~~Warm Up.~~ $y = a(x-h)^2 + k$
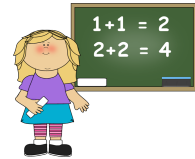
Given y = –(x + 2)² – 3, determine the following:

a. Does the parabola open up or down?

reg. leading coefficient

b. What is the vertex? $(2, -3)$

PEMA's

c. Write the equation of the parabola in standard form.

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

$y = -x^2 - 4x - 4 - 3$

$y = -x^2 - 4x - 7$

$(x+2)(x+2)$

$x^2 + 2x + 2x + 4$

Vocabulary

A parabola is defined as follows:

*For a given **point**, called **the focus**, and a given **line not through the focus**, called the **directrix**, a **parabola** is the **locus of points** such that the distance to the focus equals the distance to the directrix.*
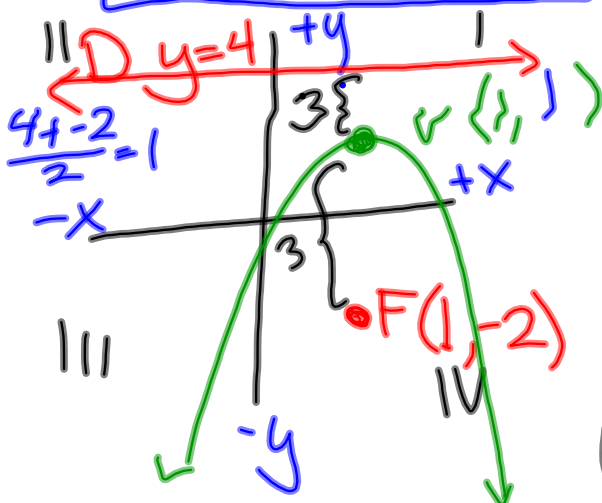
The **VERTEX** is halfway between the **directrix** and the **focus.**

The **directrix** will always be a horizontal line, **y = c** (this year).

The **parabola** and the **directrix** will **NEVER** intersect!!!

directrix

focus

Parabola

Equal distance !
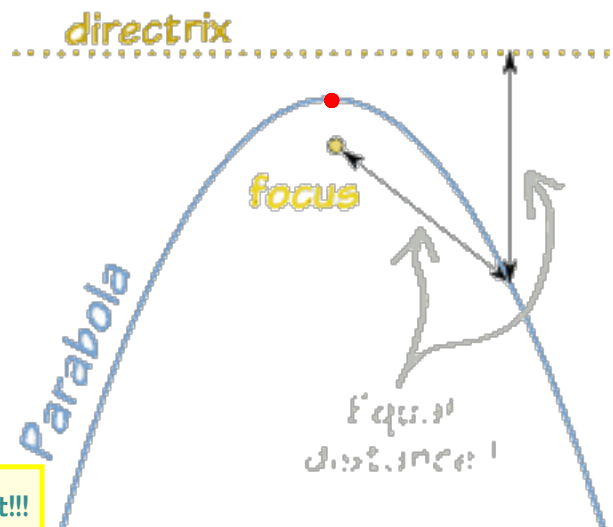
<u>Example #1:</u> Write an equation for the parabola with the focus at $(1, -2)$ and directrix at y = 4.

D y=4　+y

$\frac{4+-2}{2}=1$
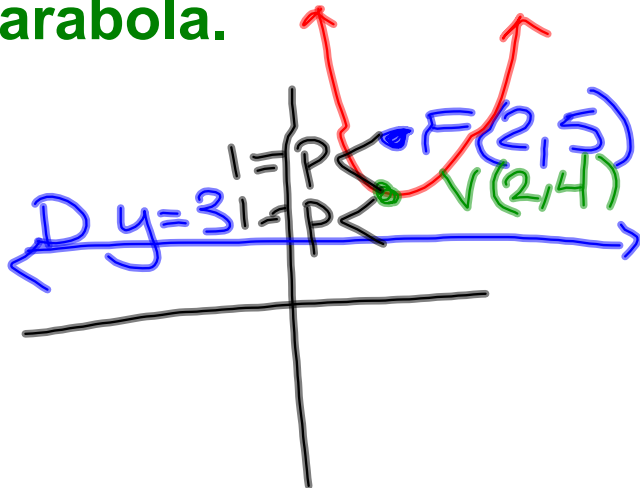
-x

3 {

r ⟨ 1, 1 ⟩

+x

3

•F(1,-2)

