Dear Teachers,

During the listening tour, the Eureka Math Team enjoyed the opportunity to witness our curriculum being implemented in St. Charles classrooms. We listened carefully to the feedback you provided about additional resources that could support implementation and are excited to deliver a pilot version of a new resource, Eureka Math Homework Guides, intended to help bridge the gap between the classroom and home.

Our writers have begun creating Homework Guides to provide families with insight of the understandings and skills gained during each math lesson. The guides are designed to deliver guidance for the problems on the homework pages (K-5)/problem sets (6-12). The problems and their worked out solutions included in each Homework Guide were chosen intentionally and closely align with at least one problem on the homework/problem set.

After examining your curriculum maps, we created ten Homework Guides for each grade level, K-10, and have done our best to create these documents for immediate use. In order for these to support student learning, please make them available for families at home. Students and their families can use the Homework Guides to receive helpful hints when homework becomes challenging.

In order for you to help us continue to improve our curriculum and accompanying resources, we welcome any and all feedback you and/or your students' families can provide. After receiving feedback, our goal is to create a Homework Guide for every lesson in the curriculum and make them available to the public.

We are excited to provide you with this pilot set of Homework Guides and even more excited to improve this resource through your valued feedback.

Many Thanks,
The Eureka Math Team

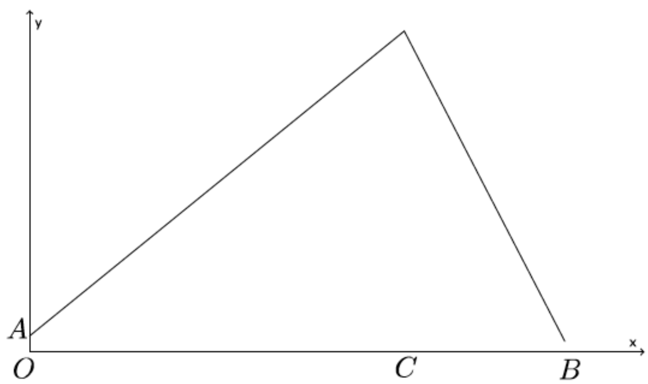
G8-M5-Lesson 1: The Concept of a Function

Lesson Goals

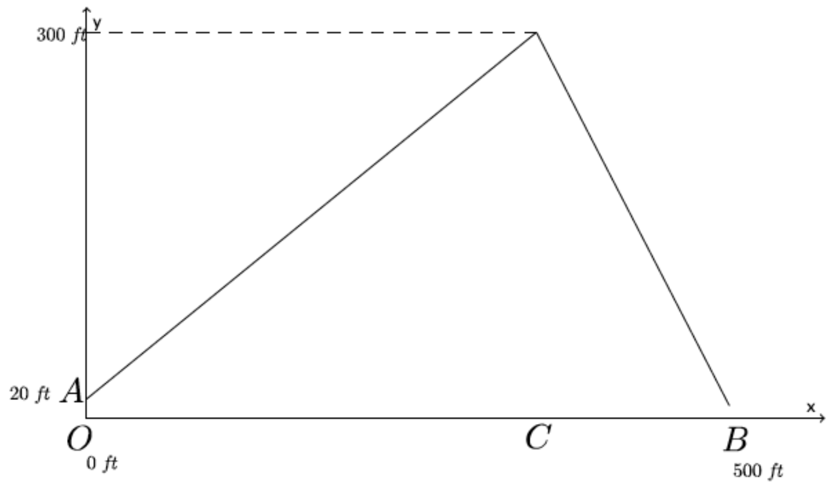
Students are introduced to functions and learn that functions allow us to make predictions about the distance an object moves in any time interval. In the example below, both distance and height are a function of time. Students calculate average speed of a moving object over specific time intervals.

Examples

1. Consider the path of the first 10 seconds of a roller coaster ride, graphed below on a coordinate plane. The x-axis represents the horizontal distance traveled and the y-axis represents the height of the roller coaster.



- Include the information below on the graph.
  - Point A represents the platform, 20 ft from the ground, where you get onto the ride.
  - The length OB is approximately 500 ft.
  - The highest point on this part of the ride, 300 ft from the ground, is reached 8 seconds after the ride begins.



a. How much time has passed if the roller coaster is at point A? Explain.

No time, $t = 0$, because this is where we get on the ride.

b. How much time has passed as the roller coaster moves from point A to point B?

10 seconds. We were told that the graph represents the first 10 seconds of the ride.

c. Approximate the coordinates of the roller coaster for the following values of t: $0, 2, 5, 8$, and 10.

At $t = 0$, the coordinates are $(0, 20)$. The coaster is on the platform and the ride hasn't started yet.

At $t = 2$, the coordinates are approximately $(100, 90)$.

I can estimate the x-value as 100. The reason is that the total distance traveled in 10 seconds is 500 ft, then $\frac{2}{10}$ of 500 is 100. I estimate the y-value to be 90 by looking at the graph. The height after two seconds must be between 20 and 300, but closer to 20.

At $t = 5$, the coordinates are approximately $\left(\frac{5}{10} \times 500, 195\right) = (250, 195)$.

At $t = 8$, the coordinates are approximately $\left(\frac{8}{10} \times 500, 300\right) = (400, 300)$. We were given the height at 8 seconds as 300 ft.

At $t = 10$, the coordinates are approximately $(500, 5)$.

d. What ordered pair represents point C? Explain how you know.

