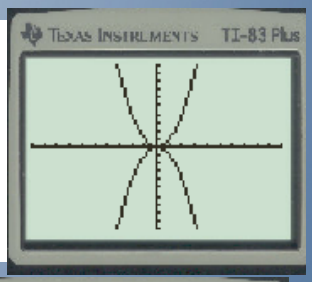
# Vertex Form...

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

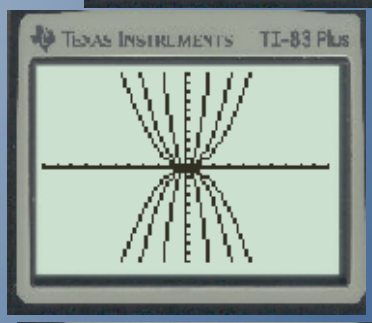
**Direction of Opening: ("Look at the sign of the stretch factor")**

- If $a > 0$, then the graph *opens upward*.
- If $a < 0$, then the graph *opens downward*.



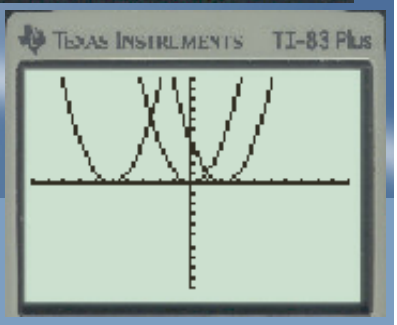

**Vertical Stretch: ("Look at the magnitude of the stretch factor")**

- If $|a| > 1$, then the graph becomes *narrower*.
- If $|a| = 1$, then the graph *stays the same*. *e same*.
- If $0 < |a| < 1$, then the graph becomes *wider*.



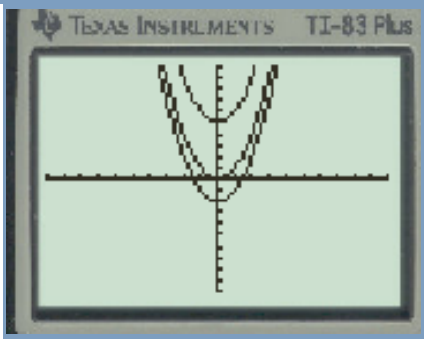

**Horizontal Translation: ("Think opposite")**

- If $h > 0$, then the graph *moves to the right h units*.
- If $h = 0$, then the graph *does not move horizontally*.
- If $h < 0$, then the graph *moves to the left h units*.

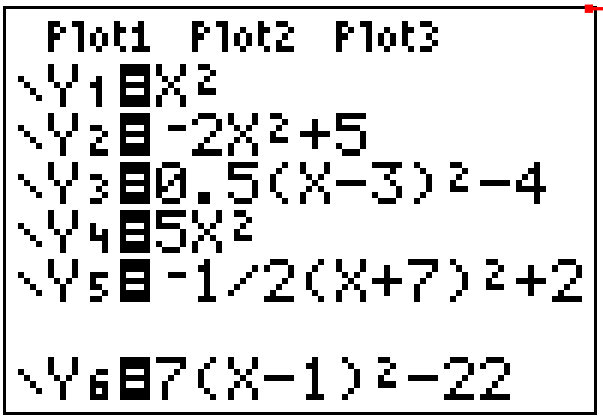



**Vertical Translation: ("Exactly the same")**

- If $k > 0$, then the graph *moves upward k units*.
- If $k = 0$, then the graph *does not move vertically*.
- If $k < 0$, then the graph *moves downward k units*.



# HOMEWORK EXERCISE:




| | OPEN UP? OPEN DOWN? | NARROW? WIDER? | LEFT? RIGHT? | UP? DOWN? |
|---|---|---|---|---|
| $Y_1$ | up | same | none | none |
| $Y_2$ | down | narrow | none | 5 |
| $Y_3$ | up | wide | R 3 | 4 |
| $Y_4$ | up | narrow | none | none |
| $Y_5$ | down | wide | L 7 | 2 |
| $Y_6$ | up | narrow | R 1 | D 22 |

# ALL Properties of a Quadratic

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

- **TRANSFORMATIONS...**

- stretch factor 'a' --> direction of opening & shape
- translations 'h' and 'k' --> horizontal / vertical movements

