

2 Linear and Quadratic Functions

2.1 Linear Functions

2.1.1 Exercises

page 163: 5, 7, 15, 18, 26, 28, 32, 35, 45

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Is a constant function $f(x) = b$ a linear function?

★ Yes, a constant function of the form $f(x) = b$ is considered a linear function. Here's why:

- **Linear Function Definition:**
 - In basic algebra, a linear function is one whose graph forms a straight line.
 - The general form of a linear function is often expressed as $f(x) = mx + b$, where 'm' is the slope and 'b' is the y-intercept.
- **Constant Function as a Special Case:**
 - A constant function $f(x) = b$ can be seen as a special case of the linear function where the slope 'm' is equal to 0.
 - Therefore, $f(x) = 0x + b$, which simplifies to $f(x) = b$.
 - Graphically, this represents a horizontal line, which is indeed a straight line.

Therefore, a constant function is a form of a linear function, specifically one with a slope of zero.

Copilot

My textbook defines a linear function as $f(x) = mx + b$, where m is not equal to zero, and classifies $f(x) = b$ as a separate category. Does anyone else do this?

Yes, some textbooks and mathematical contexts do make a distinction between linear functions with a non-zero slope and constant functions. By defining a linear function specifically as $f(x) = mx + b$ with $m \neq 0$, they set apart functions that have a non-zero slope, thereby excluding horizontal lines. In this framework, constant functions $f(x) = b$ are considered separately because their slope m is zero.

This distinction can be useful in certain mathematical contexts where it's important to highlight the difference between functions with variable outputs that change with x and those that remain constant regardless of x . It's a matter of definition and context.

It's all about the context and what aspects of functions are being focused on. The more inclusive definition of a linear function might be used in some contexts to highlight the special case where the slope is zero.

2.1: 31

31. A plumber charges \$50 for a service call plus \$80 per hour. If she spends no longer than 8 hours a day at any one site, find a linear function that represents her total daily charges C (in dollars) as a function of time t (in hours) spent at any one given location.

linear function $f(x) = mx + b$

$c(t) = mt + b$, $m = \text{slope}$
 $t = C\text{-intercept}$

$b = \$50$
 $m = \frac{\$80}{\text{hr}}$

$c(t) = \left(\frac{\$80}{\text{hr}}\right)t + \50

$$c(t) = \left(\frac{\$80}{\text{hr}} \right) t + \$50$$

$$c(t) = 80t + 50$$

If she works for 3 hours at one location.
What is the charge for that customer?

$$c(3 \text{ hr}) = \left(\frac{\$80}{\text{hr}} \right) (3 \text{ hr}) + \$50$$

$$= \$240 + \$50$$

$$c(3 \text{ hr}) = \$290$$

$$c(3) = (80)(3) + 50$$

$$c(3) = 240 + 50$$

$$c(3) = 290$$

she charges \$290

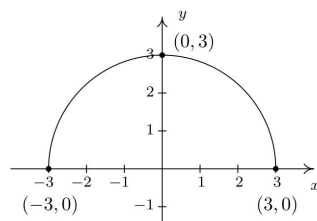
Quiz 2 MDE 61 (group quiz)

Theorem 1.7. Transformations. Suppose f is a function. If $A \neq 0$ and $B \neq 0$, then to graph

$$g(x) = Af(Bx + H) + K$$

1. Subtract H from each of the x -coordinates of the points on the graph of f . This results in a horizontal shift to the left if $H > 0$ or right if $H < 0$.
2. Divide the x -coordinates of the points on the graph obtained in Step 1 by B . This results in a horizontal scaling, but may also include a reflection about the y -axis if $B < 0$.
3. Multiply the y -coordinates of the points on the graph obtained in Step 2 by A . This results in a vertical scaling, but may also include a reflection about the x -axis if $A < 0$.
4. Add K to each of the y -coordinates of the points on the graph obtained in Step 3. This results in a vertical shift up if $K > 0$ or down if $K < 0$.

The complete graph of $y = f(x)$ is given below. In Exercises 38 - 49, use it and Theorem 1.7 to graph the given transformed function.



The graph for Ex. 38 - 49

$$A = 1$$

$$B = -2$$

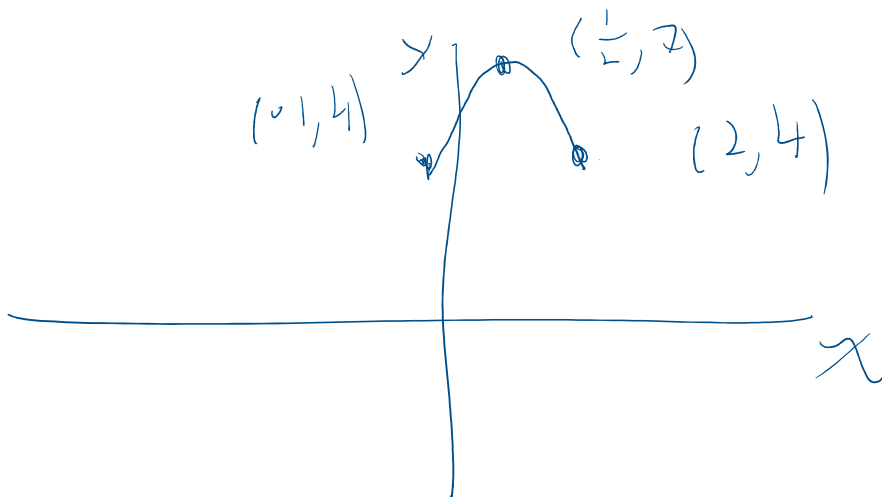
$$H = 1$$

$$K = 4$$

48. $p(x) = 4 + f(1 - 2x)$

In your transformed graph, show where the three given points are transformed.

- | | | | |
|---|----------------------|-------------------------|---------------------|
| | $(-3, 0)$ | $(0, 3)$ | $(3, 0)$ |
| ① | $(-3-1, 0)$ | $(0-1, 3)$ | $(3-1, 0)$ |
| | $(-4, 0)$ | $(-1, 3)$ | $(2, 0)$ |
| ② | $(-\frac{4}{-2}, 0)$ | $(\frac{-1}{-2}, 3)$ | $(\frac{2}{-2}, 0)$ |
| | $(2, 0)$ | $(\frac{1}{2}, 3)$ | $(-1, 0)$ |
| ③ | $(2, 0(1))$ | $(\frac{1}{2}, (3)(1))$ | $(-1, 3(0))$ |
| | $(2, 0)$ | $(\frac{1}{2}, 3)$ | $(-1, 0)$ |
| ④ | $(2, 0+4)$ | $(\frac{1}{2}, 3+4)$ | $(-1, 0+4)$ |
| | $(2, 4)$ | $(\frac{1}{2}, 7)$ | $(-1, 4)$ |



original function is from $x^2 + y^2 = 3^2 = 9$

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$$y^2 = 9 - x^2$$

$$y = \pm \sqrt{9 - x^2}$$

$$\text{then } f(x) = \sqrt{9 - x^2}$$

$$p(x) = 4 + \sqrt{9 - (1 - 2x)^2}$$

$$p(x) = 4 + \sqrt{9 - 1 + 4x - 4x^2}$$

$$p(x) = 4 + \sqrt{8 + 4x - 4x^2}$$

Our graph of the transformed function includes the three transformed points we calculated.

