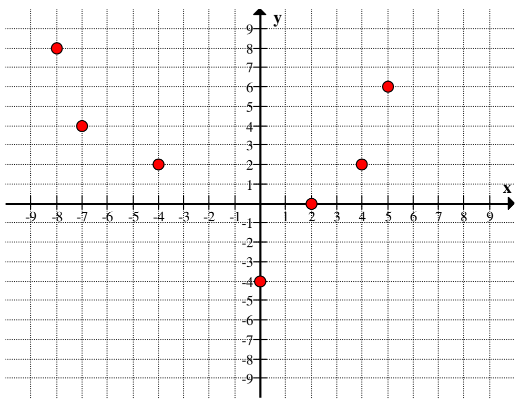
Name ________SOLUTIONS____________ Date ___________ Period _______

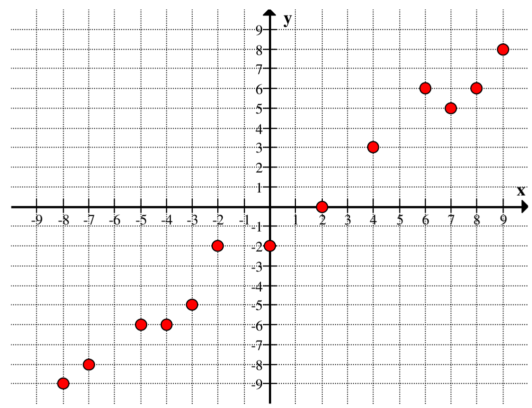
Pre-Calculus Unit 1 Practice Test
Complete the problems below and show your work.

Learning Target 1A—I can identify linear and quadratic correlations in data and use technology to define an appropriate linear or quadratic regression function.
Learning Target 1B—I can describe a set of numbers in a variety of ways.
Learning Target 1C—I can define, interpret, and use piecewise functions in function notation and as a graph.
Learning Target 1D—I can determine the average rate of change for a function as well as identify increasing and decreasing functions and intervals.

1. Write an equation that models the following functions in the graphs below.



$y = -.2513x + 2.28,\ r = -.33$
$y = .206x^2 + .403x - 2.091,\ R^2 = .866$
Quadratic is best model



$y = .991x - 1.303$
$y = .004x^2 + .985x - 1.427$
Linear is best model.

2. Use the data in the table below to answer the following questions.

x	1	2	3	4	5	6	7	8	9	10
y	5.1	6.2	6.5	6.8	9.4	10.5	13.6	16.1	20.2	26.3

a. Write the equation for a quadratic function that models the data in the table.

$$f(x) = 0.295x^2 - 1.070x + 6.610$$

$$R^2 = .992$$

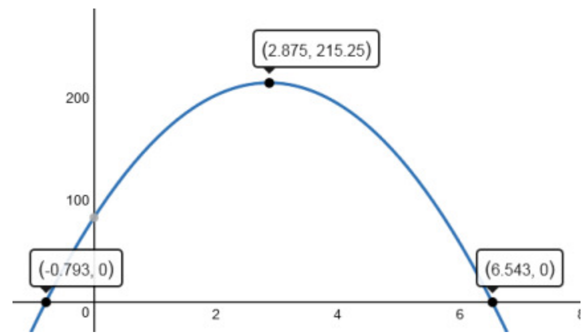
b. Use your regression model to predict y when $x = 15$.

$$f(15) = 56.84$$

3. A promotion for the Houston Astros downtown ballpark, a competition is held to see who can throw a baseball the highest from the front row of the upper deck of seats, 83 feet above the field. The winner throws the ball with an initial vertical velocity of 92 ft/sec and it lands on the infield grass. Use the function $s(t) = s_0 + v_0 t - \frac{1}{2}gt^2$ and use the gravitation constant $g = 32\ ft/sec$.

a. Find the maximum height of the ball.

By the graph, the max height at the vertex is **215.25** feet at 2.875 seconds

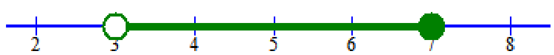


b. How long did it take for the ball to reach the ground?

The x-intercept gives us the time to hit the ground at 6.543 seconds.

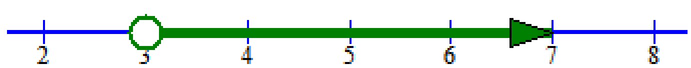
For each of the following, fill in the missing type of interval or graph. Describe the interval as bounded, unbounded, open, closed, half-open.

