MCF3M Unit 3, Lesson 6

## Completing the Square (Part 2)

Today we will look at completing the square for quadratic functions where the leading coefficient (a-value) is not equal to one.

As a warm-up, complete the square for the following:

$$f(x) = x^{2} - 6x + 1$$

$$= x^{2} - 6x + 9 + 1 - 9$$

$$= (x - 3)^{2} - 8$$

$$(-3)^{2} = 9$$

We will work through an example of how to handle the case where  $a \neq 1$ .

$$y = \frac{2x^{2} + 8x - 1}{2}$$

$$= 2(x^{2} + 4x + 4) - 1 - 8$$

$$= 2(x + 2)^{2} - 9$$

$$f(x) = \frac{3x^{2} + 18x + 2}{3}$$

$$= 3(x^{2} + 6x + 9) + 2^{-27} + \frac{6}{2} = 3$$

$$= 3(x + 3)^{2} - 25$$

$$= 3(x + 3)^{2} - 25$$

You try: 
$$y = \frac{-2x^2}{-2} = \frac{4x}{-2} + 6$$
  
=  $-2(x^2 + 2x + 1) + 6 + 2$   
=  $-2(x + 1)^2 + 8$ 

Notice that fractions become necessary if the second coefficient is not divisible by a.

$$y = 2x^{2} + x - 1$$

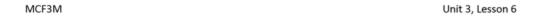
$$= 2\left(x^{2} + \frac{1}{2}x + \frac{1}{16}\right) - 1 - \frac{1}{8}$$

$$= 2\left(x + \frac{1}{14}\right)^{2} - 1\frac{1}{8}$$

$$\left(\frac{1}{14}\right)^{2} = \frac{1}{16}$$

$$y = -2x^{2} + 3x + 1$$

$$\left(\frac{1}{14}\right)^{2} = \frac{1}{16}$$



You try... Complete the square for  $f(x) = 3x^2 + 2x - 3$  and state the vertex.

It is also possible to complete the square in one step (if you derive the formula below.)

$$y = ax^2 + bx + c$$

Try it with...

$$y = 2x^2 - 5x + 3$$