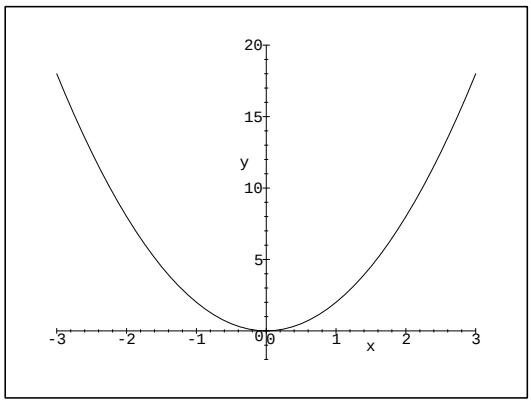
Solutions for Section 1.1 Reading Questions

1. A function is a rule that assigns an input to at most one output.

2. The following are examples of possible answers.

(a) $C = 2\pi r$

(b)



(c)

x	1	2	3	4
y	3	5	7	9

(d) The cost of gasoline is \$1.109 per gallon.

3. No. Since a function is a rule that assigns an input to at most one output, an input cannot be repeated with different outputs.

4. Yes. It is possible to have a function where different inputs result in the same output, just as long as each input has at most one output.

5. (a) To determine if a rule is a function when represented symbolically, decide if each input can give at most one output.

(b) To determine if a rule is a function when represented graphically, use the vertical line test.

(c) To determine if a rule is a function when represented numerically, you need to notice if each gives one output or not.

(d) To determine if a rule is a function when represented verbally, you need to determine if each input gives at most one output.

6. (a) Inputs will give more than one output. For example, when $x = 0, y = \pm 2$.

(b) The graph fails the vertical line test

(c) The input of 3 gives outputs of 8 and 9.

(d) A person can have more than one sister. This means, more than one output to a single input.

7. The vertical line test works because if the line intersects the graph at more than one point, there is more than one output for a single input. However, if it intersects the graph at only one point, then there is only one output for a single input.

8. The domain of a function is the set of valid inputs.

9. The range of a function is the set of actual outputs.

10. When input of a function causes division by zero or when the input of a function causes a negative number under a square root sign, the domain of a function will not include all real numbers.

11. The context of a function is important because in a real situation the domain and range will naturally be limited. For example some inputs cannot be negative (as in the case of radius, area, and volume).

12. (a) Domain: $x \geq 4$. Range: $y \geq 0$.

(b) Domain: $-4.5 \leq x \leq 4.5$. Range: $-100 \leq y \leq 100$.

(c) Domain: $0, 1, 2, 3$. Range: $0, 2, 3$.

(d) Domain is the set of days of the year (perhaps 1 to 365) and the range is the set of temperatures for each day in Detroit, Michigan.

13. The letter x represents the input.

14. (a) $f(2) = \frac{2-3}{2+2} = \frac{-1}{4}$.

(b) $f(2) = 13$.

(c) $f(2) = 5$.

15. To evaluate $f(x+2)$ you add 2 to the input, before the function is applied. To evaluate $f(x)+2$, you add 2 to the output, after the function is applied.

16. Piecewise functions are functions which have different rules for different parts of their domain.

17. $g(-4) = -(-4) + 3 = 7$, $g(0) = 2(0) + 3 = 3$, $g(4) = 2(4) + 3 = 11$, $g(10) = 10^2 = 100$.

Solutions for Section 1.2 Reading Questions

1. A graphical representation of a function allows a person to quickly and easily understand the behavior of a function by seeing the relationship between the input and the output.

2. Since pay depends upon the number of years worked, the number of years worked goes on the horizontal axis and pay goes on the y-axis.

3. Labeling axes is important because it tells the reader of the graph which axis represents which variable. By putting numbers on the axes, points on the graph can be read.

