Secondary Math 2

Name Key

Unit 8 Functions Review

Date_____ Period____

Identify the vertex and min/max value of each.

1) $y = x^2 - 12x + 43$

Vertex: (6, 7)

Min value: 7

2) $y = -x^2 + 8x - 6$

Vertex: (4, 10)

Max value: 10

3) $y = -2x^2 + 20x - 48$

Vertex: (5, 2)

Max value: 2

4) $y = x^2 - 20x + 98$

Vertex: (10, -2)

Min value: -2

Transform the given function $f(x)$ as described and write the resulting function as an equation.

5) $f(x) = x^2$
translate right 1 unit
translate up 1 unit

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

6) $f(x) = x^2$
expand vertically by a factor of 2
translate down 2 units

$y = 2x^2 - 2$

7) $f(x) = |x|$
translate left 3 units
translate down 3 units

$y = |x+3| - 3$

8) $f(x) = x^2$
reflect across the x-axis
translate right 2 units

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

Describe the transformations necessary to transform the graph of $f(x)$ into that of $g(x)$.

9) $f(x) = |x|$
$g(x) = 3|x| + 3$

Vertical stretch by 3
Vertical shift up 3

10) $f(x) = x^2$
$g(x) = \frac{1}{3}(x+1)^2$

Vertical compression by $\frac{1}{3}$
Horizontal shift left 1

For each problem, find the average rate of change of the function over the given interval.

11) $y = 2x^2 + 2x + 2;\ [0, \frac{1}{2}]$

3

12) $y = x^2 - x + 2;\ [-1, 2]$

0

13) $y = 2x^2 + x + 2;\ [-1, 1]$

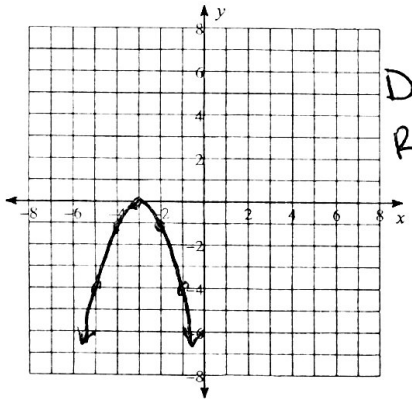
1

14) $f(x) = 2x^2 + 2;\ [1, \frac{4}{3}]$

$\frac{14}{3}$

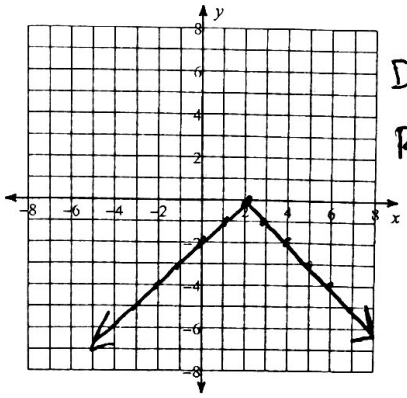
Sketch the graph of each function. Then state the domain and range.

15) $g(x) = -(x + 3)^2$



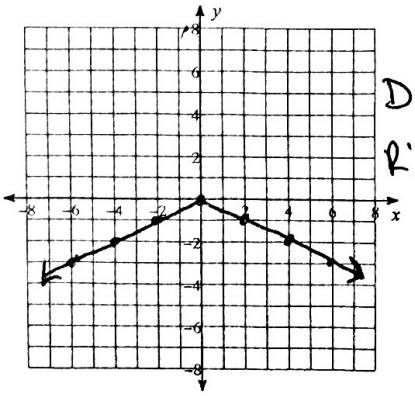
D: $(-\infty, \infty)$
R: $(-\infty, 0]$

16) $g(x) = -|x - 2|$



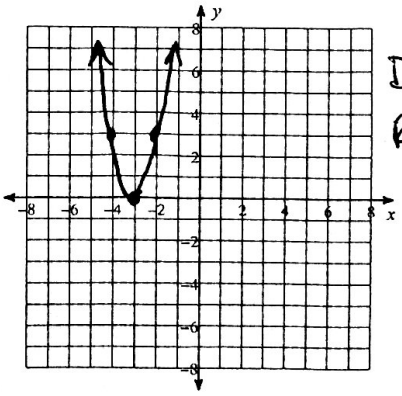
D: $(-\infty, \infty)$
R: $(-\infty, 0]$

