

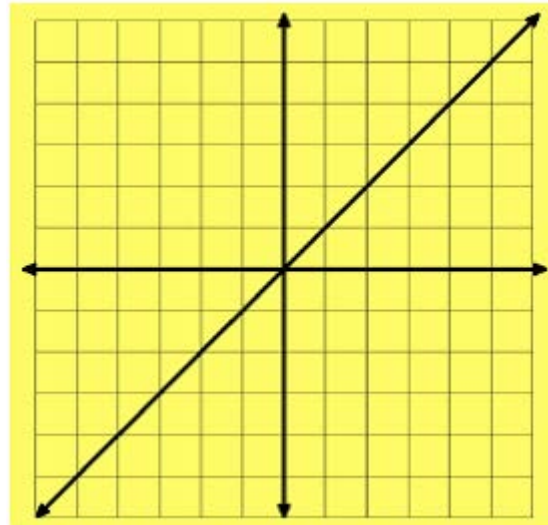
7.1 Characteristics of Function Families

Practice Tasks



I. Concepts and Procedures

1. Graph the following linear equations on the grid. The equation $y = x$ has been graphed for you. For each new equation explain what the number 2 does to the graph of $y = x$. Pay attention to the y -intercept, the x -intercept, and the slope. Identify what changes in the graph and what stays the same.

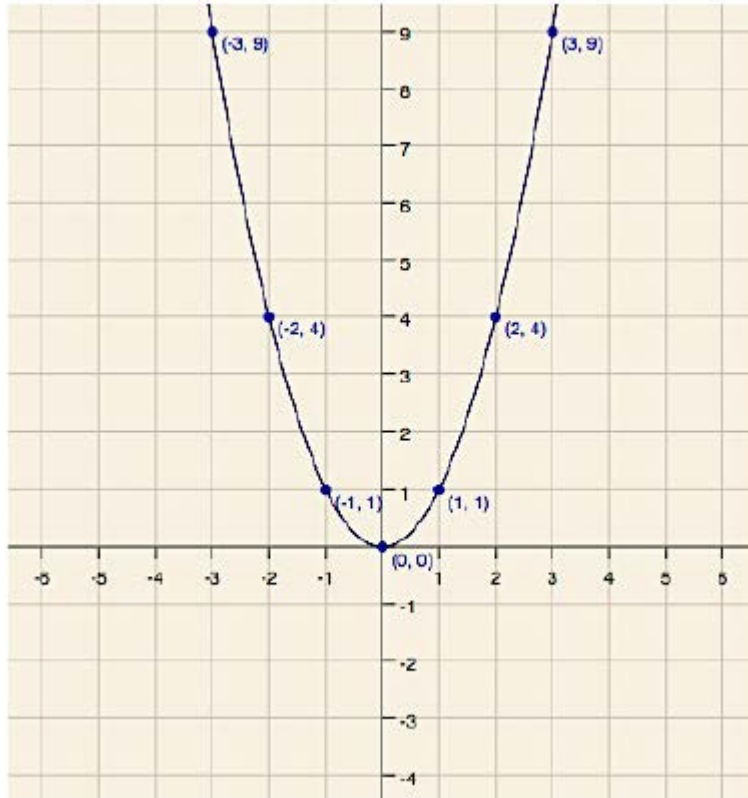


a. $y_1 = x + 2$

b. $y_2 = x - 2$

c. $y_3 = 2x$

2. Graph the following quadratic equations on the grid.



The equation $y = x^2$ has been graphed for you. For each new equation explain what the number 3 does to the graph of $y = x^2$. Pay attention to the y -intercept, the x -intercept(s), and the rate of change. Identify what changes in the graph and what stays the same.

