# 2.3.1 How can I write it in graphing form?

Completing the Square

In Lesson 2.1.1, you found that one way to rewrite the equation of a quadratic function from the standard form $f(x) = ax^2 + bx + c$ to the graphing form $f(x) = a(x - h)^2 + k$ is to find the vertex and then substitute the coordinates of the vertex for h and k. But how can you find the graphing form for an equation like $x^2 + 4x + y^2 + 2y = 11$? In this lesson you will review how to **complete the square** to rewrite equations in graphing form.

2-132. COMPLETING THE SQUARE

Tessa is at home struggling with her math homework. She missed class and does not understand **completing the square**. She is supposed to complete the square to rewrite $y = x^2 + 8x + 10$ in graphing form. Her friend Mara brought over her algebra tiles to help. She spread out the tiles shown below on the table, and said, "*Now you need to build a square!*"

Unfortunately, Mara had to leave to babysit her younger brother. Can you help Tessa out?

    a. Use algebra tiles or a rectangular area model to complete the square and rewrite the equation $y = x^2 + 8x + 10$ in graphing form. This can be done using the *2-132 Student eTool* (CPM).

    b. Where is the vertex of the parabola?

    c. Sketch a graph of the parabola.

2-133. Help Tessa with a new problem. She needs to complete the square to write $y = x^2 + 4x + 9$ in graphing form. Use algebra tiles or an area model to help her figure out how to make this expression into a square. Does she have too few or too many unit tiles this time? Write her equation in graphing form, name the vertex, and sketch the graph.

2-134. Tessa is stuck on another homework problem, and needs your team's help again. She is supposed to sketch a quick graph of $x^2 + y^2 + 4x - 8y + 11 = 0$. She is pretty sure that it is a circle, but she does not know how to get it into graphing form. She thinks she can use algebra tiles to figure it out, only this time she will need more kinds of tiles. She collected the tiles shown in the diagram below.
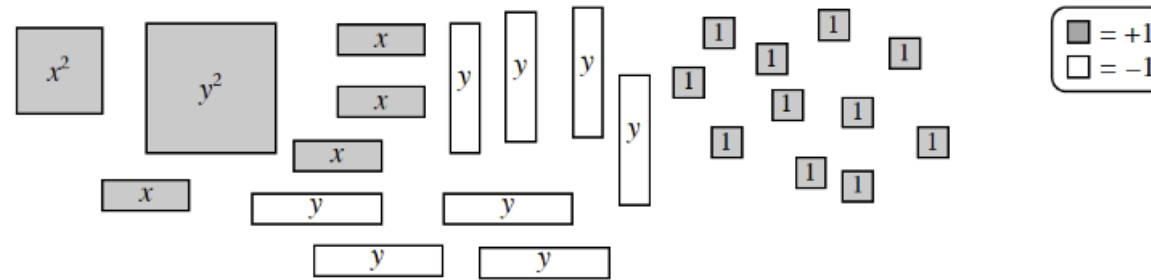
a. With your team, figure out how to arrange the tiles to form two squares. This can be done using the *2-134 Student eTool* (CPM).

b. How many unit tiles are needed to complete the two squares?

c. Write the equation in graphing form and sketch a graph.

d. Complete the square to rewrite $x^2 + y^2 - 4x + 6y - 3 = 0$ in graphing form and sketch a graph.

2-135. Write each equation in graphing form, then state the vertex of the parabola or the center and radius of the circle.

a. $y = x^2 + 6x + 7$

b. $f(x) = 3x^2 + 12x + 11$

c. $x^2 + y^2 + 2x - 4y = 4$

d. $f(x) = x^2 + 7x + 2$

e. $y = 2x^2 + 16x$

f. $x^2 + y^2 + y + 2 = 8$

b. $f(x) = 3x^2 + 12x + 11$

$f(x) =$

$+1$

$f(x) + 1 = 3(x^2 + 4x + 4)$

$f(x) + 1 = 3(x+2)^2$

$f(x) = 3(x+2)^2 - 1$