Point C appears to be on the x-axis, below the highest point on the graph, which we said was at $(400, 300)$. Therefore, Point C is approximately at $(400, 0)$.

e. Functions allow us to make predictions about the world around us. In this case, the graph represents the location of the roller coaster as a function of time. We can make predictions about the location of the roller coaster in the first 10 seconds of the ride because we have information about the distance and height of the coaster from the starting point (platform). Use your answers from part (d) to make two predictions about the path of the roller coaster.

After 1 second, the roller coaster is approximately 50 ft from the starting point and about 55 ft up.

After 9 seconds, the roller coaster is approximately 450 ft from the starting point and about 100 ft up.

Use the graph to make predictions about the roller coaster's distance from the starting point and its height for *any* point on the graph of its path.

G8-M5-Lesson 2: Formal Definition of a Function

Lesson Goals

Students learn that a function is a rule that assigns to each input exactly one output. Functions can be described by rules or formulas. Formulas (equations) are used to compute outputs for given inputs.

Examples

1. The table below represents the number of minutes Esmeralda reads each day for a week. Does the data shown below represent values of a function? Explain.

Day (x)	1	2	3	4	5	6	7
Time in Minutes (y)	85	30	60	30	15	80	10

Each input has exactly one output, therefore this data represents a function.

Check each x-value (input) to make sure each has only one unique y-value (output).

2. The table below represents the total number of steps that Jamar takes for various months in a given year. Examine the data in the table below and determine whether or not it could represent a function. Explain.

Month (x)	March	July	March	February	June	October
Number of Steps (y)	215,760	235,842	201,388	197,094	220,972	200,578

This data cannot represent a function because there are two values given for the month of March. Jamar cannot take $215,760$ and $201,388$ steps in the same month.

3. A function can be described by the rule $y = x^2 - 1$. Determine the corresponding output for each given input.

Input (x)	-3	-1	0	1	3
Output (y)	$(-3)^2 - 1$ $= 9 - 1$ $= 8$	$(-1)^2 - 1$ $= 1 - 1$ $= 0$	$0^2 - 1$ $= 0 - 1$ $= -1$	$1^2 - 1$ $= 1 - 1$ $= 0$	$3^2 - 1$ $= 9 - 1$ $= 8$

I just substitute the x-value into the equation $y = x^2 - 1$. The answer I get, y, is the output.

4. Examine the data in the table below. The inputs represent the number of cans of corn purchased, and the outputs represent the cost. Determine the cost of one can of corn, assuming the price per can is the same no matter how many cans are purchased. Then, complete the table.

Cans of Corn (x)	1	2	3	4	5	6	7
Cost (y)	$\mathbf{0.50}$	$\mathbf{1.00}$	$\$1.50$	$\mathbf{2.00}$	$\$2.50$	$\mathbf{3.00}$	$\mathbf{3.50}$

a. Write the rule that describes the function.

Let y be the cost of x cans of corn.

Write each part of the proportion as $\frac{cost}{cans\ of\ corn}$.

$$\frac{y}{x} = \frac{1.50}{3}$$
$$y = \frac{1.50}{3}x$$
$$y = 0.50x$$

Now, this problem is just like the last one!

First I define my variables x and y. Then, I write a proportion using data from the table and the variables. Once I solve the proportion for y, I'll have the rule.

b. Can you determine the value of the output for an input of $x = -10$? If so, what is it?

Yes, just substitute -10 in for x to determine the output:

$$y = 0.50x$$
$$y = 0.50(-10)$$
$$y = -5.00$$

c. Does an input of -10 make sense in this situation? Explain.

An input of -10 means that -10 cans of corn were purchased. Only a positive number of cans can be purchased so no, an input of -10 does not make sense in this situation.

G8-M5-Lesson 3: Linear Functions and Proportionality

Lesson Goals

In this lesson, students write equations that describe functions using data in a table. Each context involves constant speed and proportional relationships that represent a linear functional relationship.

Examples

1. A particular linear function has the table of values below.

Input (x)	-2	4	6	12	15	16	19
Output (y)	$\mathbf{-14}$	16	26	$\mathbf{56}$	71	$\mathbf{76}$	91

a. What is the equation that describes the function?

Any pair of data can be used to determine the rate of change. We will use $(4, 16)$ as (x_1, y_1) and $(6, 26)$ as (x_2, y_2).

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{26 - 16}{6 - 4} = \frac{10}{2} = 5$$

To write the equation I must first determine the rate of change, m. Next, I will substitute the values of x, y and m into the linear equation $y = mx + b$ to determine the value of b.

To write the equation, we select a pair of data and use $m = 5$ in the equation $y = mx + b$:

We can select any input to use as x, but we must use the corresponding output as the y-value. Using $(4, 16)$ will work because 16 corresponds to the input of 4. Using $(4, 71)$ will not work because 71 corresponds to the input of 15 not 4.

$$\begin{aligned}
&y = mx + b\\
&16 = 5(4) + b\\
&16 = 20 + b\\
&16 - 20 = 20 - 20 + b\\
&-4 = 0 + b\\
&-4 = b
\end{aligned}$$

The equation that describes this function is $y = 5x + (-4)$ or the equivalent equation $y = 5x - 4$.

b. Complete the table using the rule (the equation you wrote in part (a)).

We need the outputs that correspond to the inputs of -2, 12 and 16. To determine them, substitute the value of each input, x, into the equation we found in part (a).