4. Interval $(3, 7]$ Inequality $3 < x \leq 7$

Graph 

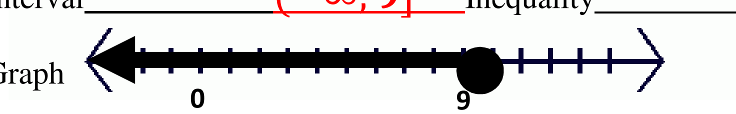
Description: bounded and half-open

5. Interval $(3, \infty)$ Inequality $x > 3$

Graph 

Description unbounded, open

6. Interval $(-\infty, 9]$ Inequality $x \leq 9$

Graph 

Description *unbounded, closed*

7. Describe the set of numbers using interval notation.

$x < 11\ \ or\ \ x \geq 15$

$(-\infty, 11) \cup [15, \infty)$

8. Describe the set of numbers using set-builder notation.

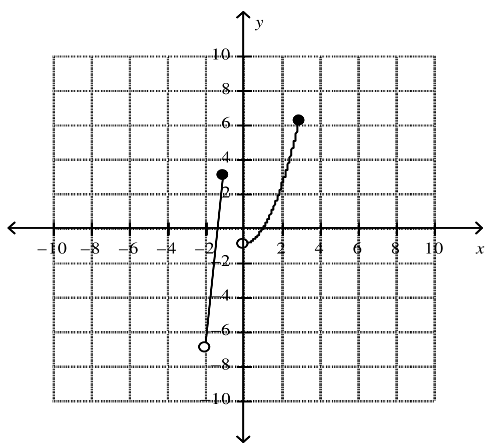
$$\{-9,-8,-7,-6,-5,\ldots\}$$

$$\{x|x \geq -9, x \in \mathbb{Z}\}$$

9. Describe the domain and range of $y = \sqrt{x+3}$ in interval notation.

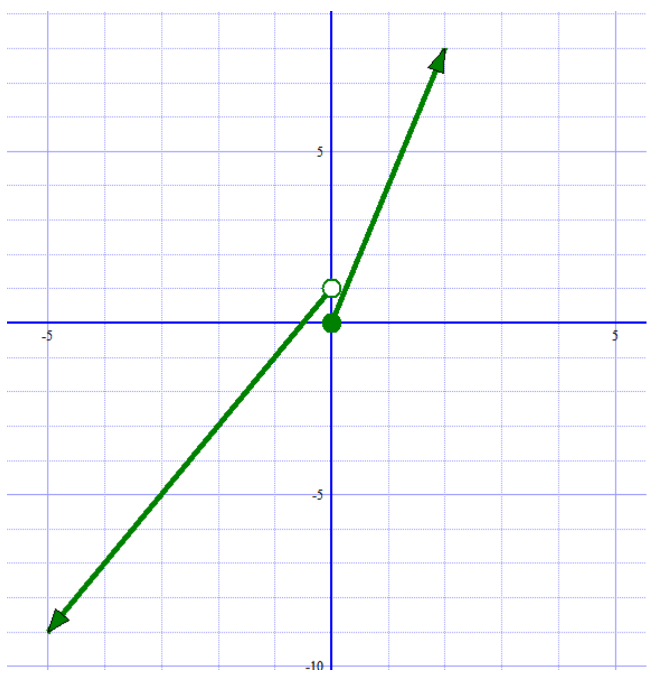
$$x + 3 \geq 0 \Rightarrow x \geq -3$$
$$D: [-3, \infty)$$
$$R: [0, \infty)$$

10. Use the graph below to find the domain and range.

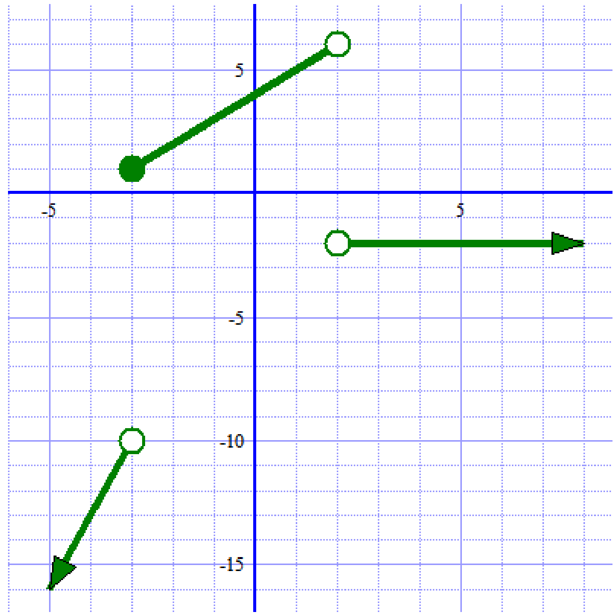


$$D: (-2, -1] \cup (0, 3]$$
$$R: (-7, 6]$$

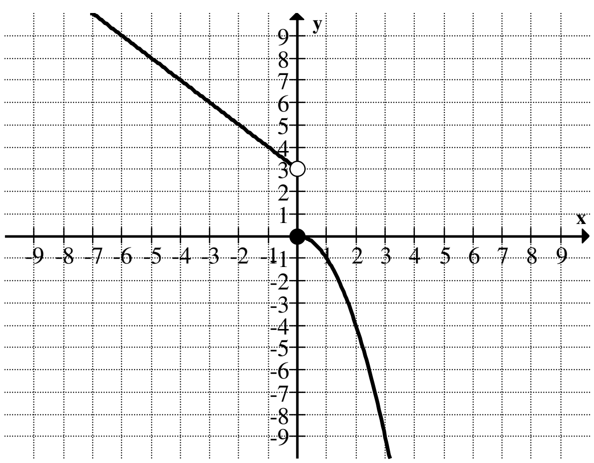
11. Graph $f(x) = \begin{cases} 2x + 1 \text{ } if \text{ } x < 0 \\ 4x \text{ } if \text{ } x \geq 0 \end{cases}$