- **KEY POINTS...**

- vertex (h, k) --> lowest / highest point on the parabola
- x intercept(s) --> where the graph crosses the x axis
  --> let y = 0 and solve for x
  **(we will come back to this property)**
- y intercept --> where the graph crosses the y axis
  --> let x = 0 and solve for y
  --> is the 'c' value in standard form

- **PROPERTIES...**

- Domain --> describes all possible x values
  --> for quadratic functions $\{x \in R\}$
- Range --> describes all possible y values
  --> depends on direction of opening and "k" value in vertex
- Maximum / Minimum Value --> highest / lowest y value
  --> depends on direction of opening and "k value)
- Axis of symmetry --> vertical line of symmetry through vertex
  [A.O.S] --> described through x = h

VERTEX FORM $y = a(x-h)^2 + k$ Ex: $y = -3(x+2)^2 - 4$

Transformations...

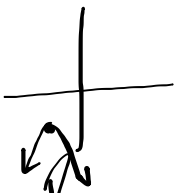
$a = -3$ ← stretch factor (sf) = 3 (always positive) ↑ narrower

$h = -2$ ← left 2

$k = -4$ ← down 4

Sign tells direction ⇒ per down

vertex $(-2, -4)$



Rearrange...

SAMDEB

x-int(s) → let $y = 0$

$0 = -3(x+2)^2 - 4$

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

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

Ooh No!

LOL?

