What's Going On?

Checking In

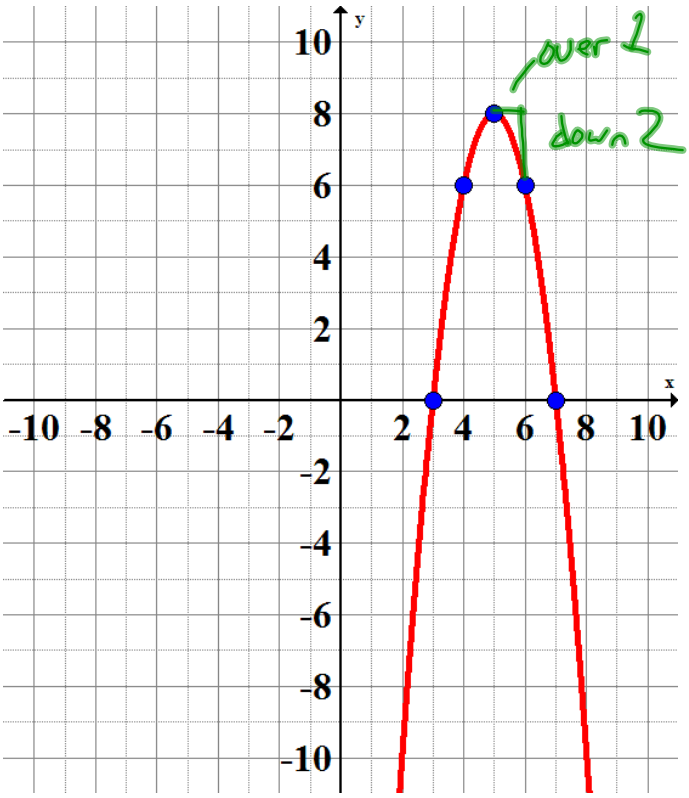
Minds on Completing the Square When a = 1

Action! Completing the Square When a ≠ 1

Consolidation Finding a Function

Learning Goal - I will understand how to graph quadratic functions in the form $y = ax^2 + bx + c$ by completing the square.

Who's Graph is it Anyway?



Vertex: (5, 8)
(h, k)

Therefore, **h = 5**
k = 8

The curve opens down so we know a is negative.

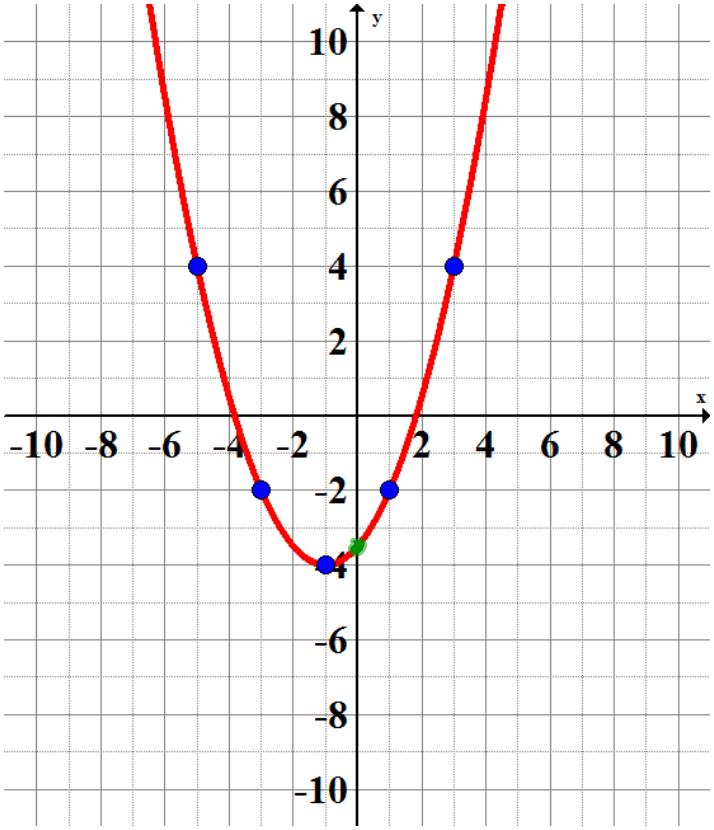
Specifically, the first step from the vertex is over 1, **down 2**.