For $x = -2$:
$y = 5x - 4$
$y = 5(-2) - 4$
$y = -10 - 4$
$y = -14$

For $x = 12$:
$y = 5x - 4$
$y = 5(12) - 4$
$y = 60 - 4$
$y = 56$

For $x = 16$:
$y = 5x - 4$
$y = 5(16) - 4$
$y = 80 - 4$
$y = 76$

2. A linear function has the table of values below. The data in the table shows the time, in hours, that a car travels and the corresponding distance traveled in miles. Assume the car travels at a constant speed.

Number of Hours Traveled (x)	1.75	3.25	4
Distance in Miles (y)	101.5	188.5	232

a. Describe the function in terms of distance and time.

The distance the car travels is a function of the time it spends traveling.

Is distance a function of the time the car travels or is time a function of the distance traveled? I normally say that the output is a function of the input.

b. Write the rule that represents the linear function that describes the distance traveled in miles, y, in x hours.

This is just like part (a) of the previous problem!

$$m = \frac{232 - 188.5}{4 - 3.25} = \frac{43.5}{0.75} = 58$$

Using $(x, y) = (4, 232)$ and $m = 58$ in the equation $y = mx + b$:

$$232 = 58(4) + b$$
$$232 = 232 + b$$
$$232 - 232 = 232 - 232 + b$$
$$0 = b$$

The equation for this function is $y = 58x$.

G8-M5-Lesson 4: More Examples of Functions

Lesson Goals

Discrete and continuous rates are introduced in the context of a function. Discrete rates are those where the input must be separate and distinct (e.g., number of books, children or vehicles). Continuous rates are those where the input can be any value and no gaps exist in the data.

Examples

1. A function has the table of values at right that shows the total cost for a certain number of football tickets purchased.

Number of Tickets	Total Cost in Dollars
3	18.75
7	43.75
8	50
15	93.75

   a. Is the function a linear function? Explain.

   Sample Student Response:

   Yes, the function is linear because the cost of each ticket is the same no matter how many are purchased. For example, 3 tickets costs $\$18.75$, or $\$6.25$ each. No matter how many tickets are purchased, the cost is $\$6.25$ per ticket.

   b. Describe the limitations of x and y.

   The input is a specific number of tickets so it doesn't make sense for that number to be negative or fractional. The inputs (x-values) must be positive integers. The output is the cost, which is ok to be fractional, but not negative. The outputs (y-values) must be positive rational numbers.

   I need to think about what kinds of inputs would make sense in this situation. For example, does it make sense for the values of x and y to be negative or fractional?

   c. Is the function discrete or continuous?

   The function is discrete because you cannot purchase part of a ticket. That is, there is no output that would correspond to 5.25 tickets.

   I need to use my answer from part (b) for this. Continuous rates can be measured for any input of x. Discrete rates are separate and distinct and cannot include fractional parts of an input.

d. Is it reasonable to assume that this function could be used to predict the cost of purchasing ten billion tickets? Explain.

It is unlikely that a football stadium could be large enough to hold ten billion people. The function is limited by the number of people that would fit in the stadium.

2. A function has the table of values below. Examine the information in the table to answer the questions below.

Input	Output
8:00 a.m.	Breakfast
10:00 a.m.	Snack
12:00 p.m.	Lunch
3:00 p.m.	Snack
6:00 p.m.	Dinner

a. Describe the function.

It appears that the function describes what kind of meal may be eaten at a particular time of day.

b. What output would the function assign to the input $8:15$ am?

The function would probably assign "breakfast" to the input of $8:15$ am.

c. Can this function be described using a mathematical rule? Explain.

Sample Student Response:

No, a mathematical rule cannot describe this function. It can be described in words, but there is no formula or rule that can be written.

I remember my teacher saying that some functions can only be described in words, not numbers or equations, like the problem about fruit and the color of its skin that we did in class.

G8-M5-Lesson 5: Graphs of Functions and Equations

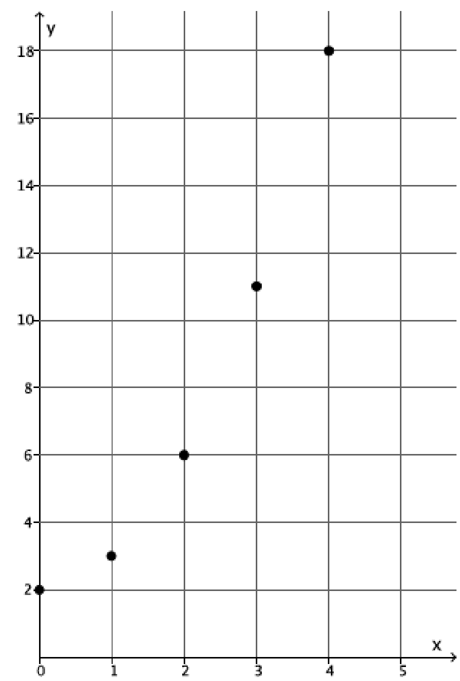
Lesson Goals

Students graph functions by relating inputs and their corresponding outputs to ordered pairs. The ordered pairs are then graphed on a coordinate plane to represent the function. Students analyze graphs to determine if the graph represents a function.

Examples

1. Graph the equation $y = x^2 + 2$ for positive values of x. Organize your work using the table below, and then answer the questions that follow.

x	y
0	$\mathbf{0^2 + 2 = 2}$
1	$\mathbf{1^2 + 2 = 3}$
2	$\mathbf{2^2 + 2 = 6}$
3	$\mathbf{3^2 + 2 = 11}$
4	$\mathbf{4^2 + 2 = 18}$



a. Plot the ordered pairs on the coordinate plane.