a. $y_1 = x^2 + 3$

b. $y_2 = x^2 - 3$

c. $y_3 = (x - 3)^2$

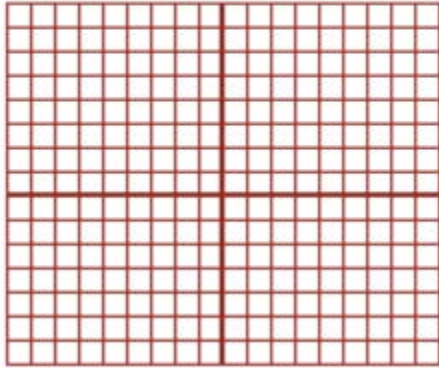
d. $y_4 = (x + 3)^2$

e. $y_5 = 3x^2$

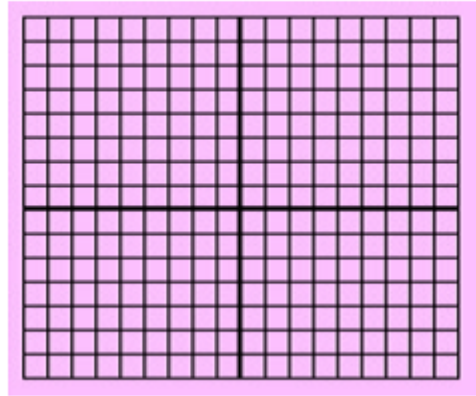
Transformations on Parent functions

Sketch the graph of the parent function and the graph of the transformed function on the same set of axes.

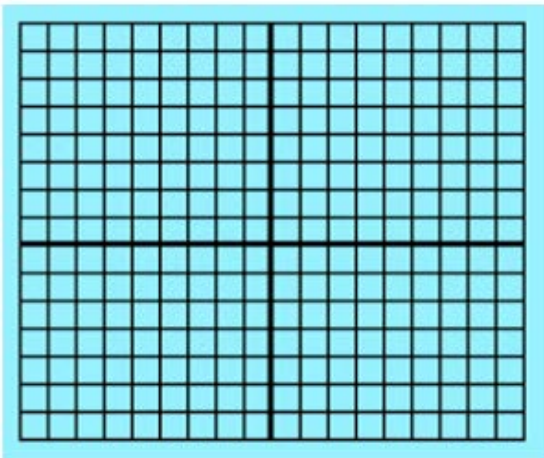
3. $f(x) = |x|$, and $g(x) = |x + 3|$



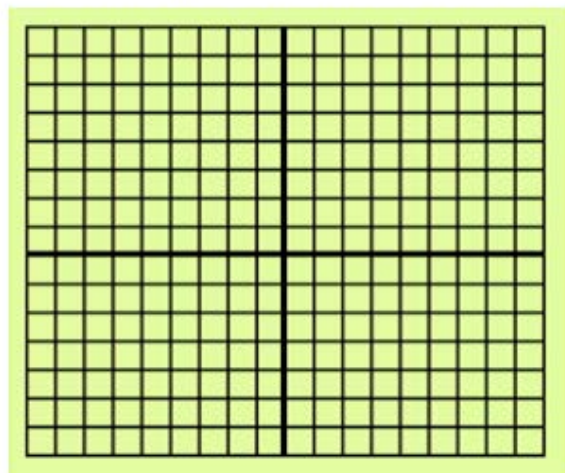
4. $h(x) = 2^x$, and $j(x) = 2^{-x}$



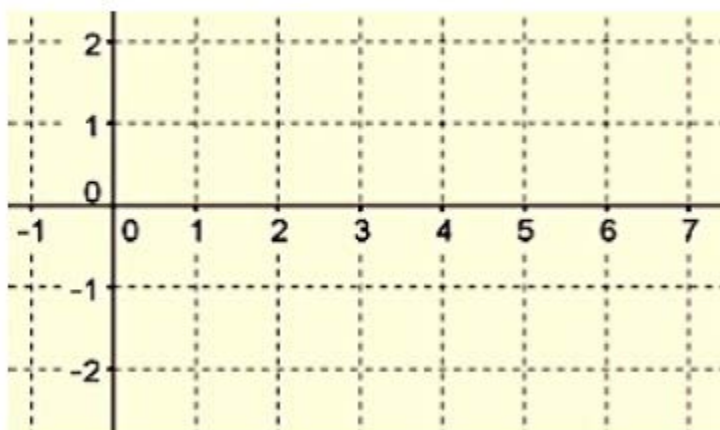
5. $r(x) = x^2$, and $s(x) = -\frac{1}{2}x^2 + 5$