17) $g(x) = -\frac{1}{2} \cdot |x|$



D: $(-\infty, \infty)$
R: $(-\infty, 0]$

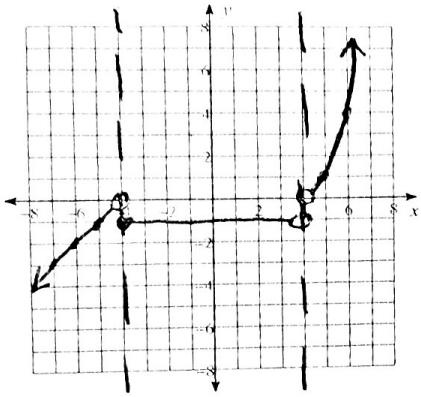
18) $g(x) = 3(x + 3)^2$



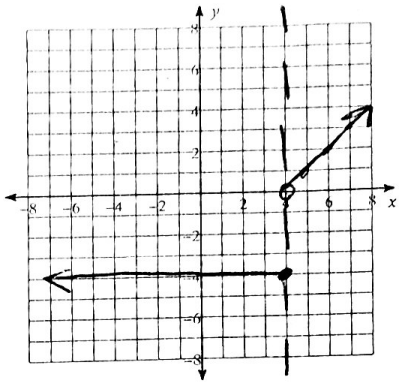
D: $(-\infty, \infty)$
R: $[0, \infty)$

Sketch the graph of each function.

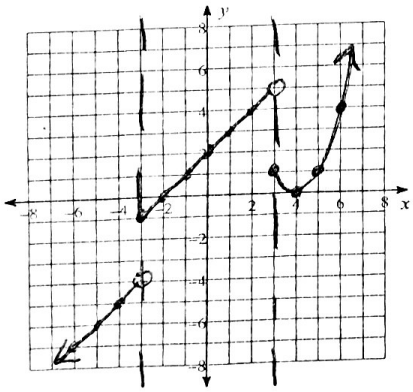
19) $f(x) = \begin{cases} x+4, & x < -4 \\ -1, & -4 \le x < 4 \\ (x-4)^2, & x > 4 \end{cases}$



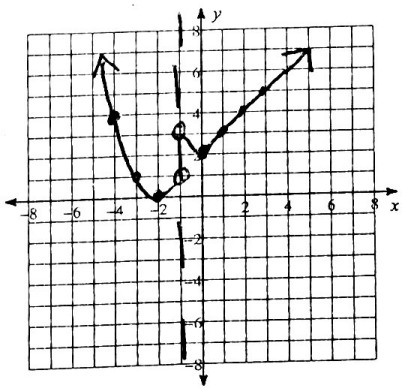
20) $f(x) = \begin{cases} -4, & x \le 4 \\ x-4, & x > 4 \end{cases}$



21) $f(x) = \begin{cases} x-1, & x < -3 \\ x+2, & -3 \le x < 3 \\ (x-4)^2, & x \ge 3 \end{cases}$



22) $g(x) = \begin{cases} (x+2)^2, & x < -1 \\ |x| + 2, & x > -1 \end{cases}$



23) Name the kinds of functions (linear, quadratic, exponential) that have the slowest and the fastest growth rate.

Slowest: Linear

Fastest: Exponential

Determine if the following are linear, quadratic, or exponential.

24) {(-2,-2), (-1,1), (0,4), (1,7), (2,10)}

Linear

25) { (3,8), (4,24), (5,72), (6,216)}

Exponential

26) A business model that reaches a maximum profit, but decreases earnings after that.

Quadratic

27) Earning a $40,000 salary with 15% commission.

Exponential

28) A tournament where 1/3 of candidates are cut each round.

Exponential

29) A gumball machine that gives out 5 gumballs for every dime you put in.

