# Review for Test #11 - Quadratic Functions

Name ______________________________ Class ____________

1.) A baseball player throws a ball from the outfield toward home plate. The ball's height above the ground is modeled by the equation $y = -16x^2 + 48x + 6$, where $y$ represents height, in feet, and x represents time, in seconds. The ball is initially thrown from a height of 6 feet.

a.) How many seconds after the ball is thrown will it again be 6 feet above the ground?

$y=6$

$6=-16x^2+48x+6$

$0=-16x^2+48x$

$\rightarrow 0=-16x(x-3)$

$\{0,3\}$

$\boxed{\text{3 seconds}}$

b.) What is the maximum height, in feet, that the ball reaches? $\boxed{42\text{ ft}}$

$y=-16(x^2-3x \quad )+6 \rightarrow (-\frac{3}{2})^2=(-1.5)^2=2.25$

$y=-16(x^2-3x+2.25)+6+36$

$y=-16(x-1.5)^2+42 \rightarrow$ vertex: $(1.5, 42)$

OR

$x=\frac{-b}{2a}=\frac{-48}{2(-16)}=\frac{-48}{-32}=1.5$

$y=-16(1.5)^2+48(1.5)+6=42$

c.) How many seconds after the ball is thrown will it hit the ground? Round to the nearest tenth.

$0=-16x^2+48x+6$

$x=\frac{-48\pm\sqrt{(48)^2-4(-16)(6)}}{2(-16)} \rightarrow x=\frac{-48\pm\sqrt{2688}}{-32}$

$x=-0.1$ or $x=3.1$

$\boxed{3.1\text{ sec}}$

d.) Find the average rate of change from 0 to 1 second and explain the meaning in the context of the problem.

$x=1$

$y=-16(1)^2+48(1)+6$

$y=38$

$x=0$

$y=-16(0)^2+48(0)+6$

$y=6$

$\frac{f(b)-f(a)}{b-a}=\frac{f(1)-f(0)}{1-0}$

$=\frac{38-6}{1-0}=\frac{32}{1}$

The ball is traveling at a rate of 32 ft/s from 0 to 1 sec.

2.) Consider the function $f(x) = -(x+3)^2 + 25$.

a.) Determine the vertex of the function.

Vertex: $(-3, 25)$

b.) Find the domain and range of the function.

Domain: all reals

Range: $f(x) \leq 25$

c.) Find the roots of the function.

$0=-(x+3)^2+25$

$-25=-(x+3)^2$

$25=(x+3)^2$

$\rightarrow \pm 5 = x+3$

$-3\pm5=x$

$\boxed{\{2,-8\}}$

3.) An arrow is shot into the air. A function representing the relationship between the number of seconds it is in the air, $t$, and the height of the arrow in meters, $h$, is given by:

$$h(t) = -4.9t^2 + 29.4t + 2.5$$

a.) Complete the square for this function.

$h(t) = -4.9(t^2 - 6t + 9) + 2.5 + 44.1$

$h(t) = -4.9(t-3)^2 + 46.6$

b.) What is the maximum height of the arrow? Explain how you know.

vertex is $(3, 46.6)$ → The maximum height is 46.6 ft.

c.) How long does it take the arrow to reach its maximum height? Explain how you know.

3 seconds - vertex is $(3, 46.6)$

d.) What is the average rate of change for the interval from $t = 1$ to $t = 2$ seconds?

$h(2) = 41.7$ $\quad \frac{h(2)-h(1)}{2-1} = \frac{41.7-27}{2-1} = \frac{14.7}{1}$ $\quad \boxed{14.7\ m/s}$

$h(1) = 27$

e.) Compare your answer to the average rate of change for the interval from $t = 2$ to $t = 3$ seconds and explain the difference in the context of the problem.

$h(3) = 46.6$ $\quad \frac{h(3)-h(2)}{3-2} = \frac{46.6-41.7}{3-2} = \frac{4.9}{1}$ $\quad \boxed{4.9\ m/s}$ The arrow is slowing down due to gravity

f.) How long does it take the arrow to hit the ground? Round to the nearest hundredth of a second. Show your work or explain.

$t = \frac{-29.4 \pm \sqrt{(29.4)^2 - 4(-4.9)(2.5)}}{2(-4.9)}$

$0 = -4.9t^2 + 29.4t + 2.5$

$\{-0.08, 6.08\}$ $\quad \boxed{6.08\ sec}$

g.) What does the constant term (c) in the original equation tell you about the arrow?

It tells us the height the arrow is when it is first shot.

h.) What does the first-degree coefficient (a) tell you about the arrow's flight?

