What's Going On?

Checking In

Minds on Discriminate!

Action! Proving It

Consolidation 4 Parabolas

Learning Goal - I will be able to use the quadratic formula to solve and graph quadratic equations.

Checking In

Test Date . . .

FRIDAY

a while

Please choose your seats wisely.
I would like you to be able to work in groups, but there is a period of about ~~10-15~~ minutes where you will need to pay **very close attention**.

Minds on

How Many Roots?

How can we discriminate between quadratics with two distinct roots, two equal roots and no equal roots using **The Quadratic Formula?**

We use the **discriminant**

$$b^2 - 4ac$$

The Discriminant

$$b^2 - 4ac$$

real

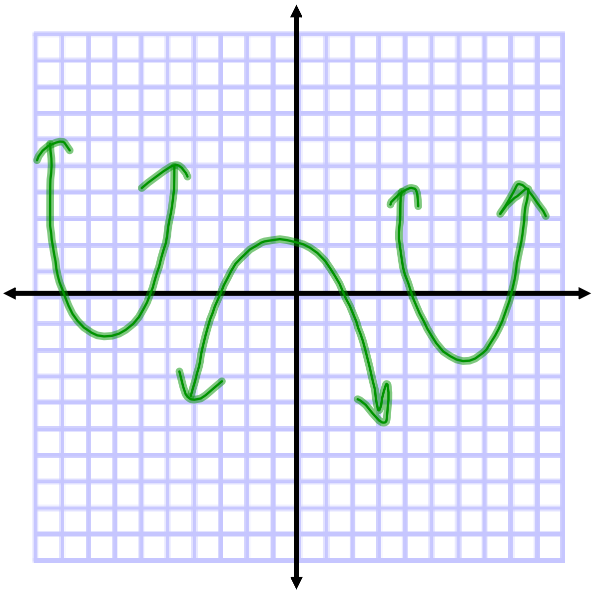
two distinct roots

The discriminant is positive

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$X = \frac{-b + \sqrt{+\#}}{2a}$$

$$X = \frac{-b - \sqrt{+\#}}{2a}$$



The Discriminant

$$b^2 - 4ac$$

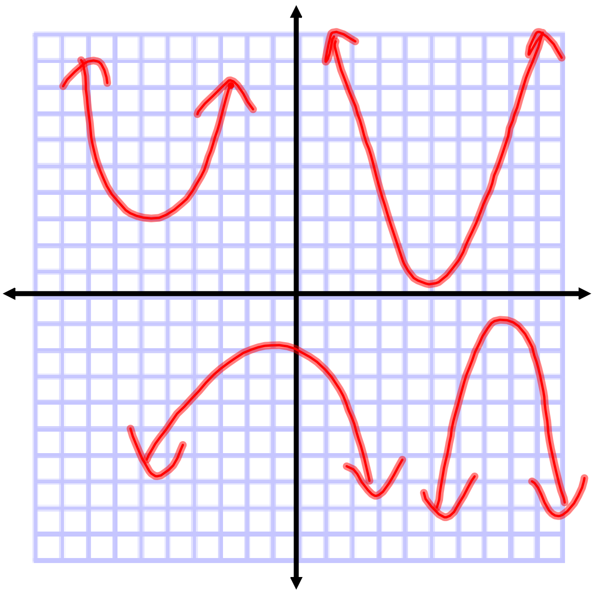
no real roots

The discriminant is negative

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$X = \frac{-b + \sqrt{-\#}}{2a}$$

$$X = \frac{-b - \sqrt{-\#}}{2a}$$



The Discriminant

$$b^2 - 4ac$$

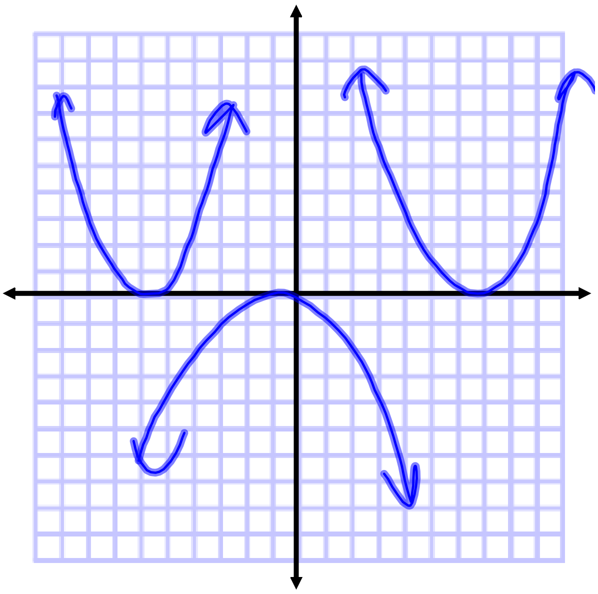
two equal roots

The discriminant is zero

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-b + \sqrt{0}}{2a}$$

$$x = \frac{-b - \sqrt{0}}{2a}$$



Action!

