1) How does $f(x)=3x^2$ compare to $g(x)=2x^2$

$f(x)=3x^2$:
- concave up
- narrower than parent func
- vertex at (0,0)

$g(x)=2x^2$:
- concave up
- vertex is (0,0)
- narrower than parent func.

- Both $f(x)$ & $g(x)$ are concave up.
- Both $f(x)$ & $g(x)$ have their vertex @ (0,0).
- Both $f(x)$ & $g(x)$ are narrower than parent function.
- $f(x)$ is narrower than $g(x)$.
- Both $f(x)$ & $g(x)$ are parabolas.

Aug 28-8:59 AM

Quadratics1b - Concavity & Y-Intercept

Standards: **F-IF.7**

GLOs: #3 Complex Thinker

Math Practice: -Model with mathematics
-Make sense of prblems and persevere in solving them

Learning Target: How do you determine the y-intercept of a quadratic, and what does it mean in context?

#8HW: Quads 1b #1-6

Y-intercept:
Understanding of what the constant term, c, tells us about the graph of a quadratic function

1) For each quadratic function below, determine the value of the function at $x = 0$.

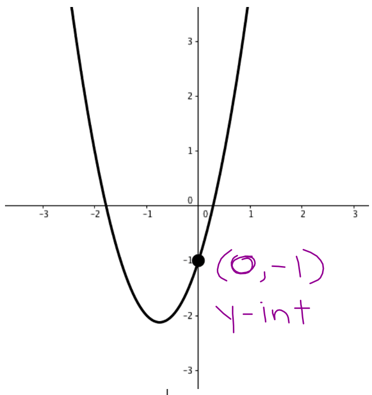
A. $f(x) = 2x^2 + 3x - 1$

$f(0) = 2\underbrace{(0)^2}+\underbrace{3(0)}-1$

$f(0) = \underbrace{2(0)} + 0 - 1$

$f(0) = 0 + 0 - 1$

$\boxed{f(0) = -1}$



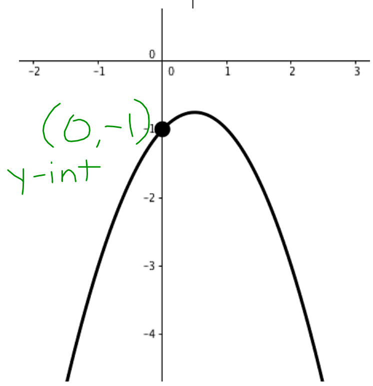
B. $g(x) = -x^2 + x - 1$

$g(0) = -(0)^2 + (0) - 1$

$g(0) = -(0) + 0 - 1$

$g(0) = 0 + 0 - 1$

$\boxed{g(0) = -1}$



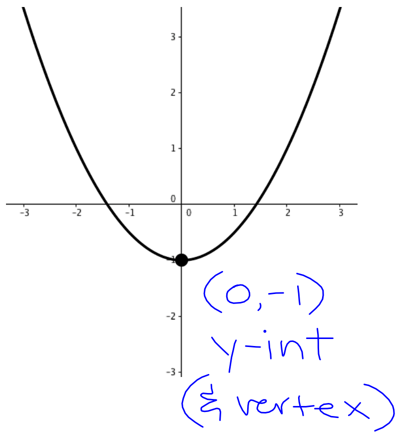
C. $h(x) = \frac{1}{2}x^2 - 1$

$h(0) = \frac{1}{2}(0)^2 - 1$

$h(0) = \frac{1}{2}(0) - 1$

$h(0) = 0 - 1$

$\boxed{h(0) = -1}$



2) Compare each of your answers (in question 1 above) to the symbolic representation and y-intercept of the graph of each function. What do you notice?

- the -1 is always the c-value in standard form, ax^2+bx+c.
- it is always the y-intercept.

(erase to show)

For a quadratic function, $f(x) = ax^2 + bx + c$, the value of "**c**" is often referred to as the "**constant term**" of the function.

- $\boldsymbol{f(0) = c}$
- Therefore, the value of c tells us the y-coordinate of the y-intercept: **(0, c)**

Aug 27-1:49 PM

3) While Jane is standing near the edge of a cliff enjoying the view of the ocean, she tosses a pebble upward, which then falls into the ocean below. The function

$$h(t) = -16t^2 + 45t + 125$$

represents the height of the pebble, ***h(t)***, measured in feet, ***t*** seconds after the pebble left her hand.

a. By simply analyzing the function, determine the *y*-intercept of the graph of *h(t)*.
(Note: you do **not** have to evaluate or graph the function.)