The ordered pairs are $(\mathbf{0, 2})$, $(\mathbf{1, 3})$, $(\mathbf{2, 6})$, $(\mathbf{3, 11})$ and $(\mathbf{4, 18})$.

b. What shape does the graph of the points appear to take?

It appears to be a curve.

Does the graph appear to take the shape of a line or a curve? Can you draw one straight line through all of the points?

c. Is this the graph of a linear equation? Explain.

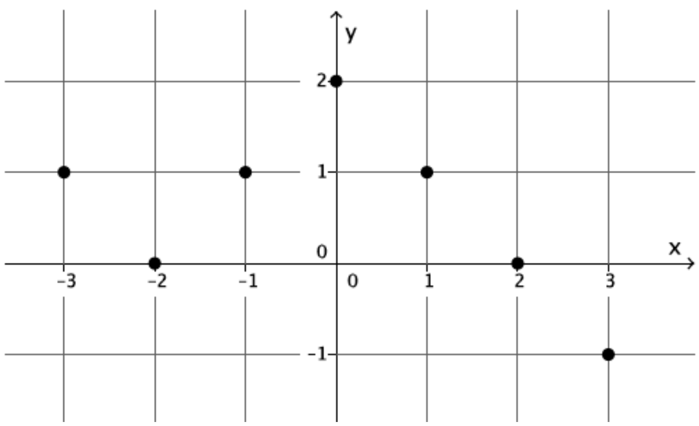
No. A graph that is linear would have the shape of a line. This graph is a curve.

d. A function has the rule so that it assigns to each input, x, the output, $x^2 + 2$. The rule for this function is $y = x^2 + 2$. What do you think the graph of this function will look like? Explain.

Since the function has the same rule as the equation, then the graph of the function will be identical to the graph of the equation. I can verify this by taking each input, x, and substituting it into the equation that describes the function, y=x^2+2, to get the output. Then I would graph the ordered pairs (input, output).

The equation $y = x^2 + 2$ and the rule for this function are the same. What will that mean about their graphs?

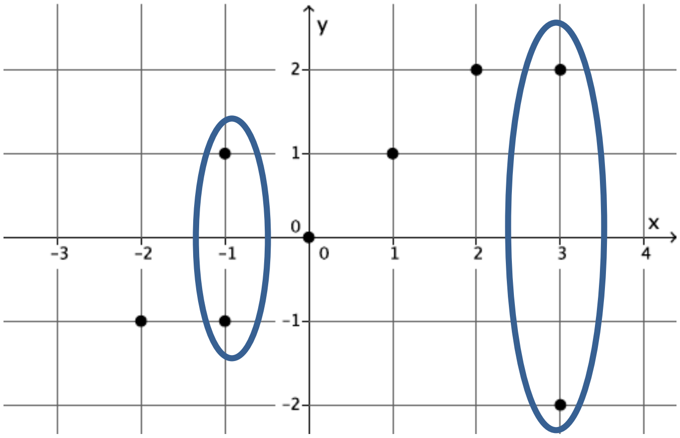
2. Examine the graph below. Could the graph represent the graph of a function? Explain why or why not.



The definition of function will help me. I need to check that every input (x-value) has only one output (y-value).

This is the graph of a function because every x-value has just one corresponding y-value.

3. Examine the graph below. Could the graph represent the graph of a function? Explain why or why not.



In this graph, I see that $x = -1$ has two y-values and so does $x = 3$.

This is <u>not</u> the graph of a function because there are some values of x (inputs) that have more than one corresponding y-value (outputs). For example, the input of -1 corresponds to both 1 and -1. Another example is the input of 3, it corresponds to the outputs of 2 and – 2.

G8-M5-Lesson 6: Graphs of Linear Functions and Rate of Change

Lesson Goals

The rate of change is used to determine if a function is a linear function. When the rate of change is constant for every pair of inputs and outputs, the function is linear.

Examples

1. A function assigns the inputs and corresponding outputs shown in the table below.

Input	Output
-3	5
-1	7
1	9
3	11

a. Is the function a linear function? Check at least three pairs of inputs and their corresponding outputs.

$$\frac{7-5}{-1-(-3)}=\frac{2}{2}=1 \qquad \frac{11-7}{3-(-1)}=\frac{4}{4}=1 \qquad \frac{11-9}{3-1}=\frac{2}{2}=1$$

I need to make sure the rate of the change is the same value for each of the three pairs that I check. If they are the same, then I know the function is a linear function.

b. What equation describes the function?

Using the input and corresponding output $(1, 9)$:

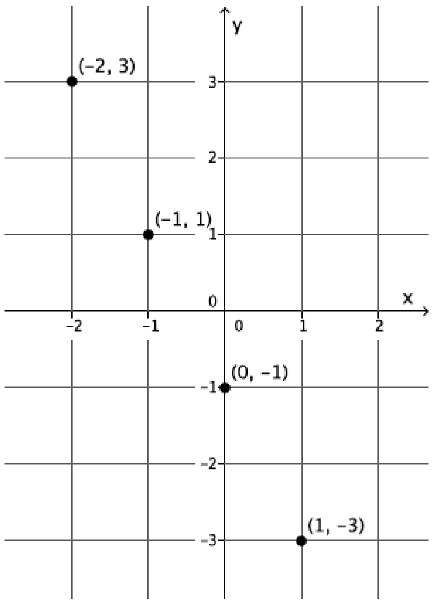
$$\begin{aligned} y &= mx+b \\ 9 &= 1(1)+b \\ 9 &= 1+b \\ 9-1 &= 1-1+b \\ 8 &= b \end{aligned}$$

Since $m = 1$ and $b = 8$, the equation that describes this function is $y = 1x + 8$ or just $y = x + 8$.

c. What will the graph of the function look like? Explain.

