Name: _____ Date: _____ **Unit 3 Class Work**

Exploring Families of Functions

Through completing this activity, you will explore the effects of altering values within various functions on the graph of the function. You will also be able to generalize, so that you do not have to graph every function you will encounter in the future to observe how it has transformed from its parent graph! ☺

General Function Notation: f(x)

Transformed Function Notation: A*(f(Bx + C)) + D
- B must be **positive**, for our purposes.
- A, B, C, and D are real numbers whose values will affect how the graph of f(x) is transformed.

Your Assigned Function: _____

★ **EFFECTS OF A:** Explore… **A*f(x)** ***Hint:** focus on how the graph of the function is opening

Set B = 1, C = 0, and D = 0. Then manipulate the value of A, and record your observations in the table below.

When A is negative…	As |A| increases…	As |A| decreases…

Feel free to change B, C, and D to any non-zero numbers. Manipulate A as you did earlier. Does A's value still have the same effects on the graph? If so, keep your chart and move on. If not, add to your chart and then move on.

★ **EFFECTS OF B:** Explore… **f(Bx)**

Set A = 1, C = any nonzero number, and D = 0. Then manipulate the value of B, and record your observations in the table below.

When B is negative…	As |B| increases…	As |B| decreases…

Change C and D to any non-zero numbers. Manipulate B as you did earlier. Does B 's value still have the same effects on the graph? If so, keep your chart and move on. If not, add to your chart and then move on.

Your assigned function for exploring the effects of C and D: f(x) = _____

★ **EFFECTS OF C:** Explore… **f(x+C)** ***Hint:** focus on how the vertex of the graph moves

Set A = 1, B = 1, and D = 0. Then manipulate the value of C, and record your observations in the table below.

As C increases…	As C decreases…

Change A, B, and D to any non-zero numbers. Manipulate C as you did earlier. Does C's value still have the same effects on the graph? If so, keep your chart and move on. If not, add to your chart and then move on.

★ **EFFECTS OF D:** Explore… **f(x)+D** ***Hint:** focus on how the vertex of the graph moves

Set A = 1, B = 1, and C = 0. Then manipulate the value of D, and record your observations in the table below.

As D increases…	As D decreases…

Change A, B, and C to any non-zero numbers. Manipulate D as you did earlier. Does D's value still have the same effects on the graph? If so, keep your chart and move on. If not, add to your chart and then move on.

⁕ Now, find at least one of your peers who was assigned a different function than you! Compare and contrast your results. What generalizations can you make regarding how the values of A, B, C, and D affect the graph of any parent function?

Describe each transformation of the parent function.

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

2. $m(x) = \frac{1}{2}|x - 3| + 1$

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Families of Functions Practice

Directions:

- *Name the parent function. Describe the transformation. Then graph the transformed function. If you would like to, feel free to graph the parent function to start as well.*

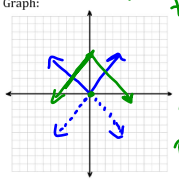
1. $f(x) = -|x| + 5$

Parent: Abs. Val.

Transformation: reflects over x-axis, up 5 units, translation

A: -1 D: 5

Graph:



D: $\mathbb{R}$ $(-\infty, \infty)$

R: $(-\infty, 5]$ $y \leq 5$

2. $y = \frac{3}{4}(x - 1)^2 + 3$

Parent: Quadratic

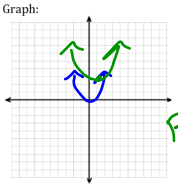
Transformation:

A: $\frac{3}{4}$ ⇒ 4/3 as wide

C: -1 right 1

D: 3 up 3

Graph:



D: $\mathbb{R}$ $(-\infty, \infty)$

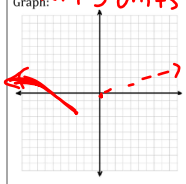
R: $[3, \infty)$

3. $y = \sqrt{(-x + 3)} - 2$

Parent: Radical

Transformation: B: reflect over y-axis, left 3 units

Graph:



D: down 2 units

L, R

D: $(-\infty, -3]$

R: $[-2, \infty)$

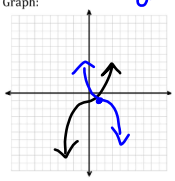
D, U

4. $f(x) = (-x - 1)^3$

Parent: Cubic

Transformation: reflects over y-axis, translates right 1

Graph:



D: $(-\infty, \infty)$

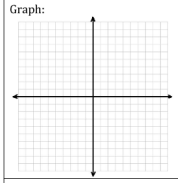
R: $(-\infty, \infty)$ $\mathbb{R}$

5. $f(x) = 2|x - 1| + 3$

Parent:

Transformation:

Graph:

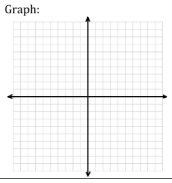


6. $g(x) = -2(x + 2)^2 - 2$

Parent:

Transformation:

Graph:

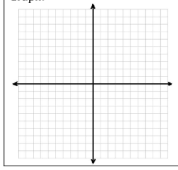


7. $f(x) = \frac{1}{4}x^3 + 1$

Parent:

Transformation:

Graph:

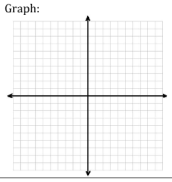


8. $f(x) = \sqrt{(-x + 4)} - 5$

Parent:

Transformation:

Graph:



Write an equation for each function described below.

9. Radical function shifted 2 units right and 1 unit down: C: -2 D: -1 $f(x) = \sqrt{(x - 2)} - 1$

10. Cubic function shifted left 5 units and up 3 units: _____

11. Linear function shifted up 11 units: _____

12. Quadratic function stretched by a factor of 8, shifted 4 units up and 9 units left: _____

13. Absolute value function shrunk by a factor of ½ and reflected over the x-axis: $y = -2|x|$

A: 2 twice as steep

A: neg.

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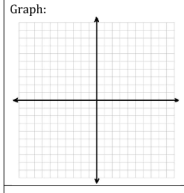
14. $f(x) = -x^2 - 5$

Parent:

Transformation:

Graph:

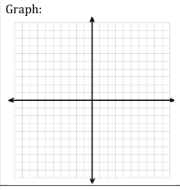


15. $y = -2\sqrt{x} + 3$

Parent:

Transformation:

Graph:

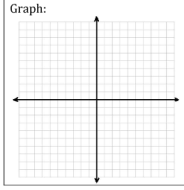


16. $h(x) = -|x - 1| - 3$

Parent:

Transformation:

Graph:

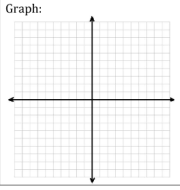


17. $y = (x + 2)^3 - 8$

Parent:

Transformation:

Graph:



Write an equation for each function described below.

18. Absolute value function stretched by a factor of 3 and shifted 3 units left and 1 unit up: _____

19. Quadratic function reflected over the x-axis, shrunk by a factor of ¼, & shifted 4 units right: _____

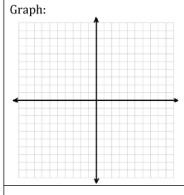
20. Radical function reflected over the y-axis, stretched by a factor of 2, and shifted 5 right: _____

21. $y = \frac{1}{4}|x + 1|$

Parent:

Transformation:

Graph:

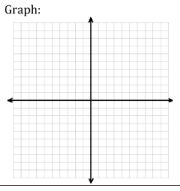


22. $r(x) = |-x| + 3$

Parent:

Transformation:

Graph:

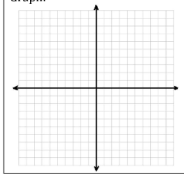


23. $y = x^3 - 5$

Parent:

Transformation:

Graph:

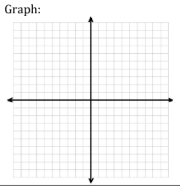


24. $f(x) = \frac{1}{2}(x+ 4)^2 + 4$

Parent:

Transformation:

Graph:



Write an equation for each function described below.

25. Absolute value function stretched by a factor of ½ and shifted 2 units right and 1 unit up: _____

26. Cubic function reflected over the x-axis, shrunk by a factor of ½, & shifted 3 units left: _____

27. Radical function reflected over the y-axis, stretched by a factor of 3, and shifted 7 up: _____

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Closure For Activity:

Describe how the graph of the function $f(x) = x^2$ can be transformed to the function:

*** If your first name begins with A – M:**

$$f(x) = -(x + 3)^2 - 9$$

*** If your first name begins with N – Z:**

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

Then, find someone who had the other function, and share. ☺

Closure For Practice:

POST A TWEET & FAVORITE

On a post-it, write your answer response to either option. Then post it on the wall, and star your favorite! ☺

OPTION A: Transforming functions is like
_____ because
_____.

OPTION B: Create a rhyme, short poem, or song to highlight any of the transformation rules.