12. Graph $f(x) = \begin{cases} 3x - 1 \; if \; x < -3 \\ x + 4 \; if -3 \le x < 2 \\ -2 \; if \; x > 2 \end{cases}$



13. Write a piecewise function for the graph below.



$$\boldsymbol{f(x) = \begin{cases} -x + 3 & if \quad x < 0 \\ -x^2 & if \quad x \ge 0 \end{cases}}$$

14. For which interval(s) is the function $y = 2x^3 - 8x + 5$ increasing and decreasing?

$\boldsymbol{Increasing: (-\infty, -1.155) \cup (1.155, \infty)}$

$\boldsymbol{Decreasing: (-1.155, 1.155)}$

15. Find the extrema for $f(x) = -3x^3 + 8x^2 + 10x - 9$ name the specific type of extrema.

$\boldsymbol{Local\ Minimum\ (-.49, -11.63)}$

$\boldsymbol{Local\ Maximum\ (2.27, 19.83)}$

16. Graph the function $y = x^4 + 2x^3 + 3x$ on your calculator. Find the x-value of any extrema to the nearest hundredth and describe what type of extrema it is.

$$Global\ Minimum\ at\ x = -1.746$$

17. Find the average rate of change for $f(x) = x^3 - x^2$ on the following intervals.

a. $[0,4]$

b. $[-4,-3]$

a. $\frac{\Delta y}{\Delta x} = \frac{f(4)-f(0)}{4-0} = \frac{(4^3-4^2)-(0^3-0^2)}{4} = \frac{48-0}{4} = 12$

b. $\frac{\Delta y}{\Delta x} = \frac{f(-3)-f(-4)}{(-3)-(-4)} = \frac{((-3)^3-(-3)^2)-((-4)^3-(-4)^2)}{1} = \frac{(-36)-(-80)}{1} = 44$

18. Find the average rate of change for $f(x) = x^2 + x$ on the following intervals.

a. $[1,3]$

b. $[-4,-1]$

$$\frac{\Delta y}{\Delta x} = \frac{f(3)-f(1)}{3-1} = \frac{(3^2+3)-(1^2+1)}{3-1} = \frac{(12)-(2)}{2} = \frac{10}{2} = 5$$

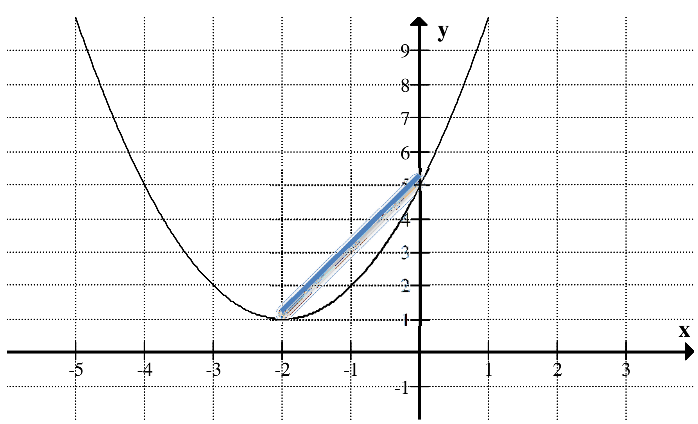
$$\frac{\Delta y}{\Delta x} = \frac{f(-1)-f(-4)}{(-1)-(-4)} = \frac{((-1)^2+(-1)) - ((-4)^2+(-4))}{(-1)-(-4)} = \frac{(0)-(12)}{3} = \frac{-12}{3} = -4$$

c. $[a, a+h]$

$$\frac{\Delta y}{\Delta x} = \frac{f(a+h)-f(a)}{(a+h)-a} = \frac{((a+h)^2+(a+h)) - (a^2+a)}{(a+h)-a} = \frac{((a^2+2ah+h^2)+(a+h)) - (a^2+a)}{a+h-a}$$

$$= \frac{a^2+2ah+h^2+a+h-a^2-a}{h} = \frac{2ah+h^2+h}{h} = \frac{h(2a+h+1)}{h} = (2a+h+1)$$

19. Find the average rate of change for the graph below on the interval $[-2,0]$.



Using the slope of the secant line from (-2,1) to (0,5), the rate of change is $\frac{\Delta y}{\Delta x} = \frac{4}{2} = 2$