U3:L3 Completing the Square

Remember, quadratics can be expressed in both…

STANDARD FORM	$f(x) = ax^2 + bx + c$
VERTEX FORM	$f(x) = a(x-p)^2 + q$

Vertex form has advantages because you can identify coordinates of the vertex (p,q) immediately.

The process of converting from standard to vertex form is called completing the square.

The goal of this is to re-write a perfect square trinomial as the square of a binomial.

Remember…

$$a^2 + 2ab + b^2$$

Perfect Square Trinomial

Square of 1st term a

Twice the product of the two terms

Square of last term b

$$(a+b)^2$$

squared binomial

$$(x+6)^2$$

$$x^2 + 2(x \cdot 6) + 6^2$$

$$x^2 + 12x + 36$$

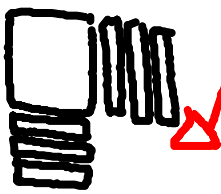
2 #s ×

2 #s +

To help complete the square, we can work with algebra tiles…

$f(x) = x^2 + 6x + 5$

create a square



what do I need?

ADD ZERO PAIRS

$+9-9$

SF

$\therefore x^2+6x+9$

or

$(x+3)^2$

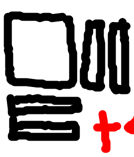
$\downarrow$

$(x+3)^2-4$

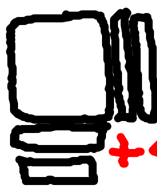
leftover

V.F

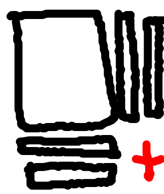
SF $f(x) = \boxed{3x^2 - 12x} - 9$



$+4$



$+4$



$+4$

x^2-4x+4

$(x-2)^2$

$\times 3$

✓ $+12$ -12 zero Pairs

leftover

$-12+(-9)$

-21

VF $3(x-2)^2-21$

$f(x) = -5x^2 - 70x$

Some equations are too big to solve with tiles… therefore we need to solve algebraically…

!! No drawing

Algebraically…

$f(x) = x^2 + 6x + 5$

$y = x^2 + 6x + 5$ ★ group 1ST 2 terms

$y = (x^2 + \underline{6}x) + 5$ ★ + and − square of ½ b

$6 - 2 = 3^2 = 9$

$y = (\underline{x^2 + 6x + 9} - 9) + 5$ ★ group perfect square trinomial

$y = (\underline{x^2 + 6x + 9}) - 9 + 5$ ★ Find square binomial

$y = (x+3)^2 - 9 + 5$ ★ simplify

$\boxed{y = (x+3)^2 - 4}$

$f(x) = 3x^2 - 12x - 9$

$y = (3x^2 - 12x) - 9$

$y = 3(x^2 - 4x) - 9$ $\quad \frac{-4}{2} = -2^2 = 4$

$y = 3(\underline{x^2 - 4x + 4} - 4) - 9$

$y = 3(x^2 - 4x + 4) - 12 - 9$

$\boxed{y = 3(x-2)^2 - 21}$

$f(x) = -5x^2 - 70x$

Verifying Equivalency

Convert $y = 4x^2 - 28x - 23$ to vertex:

Verify:

Work Backwards

Write a quadratic Model Function

A store sells re-usable water bottles for $8. At this price their weekly sales are approximately 100 items. Research says that for every $2 increase in price, they can expect the store to sell five less water bottles.

a) Represent this situation with a quadratic function

b) Determine the maximum revenue base on these estimates.

c) What selling price will give the maximum revenue?

d) Explain any assumptions made in this situation.

Practice: Pages 192 – 197 Qs: 1, 4, 6, 9, 11.