Since the function is described by a linear function and I know from the last lesson that the graph of the function will be identical to the graph of the equation that describes it, then the graph of this function is a line. Linear equations graph as lines, therefore linear functions will also graph as lines.

2. Is the following graph a graph of a linear function? How would you determine if it is a linear function?



This is just like part (a) of the last problem. The only difference is that my inputs and outputs are graphed instead of in a table.

If the rate of change is the same, then this is a linear function.

$$\frac{3-1}{-2-(-1)}=\frac{2}{-1}=-2$$

$$\frac{-3-(-1)}{1-0}=-\frac{2}{1}=-2$$

$$\frac{-1-1}{0-(-1)}=\frac{-2}{1}=-2$$

Since the rate of change is the same, -2, this is the graph of a linear function.

3. Xander says you really only need to check two pairs of inputs and outputs to determine if the function is linear. Is he correct? Explain. Hint: Show an example with a table where this is not true.

It is always a good idea to check three pairs of inputs and outputs.

The table below demonstrates why.

I need to develop a table of values where two pairs of inputs and outputs give the same value, but a third pair would give a different value.

Input (x)	Output (y)
3	**7**
−1	**−1**
0	**1**
5	**6**

$$\frac{7-(-1)}{3-(-1)}=\frac{8}{4}=2 \qquad \frac{1-(-1)}{0-(-1)}=\frac{2}{1}=2 \qquad \frac{6-1}{5-0}=\frac{5}{5}=1$$

Since the third pair gave a different value than the first two pairs, it shows that Xander's statement is incorrect.

G8-M5-Lesson 7: Comparing Linear Functions and Graphs

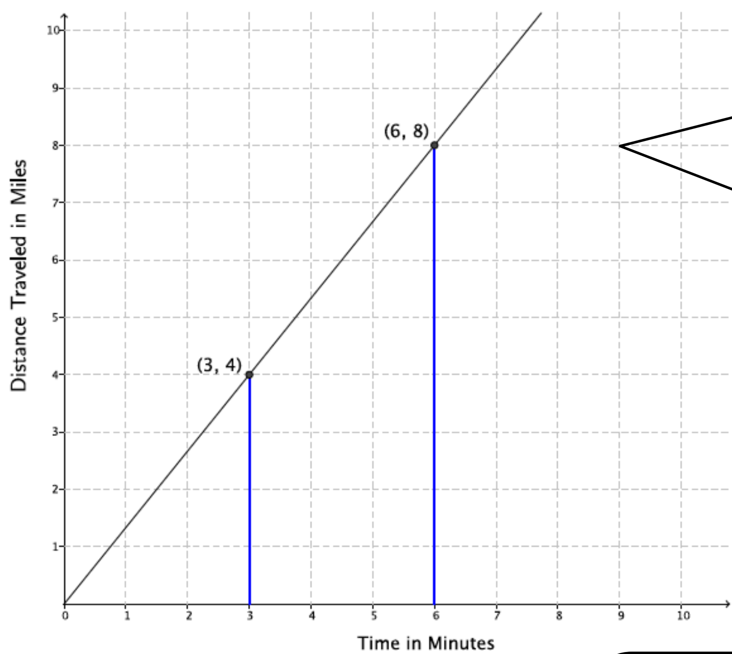
Lesson Goals

Students compare functions that are represented in different ways. Functions may be described in words, expressed by an equation, represented in a table of values or a graph. The functions are compared by analyzing each function's rate of change and/or y-intercept.

Examples

1. The graph below represents the distance, y, Car A travels in x minutes. The table represents the distance, y, Car B travels in x minutes.

Car A:



If this car is traveling at a constant rate I can compute its rate by using the slope formula or looking at the fraction that compares the vertical distance to the horizontal distance between any pair of points.

Car B:

Time in minutes (x)	Distance (y)
15	13.5
25	22.5
35	31.5

To figure out if this car is traveling at a constant rate I need to check various pairs of data using the slope formula to see if they are equal to the same value. That value, if constant, will be the rate the car travels.

a. Is Car A traveling at a constant rate? Explain how you know.

Since the graph of the data related to Car A is a line, then the equation that describes the function must be a linear equation. Therefore, this car is traveling at a constant rate.

b. Is Car B traveling at a constant rate? Explain how you know.

$\frac{22.5-13.5}{25-15} = \frac{9}{10}$ $\frac{31.5-22.5}{35-25} = \frac{9}{10}$ $\frac{31.5-13.5}{35-15} = \frac{18}{20} = \frac{9}{10}$

Car B is traveling at a constant rate because all pairs of data have the same slope value or rate.

c. Which car is traveling at a slower rate? Explain.

Using the graph or the slope formula, Car A travels at a rate of $\frac{4}{3}$. By inspecting the rate of change for the data within the table, Car B travels at a rate of $\frac{9}{10}$. Since $\frac{9}{10} < \frac{4}{3}$, Car B is travelling at a slower rate.

2. The rule $y = 6.67x + 35$ describes the cost function for a phone plan at Company A. Company A charges a flat fee of $35 for phone service, plus $6.67 per gigabyte of data used each month. Company B has a similar function that assigns the values shown in the table below.

Gigabytes of Data (x)	Total Cost in Dollars (y)
1	39.50
3	54.50
5	69.50

If the data in this table represents a linear function, then I can write the equation that describes the function in the form of $y = mx + b$. Then, I can compare the rates for data, m, and the flat fee, b.