Proving It

Last week I told you that,

given a quadratic in the form: $ax^2 + bx + c = 0$

the **roots** are: $$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

And you believed me!!!

I don't know about you... but I need some **proof**!

Action!

Proving It

Claim

Given $ax^2 + bx + c = 0$, $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

To prove it, let's start by completing the square!

Steps to Completing the Square
(Review)

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

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

(**Square half the coefficient of x**)

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

4. Group the perfect square trinomial.

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

6. Use the distributive property to clear the square brackets and then simplify!

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Proving the Quadratic Formula

$$ax^2 + bx + c = 0$$

$$a\left[x^2 + \frac{bx}{a}\right] + c = 0$$

$$a\left[x^2 + \frac{bx}{a} + \frac{b^2}{4a^2} - \frac{b^2}{4a^2}\right] + c = 0$$

$$a\left[\left(x^2 + \frac{bx}{a} + \frac{b^2}{4a^2}\right) - \frac{b^2}{4a^2}\right] + c = 0$$

$$a\left[\left(x + \frac{b}{2a}\right)^2 - \frac{b^2}{4a^2}\right] + c = 0$$

$$a\left(x + \frac{b}{2a}\right)^2 - \frac{b^2}{4a} + c = 0$$

$$a\left(x + \frac{b}{2a}\right)^2 - \left(\frac{b^2 - 4ac}{4a}\right) = 0$$

General Vertex Form Equation

$$a\left(x+\frac{b}{2a}\right)^2 - \left(\frac{b^2-4ac}{4a}\right) = 0$$

$$\frac{\cancel{a}\left(x+\frac{b}{2a}\right)^2}{\cancel{a}} = \frac{\frac{b^2-4ac}{4a}}{a}$$

$$\sqrt{\left(x+\frac{b}{2a}\right)^2} = \frac{\sqrt{b^2-4ac}}{\sqrt{4a^2}}$$

$$x+\cancel{\frac{b}{2a}} = \pm\frac{\sqrt{b^2-4ac}}{2a}$$

$$\cancel{\left(-\frac{b}{2a}\right)} \quad \left(-\frac{b}{2a}\right)$$

$$x = \frac{-b}{2a} \pm \frac{\sqrt{b^2-4ac}}{2a}$$

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

Your New Best Friend!

Given

$$ax^2 + bx + c = 0$$

$$\boxed{h = \frac{-b}{2a}}$$

x-value of the vertex

Consolidation

Changing Gears

<u>Use the discriminant</u> to determine how many roots each quadratic has.

b^2-4ac

1. $y = -x^2 - 12x - 11$
2. $y = 2x^2 - 20x + 50$
3. $y = -0.5x^2 - 2x + 13$
4. $y = 2x^2 + 7x + 12$

Consolidation

Discriminate

Use the discriminant to determine how many roots each quadratic has.

b^2-4ac

1 $y = -x^2 - 12x - 11$

$a=-1,\ b=-12,\ c=-11$

b^2-4ac

$=(-12)^2-4(-1)(-11)$

$=144-44$

$=100$

The discriminant is (+)ve $\therefore$ we have 2 real roots

Consolidation

Discriminate

Use the discriminant to determine how many roots each quadratic has.

$b^2 - 4ac$

2 $y = 2x^2 - 20x + 50$

$a = 2,\ b = -20,\ c = 50$

$b^2 - 4ac$

$= (-20)^2 - 4(2)(50)$

$= 400 - 400$

$= 0$

The discriminant is 0. ∴ we have a double root or two equal roots.

Consolidation

Discriminate

Use the discriminant to determine how many roots each quadratic has.

$b^2 - 4ac$

3 $y = -0.5x^2 - 2x + 13$

$a = -0.5,\ b = -2,\ c = 13$

$b^2 - 4ac$

$= (-2)^2 - 4(-0.5)(13)$

$= 4 + 26$

$= 30$

The discriminant is $\oplus$ve. $\therefore$ we have 2 real roots.

Consolidation

Discriminate

<u>Use the discriminant</u> to determine how many roots each quadratic has.

$b^2 - 4ac$

4 $y = 2x^2 + 7x + 12$

$a = 2, b = 7, c = 12$

$b^2 - 4ac$

$= (7)^2 - 4(2)(12)$

$= 49 - 96$

$= -47$

The discriminant is negative. $\therefore$ we have no real roots.

Homework

Finish the Homework

Feel free to use your new skillz!

Two Line Calculator

Let's solve, with a two-line calculator using The Quadratic Formula.

$$x^2 + 6x + 8 = 0$$

NOTE: If you are asked for the ***exact roots***, a two-line calculator may not work!

They typically throw up decimal numbers!

So don't be too lazy, use your pencil.

Besides, it's easy to make a mistake with all the brackets and junk.