Therfore, **a = -2**

Our equation is:

$y = -2(x - 5)^2 + 8$

Who's Graph is it Anyway?



Vertex: (-4, -4)
(h, k)

Therefore, **h = -4**
k = -4

The curve opens up so we know a is positive.

Specifically, the first step from the vertex is over 1, **up 0.5**.

Therfore, **a = +0.5**

Our equation is:

$y = 0.5(x + 4)^2 - 4$

Minds on

Graph It

Graph $y = x^2 + 8x + 12$

So far, we know how to graph quadratic functions (parabolas) in the form:

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

But this parabola is in the form:

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

What gives?

Minds on

Graph It

Graph $y = x^2 + 8x + 12$

To graph functions in the form $y = ax^2 + bx + c$

we first need to convert them into the form $y = a(x - h)^2 + k$.

perfect square trinomial

Minds on

Graph It

Graph $y = x^2 + 8x + 12$

If we just had $\mathbf{x^2 + 8x}$... what constant term would we need to get a perfect square trinomial?

We would need 16!!

$x^2 + 8x + 16 = (x + 4)^2$

Minds on

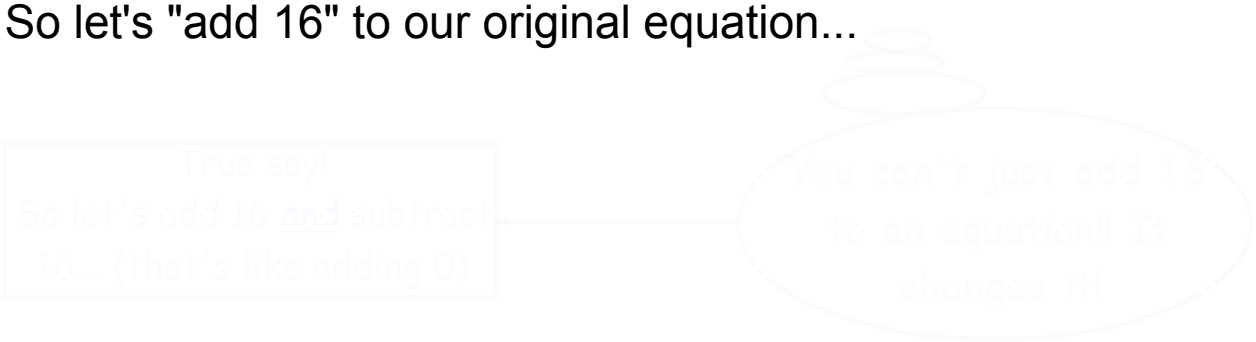
Graph It

Graph $y = x^2 + 8x + 12$

If we just had $x^2 + 8x$... what constant term would we need to get a perfect square trinomial?

16!

So let's "add 16" to our original equation...



Minds on

Graph It

Graph $y = x^2 + 8x + 12$

First we are going to add **and** subtract 16 to the original equation.

$$y = x^2 + 8x + 16 - 16 + 12$$

Let's factor this 'perfect square trinomial' like we did back in the day.