We need to check that the data in the table represents a linear function.

$\frac{54.50-39.50}{3-1} = \frac{15}{2} = 7.5$ $\frac{69.50-54.50}{5-3} = \frac{15}{2} = 7.5$ $\frac{69.50-39.50}{5-1} = \frac{30}{4} = 7.5$

Since the rate of change is equal to the same constant, 7.5, I can write the equation that describes the cost function for Company B. Using the input, x, and output, y, $(1, 39.50)$:

$$y = mx + b$$
$$39.50 = 7.5(1) + b$$
$$39.50 = 7.5 + b$$
$$39.50 - 7.50 = 7.50 - 7.50 + b$$
$$32 = b$$

The equation that describes the cost function for Company B is $y = 7.5x + 32$.

a. Which company charges a higher rate for data usage?

Comparing the rates, $7.5 > 6.67$, we can conclude that Company B charges a higher rate for data usage.

b. Which company charges a higher flat fee for phone service?

Comparing the flat fees, $35 > 32$, we can conclude that Company A charges a higher flat fee.

c. At what number of gigabytes of data used would both companies charge the same amount of money? How much will the total cost be for that amount of gigabytes used?

If the data related to both companies was graphed on the same coordinate plane, then the point of intersection of their lines would be when the costs were equal. I should write and solve a system of equations to answer this question.

$$\begin{cases} y = 6.67x + 35 \\ y = 7.5x + 32 \end{cases}$$

Since both equations are equal to y, I can write the expressions on the right of the equal sign as equal to one another, then solve.

$$6.67x + 35 = 7.5x + 32$$
$$6.67x - 6.67x + 35 - 32 = 7.5x - 6.67x + 32 - 32$$
$$3 = 0.83x$$
$$\frac{3}{0.83} = x$$
$$3.61 \approx x$$

Now substitute the value of x into the first equation and solve:

$$y = 6.67(3.61) + 35$$
$$y \approx 59.08$$

At about 3.61 gigabytes the cost would be the same at both companies. That cost would be about $\$59.08$.

G8-M5-Lesson 8: Graphs of Simple Nonlinear Functions

Lesson Goals

Students learn to distinguish between linear and nonlinear functions by examining the rate of change.

Examples

In Module 4 we analyzed linear and nonlinear equations. I remember that to be linear, the exponent of the variable, x, had to be equal to 1.

1. A function has the rule so that each input of x is assigned an output of $x^3 + 1$.

   a. Do you think the function is linear or nonlinear? Explain.

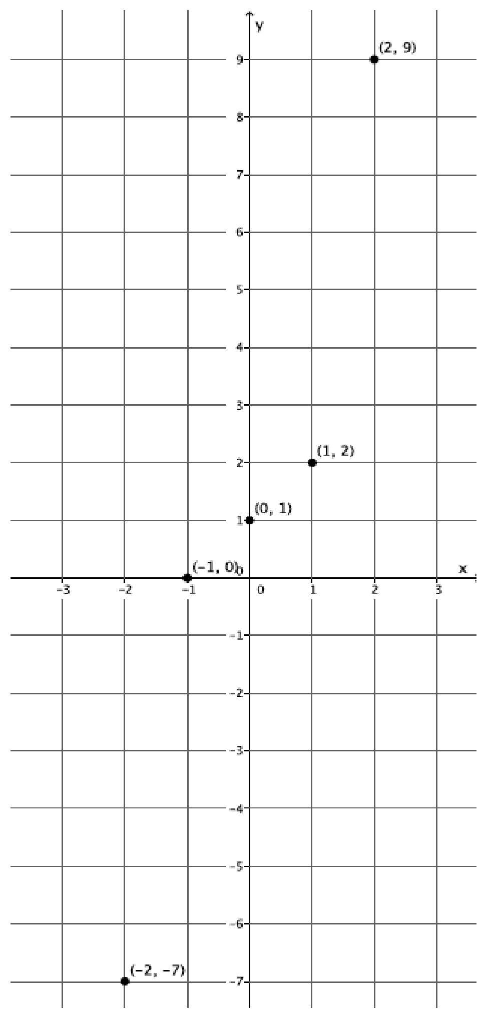
   The equation that describes this function is nonlinear because the exponent of the variable, x, is not equal to 1 so I think this is a nonlinear function.

   b. What shape do you expect the graph of the function to be?

   The graph won't be a line, because it's not linear, so it probably has a curve to it.

   c. Develop a list of inputs and outputs for this function. Plot the inputs and outputs as points on the coordinate plane where the output is the y-coordinate.

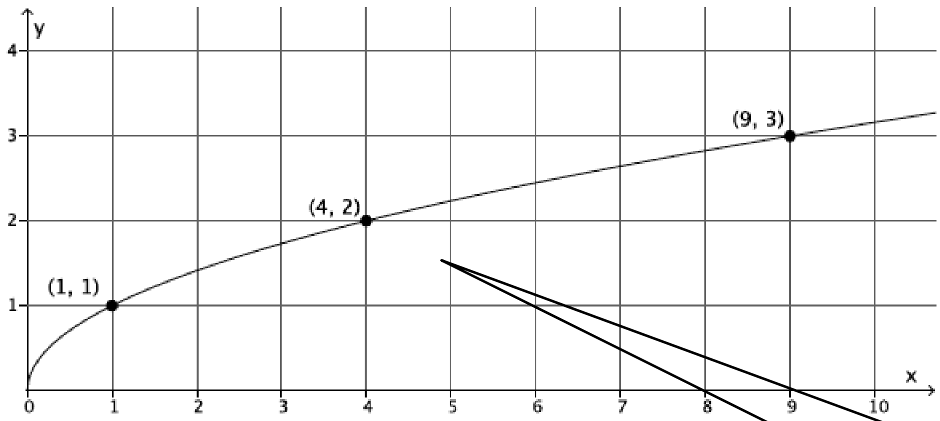
Input (x)	Output (x^3+1)
-2	$(-2)^3+1=-8+1=-7$
-1	$(-1)^3+1=-1+1=0$
0	$0^3+1=0+1=1$
1	$1^3+1=1+1=2$
2	$2^3+1=8+1=9$



d. Was your prediction correct?