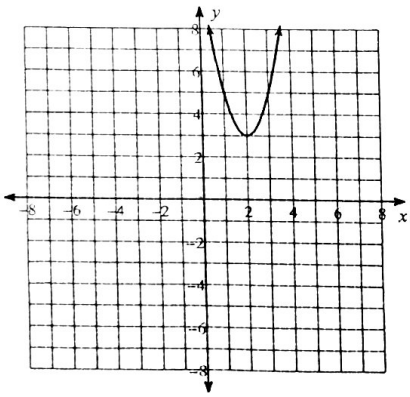
Linear

30) Two seagulls dive into the ocean. The given functions represent the height of each seagull above the surface of the ocean as a function of the seagull's horizontal distance from a certain buoy. For each set of functions, determine which bird descends deeper into the ocean.

a. $y = 3(x-5)^2 - 9$ or $g = \{(-8,0), (-6,-12), (-4,0)\}$

The second bird dives deeper.

b. or $g = 2(x+4)^2 + 1$



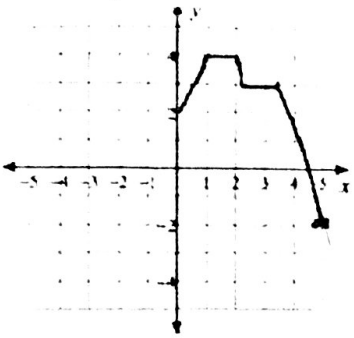
The second bird dives deeper.

31) Three students are shooting wads of paper with a rubber band, aiming for a trash can in the front of the room. The height of each student's paper wad in feet is given as a function of the time in seconds. Which student's paper wad flies the highest?

Alejandro: $y = -x^2 + 2x + 7$
Melissa: $g = -(x-3)^2 + 7$
Connor: After 3 seconds his wad achieves a maximum height of 6.5 feet

Alejandro's was highest.

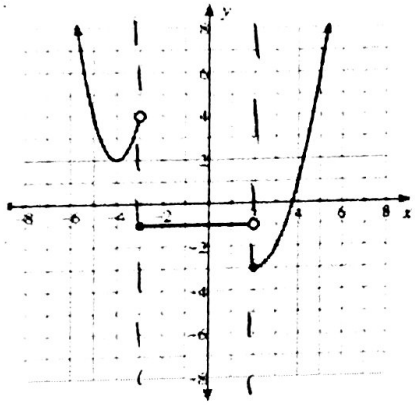
32) Write the situation that could be modeled by the following graph.



Jane starts at her house. She walks to her friend's house and stays for a little. On her way back home, she stops to play at the park. Instead of going home, she walks past her house and ends up at the grocery store.

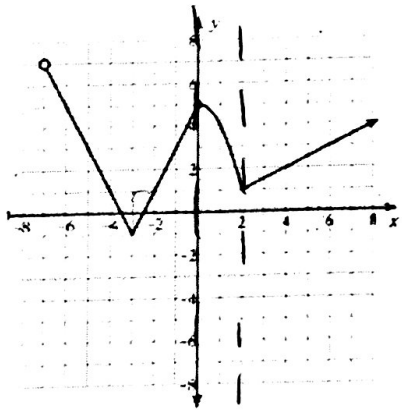
Write the equation for each piecewise function.

33)



$$f(x) = \begin{cases} 2(x+4)^2+2, & x<-3 \\ -1, & -3 \le x < 2 \\ (x-2)^2-3, & x \ge 2 \end{cases}$$

34)



$$f(x) = \begin{cases} 2|x+3|-1, & x<0 \\ -x^2+5, & 0 \le x < 2 \\ \frac{1}{2}x, & x \ge 2 \end{cases}$$

State the initial value, growth/decay factor, and growth/decay rate of each.

35) $y = 1.32^x$

I: 1 GF: 1.32 GR: 32%

36) $y = 12 \cdot 0.44^x$

I: 12 DF: 0.44 DR: 56%

37) $y = 63 \cdot 2.1^x$

I: 63 GF: 2.1 GR: 110%

38) $y = 1.08^{3x}$

I: 1 GF: 1.26 GR: 26%

39) $y = 18 \cdot 0.71^{2x}$

I: 18
DF: 0.50
DR: 50%

40) $y = 131 \cdot 0.87^{4x}$

I: 131
DF: 0.57
DR: 43%