Minds on

Graph It

Graph $y = x^2 + 8x + 12$

First we are going to add **and** subtract 16 to the original equation.

$$y = x^2 + 8x + 16 - 16 + 12$$

$$y = (x + 4)^2 - 16 + 12$$

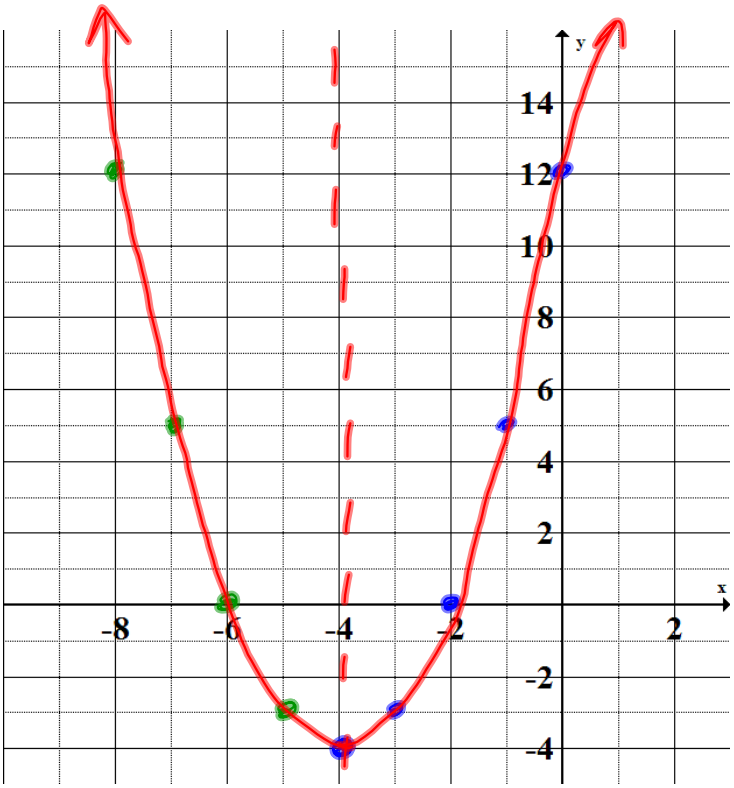
$$y = (x + 4)^2 - 4$$

Minds on

Graph $y = x^2 + 8x + 12$. Find the max/min.

After completing the square:

$y = (x + 4)^2 - 4$



a = 1, k = -4, h = -4

vertex

(-4, -4)

x-intercepts

x = -6, -2

y-intercept

y = 12

axis of symmetry

x = -4

maximum / minimum

y = -4

Minds on

Completing the Square When a = 1

$y = ax^2 + bx + c$

when a = 1

1. Determine what must be added to $x^2 + bx$ to make it a perfect square trinomial.

take half of b and square it

(Square half the coefficient of x)

2. Add **and** subtract the number found in step 1 to the original equation.

3. Group (or identify) the perfect square trinomial.

4. Factor the perfect square trinomial and include the remaining constant at the end.

Minds on

Completing the Square When a = 1

$y = x^2 + bx + c$ when $a = 1$

1. Determine what must be added to $x^2 + bx$ to make it a perfect square trinomial.

(Square half the coefficient of x)