(0, 125)

b. Interpret what the *y*-intercept means in the context of the given situation.

input → time (in sec.)
output → height of pebble (in feet)

At 0 seconds, the height of the pebble is 125 ft. (initial height)

*The initial height of the pebble was 125 ft.

4) The Lokahi Surfboard Company uses the following function to predict its monthly profit, $P(x)$, from selling any number of surfboards, x: ← input ← output

$$P(x) = -8x^2 + 300x - 1500$$

a. By simply analyzing the function, determine the *y*-intercept of the graph of $P(x)$.
(Note: you do **not** have to evaluate or graph the function.)

(0, -1500)

b. Interpret what the *y*-intercept means in the context of the given situation.

input → # of surfboards
output → monthly profit

When you sell 0 surfboard your monthly profit is -$1500.

*The initial monthly profit is -$1500.

5) When a baseball is hit into the air, the path that it travels takes the shape of a parabolic curve. When Patrick hit a baseball, the path of the ball could be modeled by the function

$$f(x) = -0.0025x^2 + 4x + 3.5$$

where $f(x)$ represents the height, in feet, of ball x seconds after the ball was hit.
output input

a. By simply analyzing the function, determine the *y*-intercept of the graph of $f(x)$.
(Note: you do **not** have to evaluate or graph the function.)

(0, 3.5)

b. Interpret what the *y*-intercept means in the context of the given situation.

After 0 seconds, the ball was 3.5 ft high. (initial height).

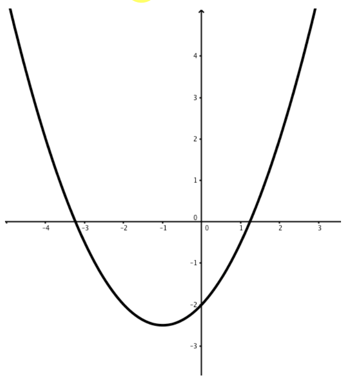
*The initial height of the ball is 3.5 ft.

Aug 27-1:58 PM

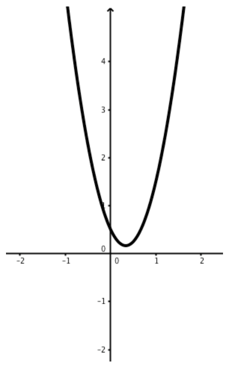
Concavity:

Of the six functions graphed below, compare the three graphs in the top row to the three graphs in the bottom row. What do you notice?

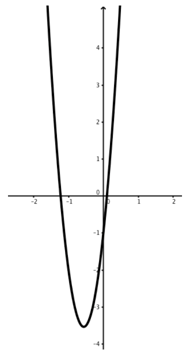
A. $f(x)=\frac{1}{2}x^2+x-2$



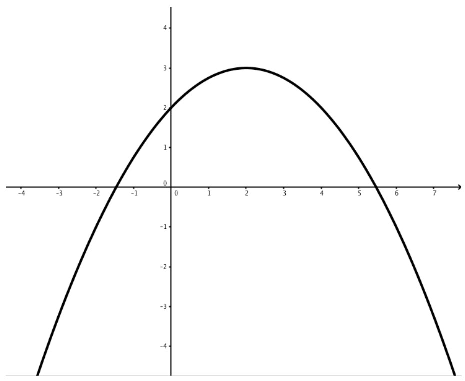
B. $g(x)=3x^2-2x+\frac{1}{2}$



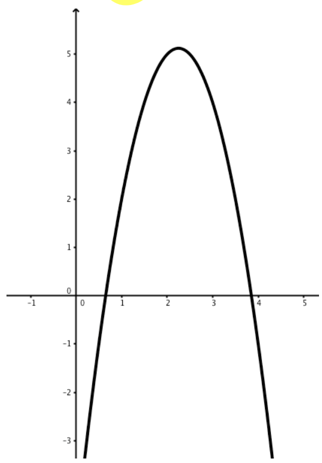
C. $h(x)=8x^2+9x-1$



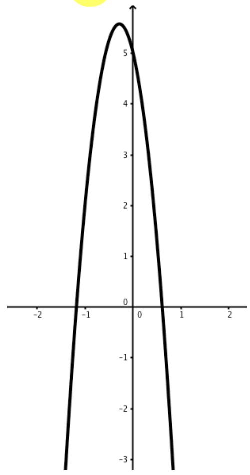
D. $p(x)=-\frac{1}{4}x^2+x+2$



E. $q(x)=-2x^2+9x-5$



F. $r(x)=-7x^2-4x+5$



6) For each function, place a " √ " in the appropriate columns. Each row should have two " √ ".