4. If tick marks are not equally spaced on the axis, the graph is distorted.

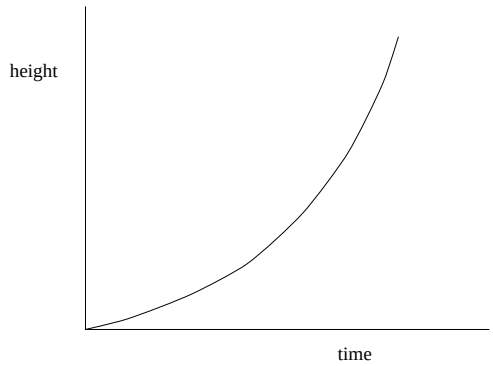
5. A function is increasing on an interval if, for every point in that interval, a point to the right has a greater output.

6. The golden arches at McDonalds are Concave down.

7. The point $(0, 8)$ is a y-intercept because the x-coordinate is 0.

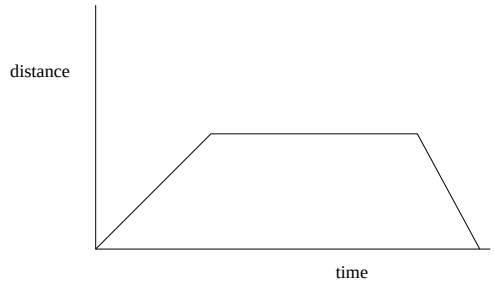
8. If f is symmetric about the origin, then $f(x) = -f(-x)$ so, $f(-1) = -2$.

9.



This graph is concave up while the graph in Example 4 is concave down.

10.



11. A scatterplot is a graph that is used to plot data consisting to two variables.

12. The scatterplot in Figure 14 does not represent a function because some inputs have more than one output.

13. People whose points lie above the line $y = x$ have arm spans are longer than their height. People whose points lie below the line $y = x$ have arm spans shorter than their height.

Solutions for Section 1.4 Reading Questions

1. It is important to transform the original question because it is vague and is something that cannot be answered mathematically.

2. It is important to have to the same area in order to standardize the problem, so that the two situations (square inscribed in a circle and circle inscribed in a square) are the same except for the shapes.

3. In order to develop a mathematical model that gives the price of a pizza for a given diameter, you have to assume that the pizza is circular, you have a certain number of toppings, and a certain type of crust.

4. "Getting specific" is a good strategy because it helps you understand your model better and test the validity of the model by comparing it with what you know about the situation.

5. The difference between the area of a square inscribed in a circle of area 2 is greater. This area is $2 - \frac{4}{\pi} \approx 0.7267$. The difference between the area of a circle inscribed in a square of area 2 is $2 - \frac{\pi}{2} \approx 0.4292$.

6. Since 5280 feet = 1 mile, 1454 feet is $\frac{1454}{5280}$ miles.

7. We did not include $\pm$ in our "distance we could see out to the horizon" when solving for d, because distance cannot be negative.

8. Finding general formulas is important because specific formulas only allow you to reach conclusions for few cases, while general formulas are always true and versatile enough to be used for any input.

9. Algebra is important in generalizing because it uses variables instead of numbers. In doing so, this allows for any input.

10. It is safe to assume that A is always positive because area cannot be negative.

11. $d = \sqrt{7900 \cdot 555 + 555^2} \approx 28.8$, therefore you could see about 28.8 miles out to the horizon if you were on a building that was 555 feet tall.

12. When you analyze a mathematical model, you should connect your model back to the physical situation, determine any limitations in your model, and ask yourself other questions that could lead to developing a different model.

13. To determine the distance to the horizon from the tops of the buildings by using the model $d = \sqrt{7900h + h^2}$, an appropriate domain is about $\frac{10}{5280}$ miles $\leq h \leq \frac{1500}{5280}$ miles, and corresponding range is about 3.9 miles $\leq d \leq$ 47.4 miles.

14. If you are ahead of the critical point and the light turns yellow, you should drive through, however, if you are behind the critical point when the light turns yellow, you should stop.

15. In the model $t = 1 + \frac{v}{20} + \frac{70}{v}$, 1 represents the reaction time, $\frac{v}{20}$ represents the time needed to brake, and $\frac{70}{v}$ represents the time needed to drive through the intersection.

16. The width of the intersection affects the time needed for a yellow light, because the faster you are traveling, the less time it will take you to travel through the intersection. The velocity of the cars affect the time needed for a yellow light, because the faster you are traveling the more time it will take you to safely slow down to stop.