2. Add **and** subtract the number found in step 1 to the original equation.

3. Group (or identify) the perfect square trinomial.

4. Factor the perfect square trinomial and include the remaining constant at the end.

$y = x^2 + 6x + 8$

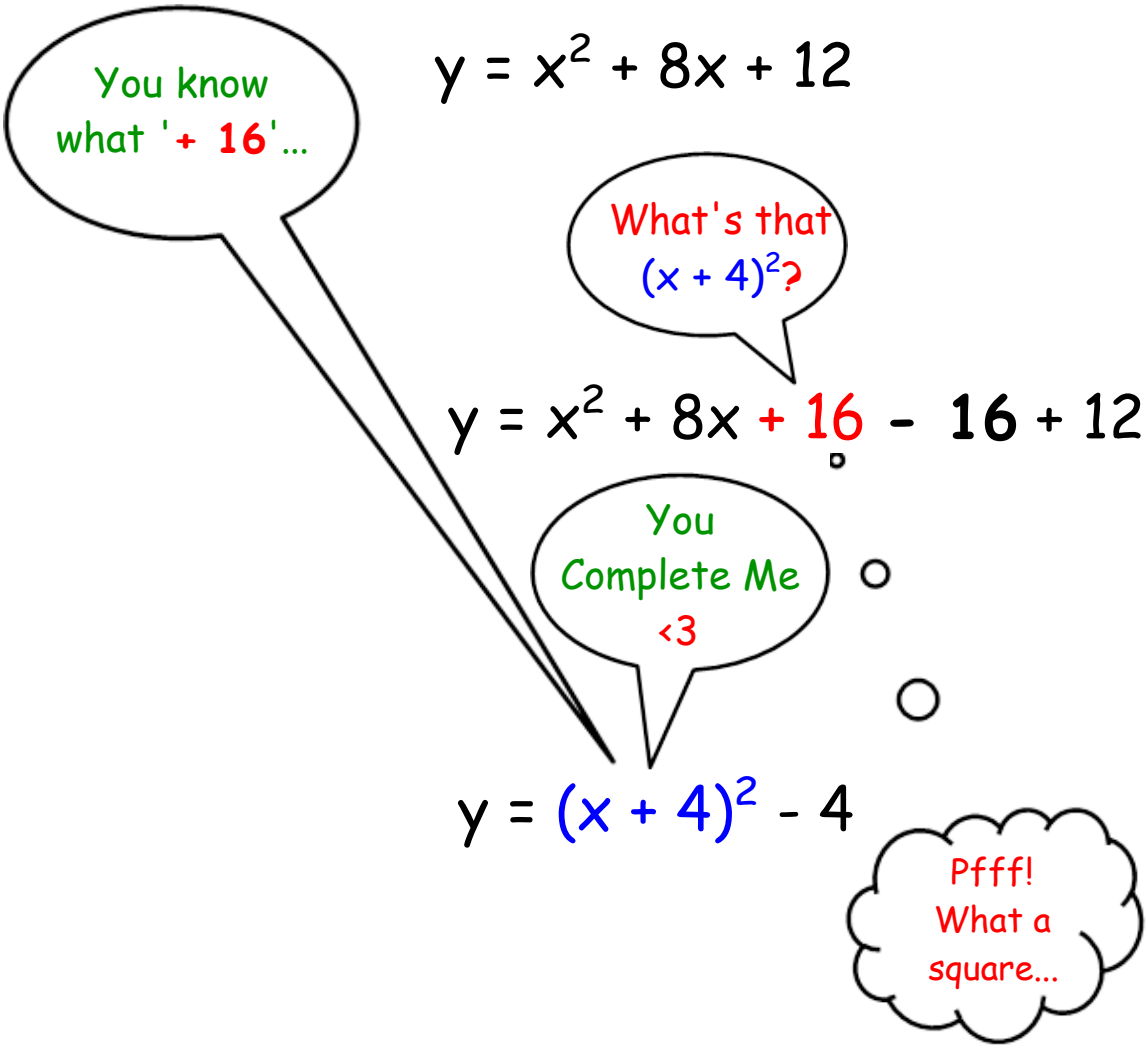
1. To make $x^2 + 6x$ a perfect square, we need to add 9.

(half the coefficient of x is 3... 3^2 is 9)

2. $y = x^2 + 6x + 9 - 9 + 8$

3. $y = (x^2 + 6x + 9) - 9 + 8$

4. $y = (x + 3)^2 - 1$


You know what '+ 16'...
$y = x^2 + 8x + 12$
What's that $(x + 4)^2$?
$y = x^2 + 8x + 16 - 16 + 12$
You Complete Me <3
$y = (x + 4)^2 - 4$
Pfff! What a square...

Complete the square: $y = x^2 + 4x - 7$

What do we need to add to $x^2 + 4x$
to create a ***perfect square trinomial***?

4

$\left(\frac{+4}{2}\right)^2 = (2)^2 = 4$

$y = (x^2 + 4x + 4) - 4 - 7$

$y = (x+2)^2 - 11$

Action!