I was right! There is no way to draw one straight line through all of the points on the graph. Therefore, this function is nonlinear.

2. Is the function that is represented by this graph linear or nonlinear? Explain. Show work that supports your claim.



This graph doesn't look linear at all. The way to show work to support my claim is by showing that the rate of change between pairs of points are not equal to the same value.

$$\frac{3-2}{9-4} = \frac{1}{5}$$

$$\frac{2-1}{4-1} = \frac{1}{3}$$

$$\frac{3-1}{9-1} = \frac{2}{8} = \frac{1}{4}$$

Since the rate of change was equal to a different value for all three pairs of inputs and outputs that were checked, the function represented by this graph is a nonlinear function.

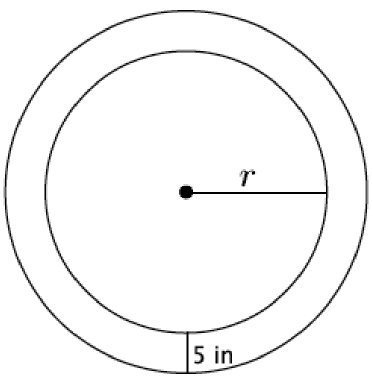
G8-M5-Lesson 9: Examples of Functions from Geometry

Lesson Goals

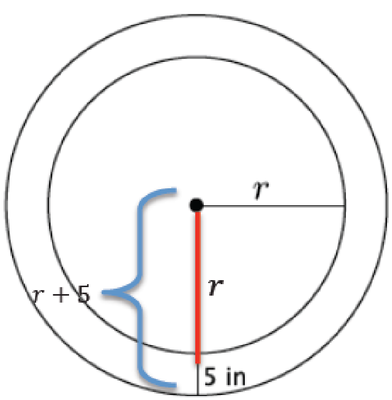
Students write rules to express functions in a geometric context like area and volume. Students determine the volume of rectangular prisms.

Examples

1. Write a function that would allow you to calculate the area, A, of the outer ring for any sized dartboard with radius r. Write an exact answer that uses π (*do not* approximate your answer by using 3.14 for π).



This is a lot like the problem we did in class. I need to write an expression that shows the difference of the areas in the two circles; the circle with radius r and the circle with radius $r + 5$.



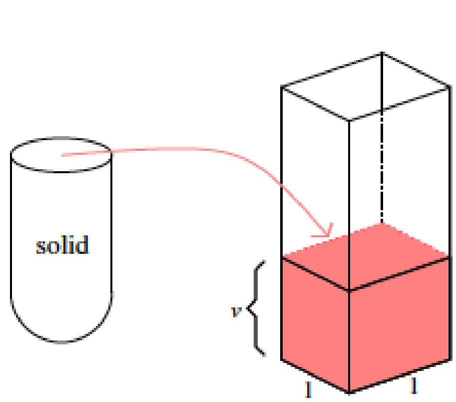
The area of the inner, smaller, circle is found by calculating πr^2.

The area of the outer, larger, circle is found by calculating $\pi(r+5)^2$.

To find the area of the outer ring, we have to find the difference of the two areas:

$$A = \pi(r+5)^2 - \pi r^2$$

2. The shell of the solid shown was filled with water and then poured into the standard rectangular prism, as shown. The height that the volume reaches is 74.68 cm. What is the volume of the solid?



The volume formula for a rectangular prism is $V = Bh$, where B is the area of the base.

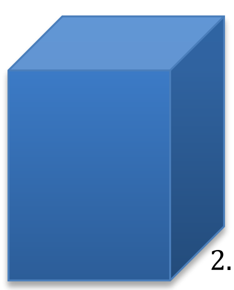
The area of the base of this prism is $1\ cm^2$ because the length and width of the base are both equal to 1.

$B = 1$ and $h = 74.68$, then

$$V = 1(74.68)$$
$$V = 74.68$$

The volume is $74.68\ \text{cm}^3$.

3. The volume of the prism shown below is 60 in^3. What is its length?



The area of the base, B, is found by multiplying the length of the base, l, by the width of the base, w.

$$V = Bh$$
$$V = l \times w \times h$$
$$60 = l \times 2.5 \times 6$$
$$60 = l \times 15$$
$$\frac{60}{15} = l\left(\frac{15}{15}\right)$$
$$4 = l$$

The length of the prism is 4 in.

G8-M5-Lesson 10: Volumes of Familiar Solids–Cones and Cylinders

Lesson Goals

Students apply the volume formulas for cones and cylinders to real-world and mathematical problems.

Examples

1. Dayna wants to fill with water a bucket that is the shape of a right circular cylinder. It has a 4-inch radius and 8-inch height. She uses a shovel that has the shape of right circular cone with a 2-inch radius and 3-inch height. How many shovelfuls will it take Dayna to fill the bucket up level with the top?