y-int → let $x = 0$

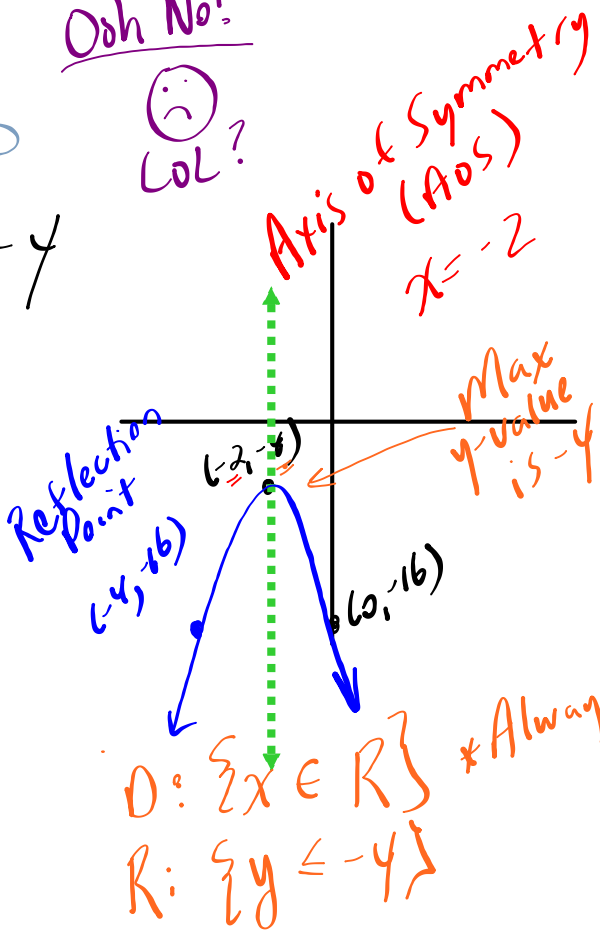
$y = -3(0+2)^2 - 4$

$y = -3(4) - 4$

$y = -12 - 4$

$y_{int} = -16$

$(0, -16)$




D: $\{x \in R\}$ *Always

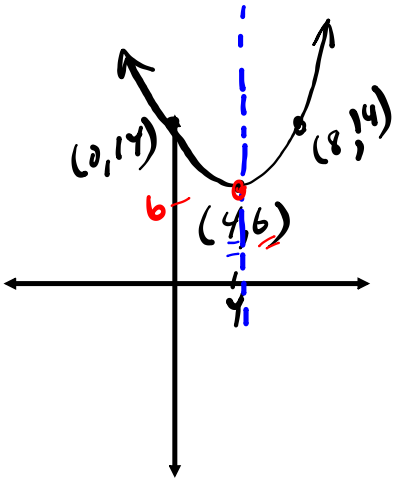
R: $\{y \leq -4\}$

Ex #2 $y = \frac{1}{2}(x-4)^2 + 6$

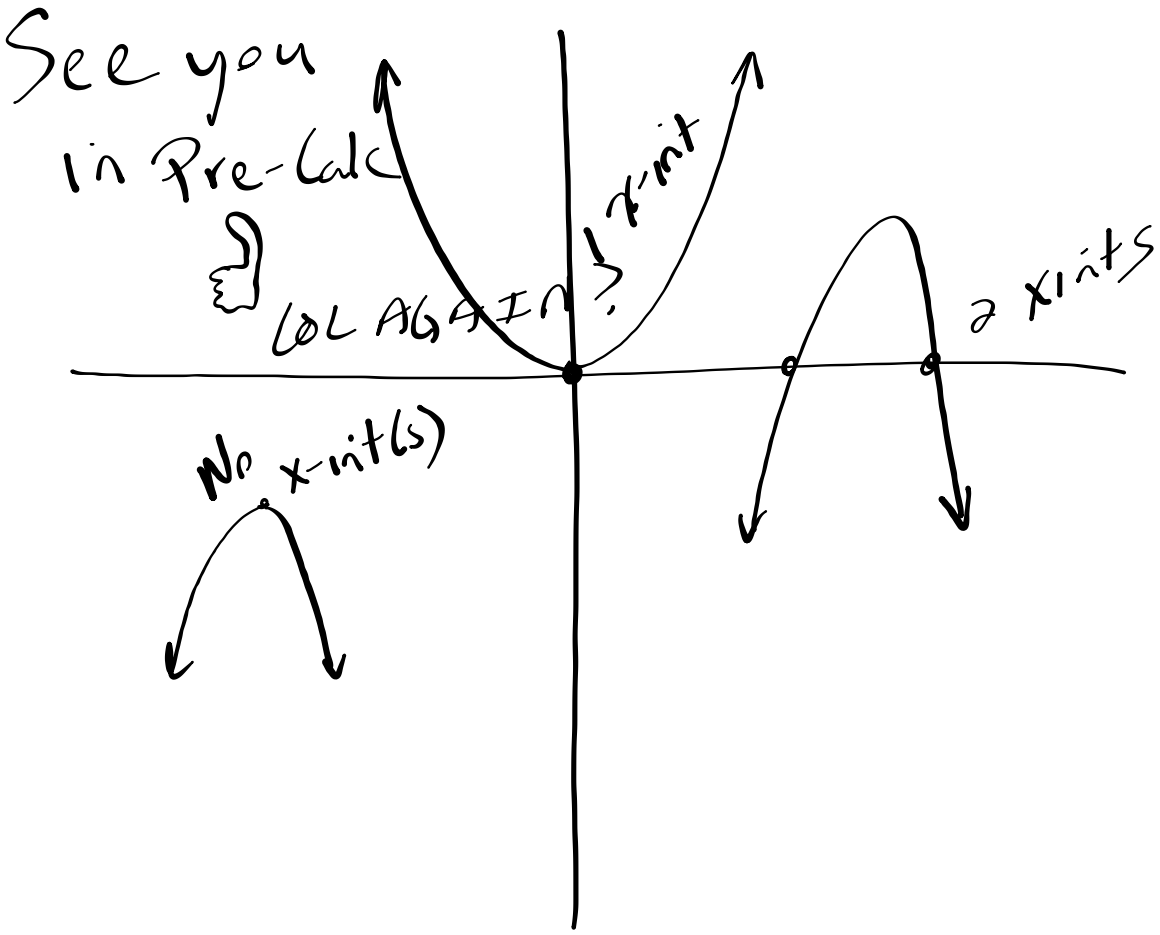
$a = \frac{1}{2}$ → open up / wider
$h = 4$ → R4
$K = 6$ → U6
S.f = ½ or 0.5
Vertex = (4,6)

y-int

$y = \frac{1}{2}(0-4)^2 + 6$
$y = \frac{1}{2}(16) + 6$
$y = 8 + 6$
$y = 14$ (0, 14)




AOS ⇒ $x = 4$
Min y value of 6
D: $\{x / x \in R\}$
R: $\{y / y \geq 6, y \in R\}$


See you
in Pre-Calc
LOL AGAIN?
1 x-int
2 x-ints
No x-int(s)

# HOMEWORK...

Worksheet - Properties of Quadratics.docx

## Attachments

Worksheet - Properties of Quadratics.docx