Completing the Square When $a \neq 1$

Graph $y = -2x^2 + 8x - 5$

1. Factor the coefficient of x^2 from the first two terms.

2. Complete the square as you would when $a = 1$.

Don't forget to use the distributive property (PROPERLY) when you drop those brackets!

$y = -2x^2 + 8x - 5$

1. $y = -2[x^2 - 4x] - 5$

$\left(\frac{-4}{2}\right)^2 = (-2)^2 = 4$

2. $y = -2[x^2 - 4x + 4 - 4] - 5$

$y = -2[x^2 - 4x + 4) - 4] - 5$

$y = -2[(x - 2)^2 - 4] - 5$

$y = -2(x - 2)^2 + 8 - 5$

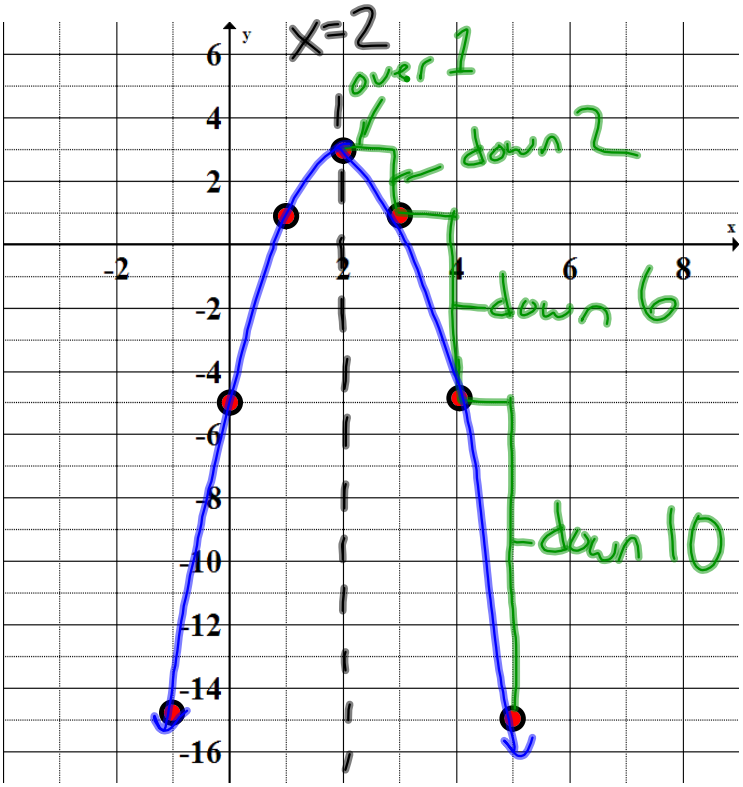
$y = -2(x - 2)^2 + 3$

Action!

Graph $y = -2x^2 + 8x - 5$

After completing the square:

$y = -2(x - 2)^2 + 3$



a = -2, k = 3, h = 2

vertex

(3, 2)

x-intercepts

x = 0.9, 3.1

y-intercept

y = -5

axis of symmetry

x = 2

maximum / minimum

y = 3

Complete the Square

$y = 3x^2 + 18x - 21$

1. Factor 3 out of $3x^2+18x$

$y=3(x^2+6x)-21$

2. What do we need to add to x^2+6x to get a perfect square trinomial?

b: "bee"

$\left(\frac{6}{2}\right)^2=(3)^2=9$

$y=3[x^2+6x+9-9]-21$

3. Identify the perfect square trinomial.

$y=3[(x^2+6x+9)-9]-21$

4. Factor it!

$y=3[(x+3)^2-9]-21$

5. Distribute the 3, simplify

$y=3(x+3)^2-27-21$

$y=3(x+3)^2-48$

Consolidation

Homework

Pg. 234 - 237

4 - 6(a, d)

7 - 9 (a, e, f)