-y

$y = \frac{1}{4p}(x-h)^2 + k$

$y = \frac{-1}{4(3)}(x - 1)^2 + 1$

$$y = \frac{-1}{12}(x-1)^2 + 1$$

Example #2: If the **focus** of a parabola is **(2, 5)** and the **directrix** is **y = 3**, find the equation of the parabola.

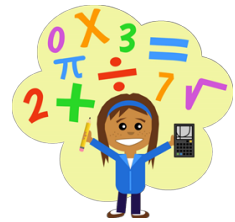$D \ y=3 \quad 1=p \quad 1=p$

$F(2,5)$

$V(2,4)$

$$y = \frac{1}{4p}(x-h)^2 + K$$

$$y = \frac{1}{4(1)}(x-2)^2 + 4$$

$$y = \frac{1}{4}(x-2)^2 + 4$$

EXAMPLE #3

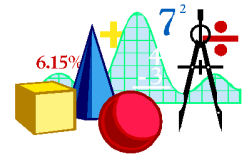**If the focus of a parabola is (-1, 6) and the directrix is y = 9, find the equation of the parabola.**

$D\ y=9$

$V(-1, 7.5)$

3

$F(-1, 6)$

$$y = \frac{-1}{4p}(x-h)^2 + K$$

$$y = \frac{-1}{4(1.5)}(x+1)^2 - 7.5$$

$$y = -\frac{1}{6}(x+1)^2 - \frac{15}{2}$$

EXAMPLE #4

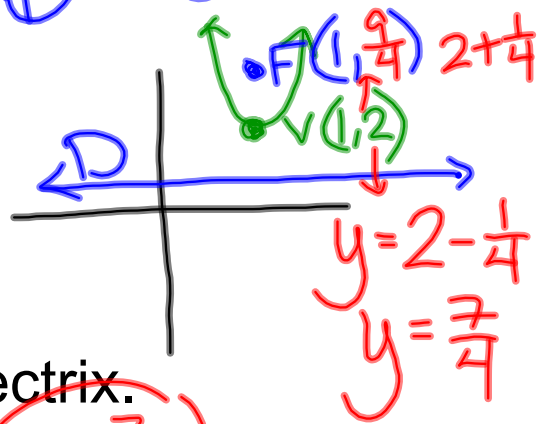$$y = \frac{1}{4p}(x-h)^2 + k$$

Given: $y = (x- 1)^2 + 2$

　a. Find the vertex.

$$(1, 2)$$

$F(1, \frac{9}{4})$　$2 + \frac{1}{4}$

$V(1, 2)$

D

$y = 2 - \frac{1}{4}$

$y = \frac{7}{4}$

　b. Find the focus and directrix.

$$4p \cdot 1 = \left(\frac{1}{4p}\right) 4p$$

$$\frac{4p}{4} = \frac{1}{4}$$

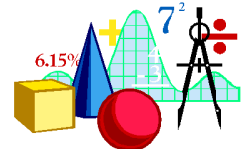$$p = \frac{1}{4}$$

$$\left(1, \frac{9}{4}\right)$$

$$y = \frac{7}{4}$$

EXAMPLE #5

Given: $y = 2x^2 + 8x + 10$

a. Find the vertex.

$(-2, 2)$

X	Y₁
-5	20
-4	10
-3	4
-2	2
-1	4
0	10
1	20

Press + for ΔTbl

b. Write the equation in vertex form.

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

$y = \frac{1}{4p}(x-h)^2 + k$

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

c. Find the focus and directrix.

$\frac{1}{4p}(4p) = 2(4p)$

$1 = 8p$

$\frac{1}{8} = p$

$F\left(-2, \frac{17}{8}\right)$

$D \quad y = \frac{15}{8}$

$V(-2, 2)$

$y + \frac{1}{8}$