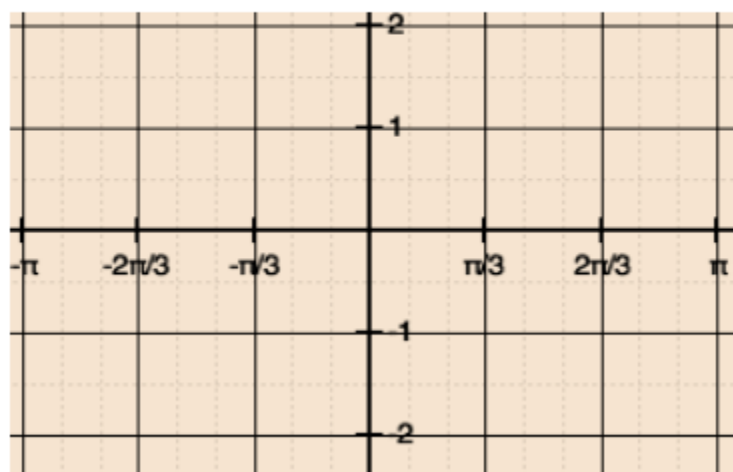
6. $v(x) = \frac{1}{x}$, and $w(x) = -\frac{1}{x}$



7. $k(x) = \log(x)$, and $m(x) = -1 + \log(x)$



8. $p(x) = \sin(x)$, and $q(x) = 2\sin\left(x + \frac{\pi}{2}\right)$



9. Find the function values: $f(-2), f(0), f(1)$ and $f(3)$. Indicate if the function is undefined for a given value of x .

a. $F(x) = |x+5|$

b. $f(x) = x|x|$

c. $f(x) = 3^{x+2}$

d. $f(x) = \frac{x}{x-4}$

e. $f(x) = \frac{x}{(x+2)} - 5$

f. $f(x) = \log_3 x$

10. A verbal description of a function is given. Find a) algebraic, b) numerical, and c) graphical representations for the function.

a. To evaluate $f(x)$, divide the input by 3 and add $\frac{2}{3}$ to the result.

b. To evaluate $g(x)$, subtract 4.3 from the input and multiply the result by -1.27.

c. Let $T(x)$ be the amount of sales tax charged in Connecticut on a purchase of x dollars. To find the tax, take 6.35% of the purchase price.

d. Let $V(d)$ be the volume of a sphere of diameter d . To find the volume, take the cube of the diameter, then multiply by π and divide by 6.

11. A function f is given, and the indicated transformations are applied to its graph (in the given order). Write the equation for the final transformed graph.

a. $f(x) = x^3$; shift upward 3 units

b. $f(x) = \sqrt{x}$; shift 2 units to the left

c. $f(x) = x^2$; shift 3 units to the right and shift upward 1 unit

d. $f(x) = |x|$; shift 4 units to the left and shift downward 2 units

II. Problem Solving

1. The temperature on a certain afternoon is modeled by the function

$$C(t) = \frac{1}{2}t^2 + 2$$

where t represents hours after 12 noon ($0 \leq t \leq 6$) and C is measured in $^{\circ}\text{C}$.

- What shifting and shrinking operations must be performed on the function $y = t^2$ to obtain the function $y = C(t)$?
- Suppose you want to measure the temperature in $^{\circ}\text{F}$ instead. What transformation would you have to apply to the function $y = C(t)$ to accomplish this? (Use the fact that the relationship between Celsius and Fahrenheit degrees is given by $F = \frac{9}{5}C + 32$.) Write the new function that results from this transformation.

III. Reasoning

- A family of functions is given in part (a). Use a calculator, GeoGebra or Desmos to graph all the given members of the family in parts (b) and (c). In part (d) state the conclusions that you can make from your graphs.
 - $f(x) = (x - c)^3$
 - $c = 0, 2, 4, 6$
 - $c = 0, -2, -4, -6$
 - How does the value of c affect the graphs of this family of functions?
- A family of functions is given in part (a). Use a calculator, GeoGebra or Desmos to graph all the given members of the family in parts (b) and (c). In part (d) state the conclusions that you can make from your graphs.
 - $f(x) = x^c$
 - $c = \frac{1}{2}, \frac{1}{4}, \frac{1}{6}$
 - $c = 1, \frac{1}{3}, \frac{1}{5}$
 - How does the value of c affect the graphs of this family of functions?

IV. Modeling

1. There are four ways to represent a function:

- Verbally
- Algebraically – with an equation
- Numerically – in a table
- Visually – in a graph

Think of a function that can be represented in all four ways, and write the four representations.