The volume of the cylinder is:

$$V = \pi r^2 h$$
$$V = \pi 4^2 (8)$$
$$V = 128\pi \text{ in}^3$$

If I take the volume of the cylinder and divide it by the volume of the cone, the answer will be the number of shovelfuls it takes Dayna to fill that cylinder.

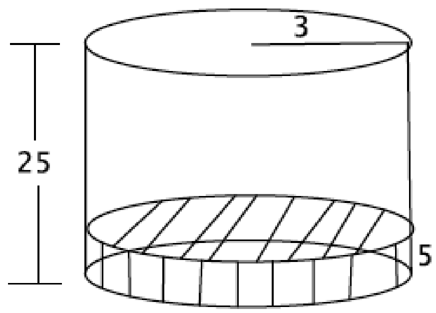
The volume of the cone is:

$$V = \frac{1}{3}\pi r^2 h$$
$$V = \frac{1}{3}\pi 2^2 (3)$$
$$V = 4\pi \text{ in}^3$$

The number of shovelfuls needed to fill they cylinder is:

$$\frac{128\pi}{4\pi} = 32$$

2. A cylindrical tank (with dimensions shown below) contains water that is 5-feet deep. If water is poured into the tank at a constant rate of $24\ \frac{\text{ft}^3}{\text{min}}$ for 18 min., will the tank overflow? Use 3.14 to estimate π.



I need to figure out the total volume of the cylinder and what is already filled. Then, compare the difference to the amount of water that is being poured into the tank.

The volume of the tank is:

$$\boldsymbol{V = (3.14)(3^2)25}$$
$$\boldsymbol{V = 706.5\ ft^3}$$

The volume of the part of the tank that is already filled is:

$$\boldsymbol{V = (3.14)(3^2)5}$$
$$\boldsymbol{V = 141.3\ ft^3}$$

The space left in the tank is:

$$\boldsymbol{706.5 - 141.2 = 565.2}$$

The volume of the tank that is not filled is:

$$\boldsymbol{706.5 - 141.3 = 565.2\ ft^3}$$

The volume of water poured into the tank is:

$$\boldsymbol{24 \times 18 = 432\ ft^3}$$

Since the volume of water going into the tank is less than the volume that remains in the tank, it will not overflow.

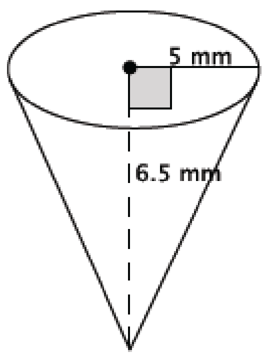
G8-M5-Lesson 11: Volume of a Sphere

Lesson Goals

Students apply the volume formulas for cylinders, cones and spheres to solve real-world and mathematical problems.

Examples

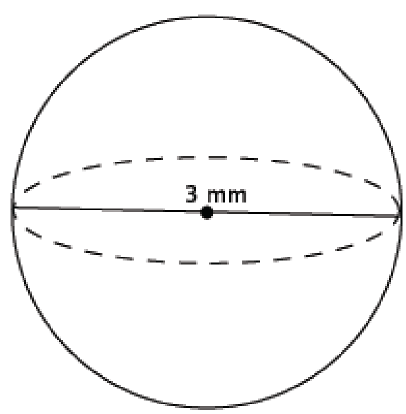
1. Which of the two figures below has the lesser volume? (Note: Figures not drawn to scale.)



The volume formula for the sphere is $V = \frac{4}{3}\pi r^3$. All I have to do is calculate the volume of each figure, then compare.

The volume of the cone is:

$$V = \frac{1}{3}\pi 5^2(6.5)$$
$$V = \frac{162.5}{3}\pi$$

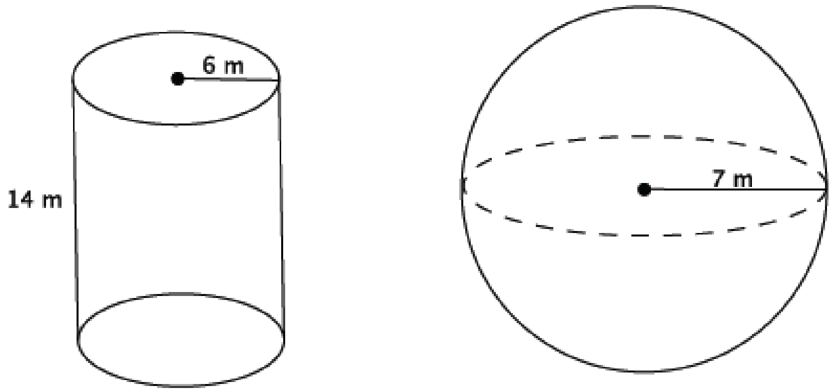


The volume of the sphere is:

$$V = \frac{4}{3}\pi(1.5)^3$$
$$V = \frac{13.5}{3}\pi$$

Since $\frac{13.5}{3}\pi < \frac{162.5}{3}\pi$ the sphere has lesser volume.

2. Which of the two figures below has the greater volume? (Note: Figures not drawn to scale.)



The volume of the cylinder is:

$$V = \pi 6^2(14)$$
$$V = 504\pi$$

The volume of the sphere is:

$$V = \frac{4}{3}\pi 7^3$$
$$V = \frac{1372}{3}\pi \approx 457.3\pi$$

Since $504\pi > 457.3\pi$ the cylinder has greater volume.