It is shot up then falls down

4.) Given the quadratic function $f(x) = 4x^2 + 4x + 5$, answer the following questions:

a.) Find the vertex of the function by using the equation for the axis of symmetry. $\boxed{(-0.5, 4)}$

$x = \frac{-b}{2a} = \frac{-4}{2(4)} = -\frac{4}{8} = -0.5$ $\quad f(-0.5) = 4(-0.5)^2 + 4(-0.5) + 5$

$f(-0.5) = 4$

b.) Find the vertex of the function by completing the square to put the function in vertex form. $f(x) = 4(x^2 + x \quad ) + 5$

$\left(\frac{1}{2}\right)^2 = \frac{1}{4}$

$f(x) = 4(x^2 + x + 1/4) + 5 - 1$

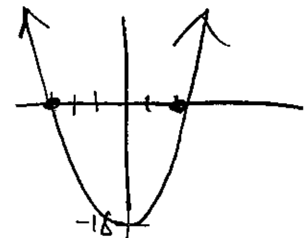
$f(x) = 4(x + 1/2)^2 + 4$

$\boxed{(-0.5, 4)}$

c.) Find the domain and the range of the function.

$f(x) \geq 4$

5.) A parabola intersects the $x$-axis at x = -3 and x = 2 and intersects the y-axis at y = -18. Which is an equation of the parabola?




(A) $y = 3x^2 + 3x - 18$

~~(B)~~ $y = -3x^2 - 3x - 18$

~~(C)~~ $y = -18x^2 - 1.5x - 1$

~~(D)~~ $y = 18x^2 + 1.5x + 1$

$a > 1$ (opens up)

$c \neq -18$

6.) How many real roots/zeros do the following functions have? Explain your answer.

a.) $f(x) = 2x^2 + 5x + 7$

$D = b^2 - 4ac$

$D = (5)^2 - 4(2)(7)$

$D = 25 - 56 = -29$

No real zeros because $D < 0$ (can't square root a neg. # w/ real values)

b.) $g(x) = 4x^2 - 28x + 49$

$D = (-28)^2 - 4(4)(49)$

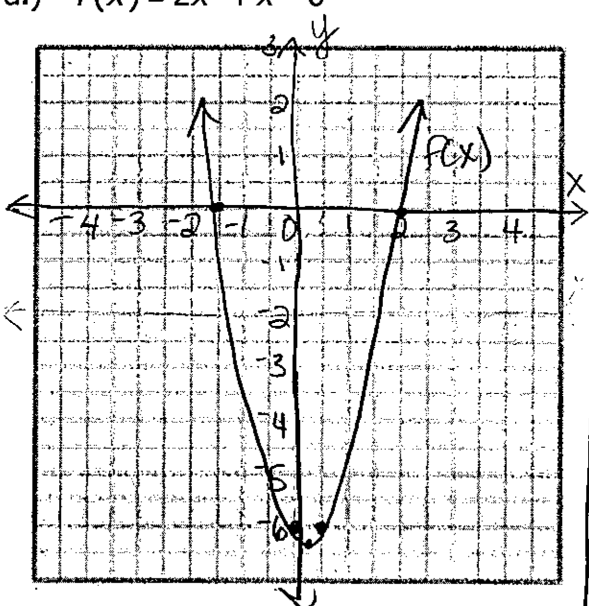
$D = 784 - 784$

$D = 0$

one real solution because $D = 0$

7.) Graph the following quadratic functions by identifying the key features. If necessary, round to the nearest tenth.

a.) $f(x) = 2x^2 + x - 6$




$f(x) = (2x+3)(x-2)$

Roots

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

$\{-3/2, 2\}$

y-int:

$f(0) = 2(0)^2 + 0 - 6 = -6$

Axis of symmetry:

$x = \frac{-b}{2a} = \frac{-1}{2(2)} = \frac{-1}{4}$

vertex:

$f(-1/4) = \frac{-49}{8} = -6.125$

Roots:

$\{-3/2, 2\}$

y-int:

$(0, -6)$

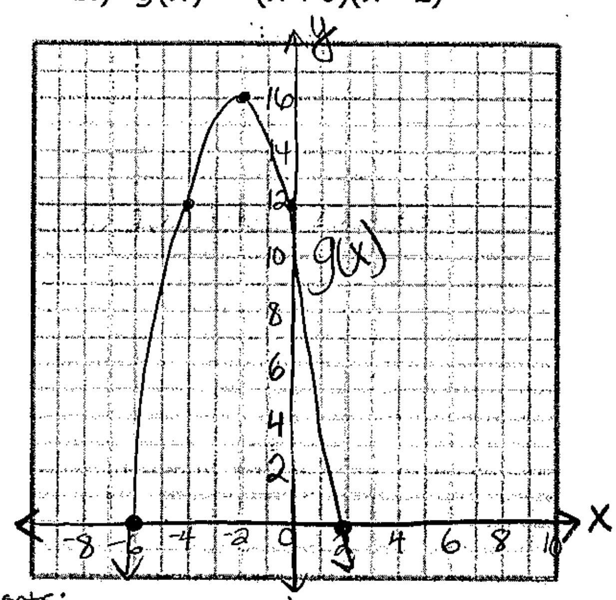
Axis of sym:

$x = -0.25$

vertex:

$(-0.25, -6.125)$

b.) $g(x) = -(x+6)(x-2)$




Roots:

$0 = -(x+6)(x-2)$

$\{-6, 2\}$

y-int:

$g(0) = 12$

$x = \frac{-6+2}{2}$

Axis of sym:

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

$g(-2) = 16$

vertex

Roots:

$\{-6, 2\}$

y-int:

$(0, 12)$

Axis of sym:

$x = -2$

$(-2, 16)$