.A, 2A.5.B, 2A.5.D, 2A.5.E

Before You graphed and wrote equations of conic sections.

Now You will translate conic sections.

Why? So you can model motion, as in Ex. 49.

Key Vocabulary
- conic sections (conics)
- general second-degree equation
- discriminant

Because parabolas, circles, ellipses, and hyperbolas are formed when a plane intersects a double-napped cone, they are called **conic sections** or **conics**.

Previously, you studied equations of parabolas with vertices at the origin and equations of circles, ellipses, and hyperbolas with centers at the origin. Now you will study how translating conics in the coordinate plane affects their equations.

KEY CONCEPT — *For Your Notebook*

Standard Form of Equations of Translated Conics

In the following equations, the point (h, k) is the *vertex* of the parabola and the *center* of the other conics.

Circle $(x-h)^2 + (y-k)^2 = r^2$

	Horizontal axis	Vertical axis
Parabola	$(y-k)^2 = 4p(x-h)$	$(x-h)^2 = 4p(y-k)$
Ellipse	$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$	$\frac{(x-h)^2}{b^2} + \frac{(y-k)^2}{a^2} = 1$
Hyperbola	$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$	$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$

EXAMPLE 1 Graph the equation of a translated circle

Graph $(x-2)^2 + (y+3)^2 = 9$.

Solution

STEP 1 **Compare** the given equation to the standard form of an equation of a circle. You can see that the graph is a circle with center at $(h, k) = (2, -3)$ and radius $r = \sqrt{9} = 3$.

STEP 2 **Plot** the center. Then plot several points that are each **3** units from the center:

$(2 + 3, -3) = (5, -3)$ $(2 - 3, -3) = (-1, -3)$

$(2, -3 + 3) = (2, 0)$ $(2, -3 - 3) = (2, -6)$

STEP 3 **Draw** a circle through the points.