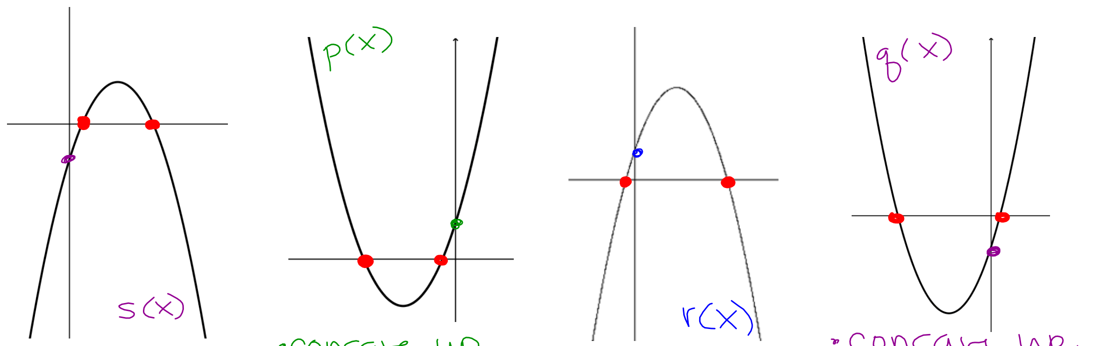
Function	Graph is Concave Up	Graph is Concave Down	Coefficient of x^2: $a>0$	Coefficient of x^2: $a<0$
$f(x)$	✓		✓	
$g(x)$	✓		✓	
$h(x)$	✓		✓	
$p(x)$		✓		✓
$q(x)$		✓		✓
$r(x)$		✓		✓

(erase to show)

Consider any quadratic function, $f(x) = ax^2 + bx + c$, with $a \neq 0$.

- The quadratic coefficient "a" determines the **concavity** of the graph of $f(x)$:
  - If **a > 0**, then the graph of *f* is **concave up** (opens upwards).
  - If **a < 0**, then the graph of *f* is **concave down** (opens downwards).
  - The closer the value of "a" is to 0, the **wider** the graph will be.
  - The farther the value of "a" is from 0, the **narrower** the graph will be.
- The value of the constant coefficient "c" tells us the y-coordinate of the y-intercept: **(0, c)**

7) Work with a partner to label each graph with its appropriate function name: $p(x)$, $q(x)$, $r(x)$, or $s(x)$.



•concave down, so a is neg.
•y-int is neg, so c is neg.
$s(x) = -x^2 + 3x - 1$

•concave up, so a is pos.
•y-int is pos, so c is pos.
$p(x) = x^2 + 3x + 1$

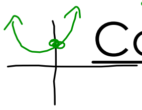
•concave down, so a is neg.
•y-int is pos, so c is pos.
$r(x) = -x^2 + 3x + 1$

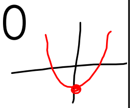
•concave up, so a is pos.
•y-int is neg, so c is neg.
$q(x) = x^2 + 3x - 1$

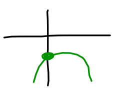
8) A quadratic function $f(x) = ax^2 + bx + c$ will have two x-intercepts if the graph crosses the x-axis at two points.

A. For each of the functions above in question 7, place two points on each graph to show the locations of the x-intercepts. (in red)

B. However, some quadratic functions do not have any x-intercepts: their graphs will never cross the x-axis. Consider the four cases shown below. Working with a partner, circle the two cases that are guaranteed to have x-intercepts, and place an asterisk, " * " next to the two cases that MAY NOT have x-intercepts.


* Case 1: a > 0 and c > 0

Case 2: a > 0 and c < 0



* Case 3: a < 0 and c < 0

Case 4: a < 0 and c > 0