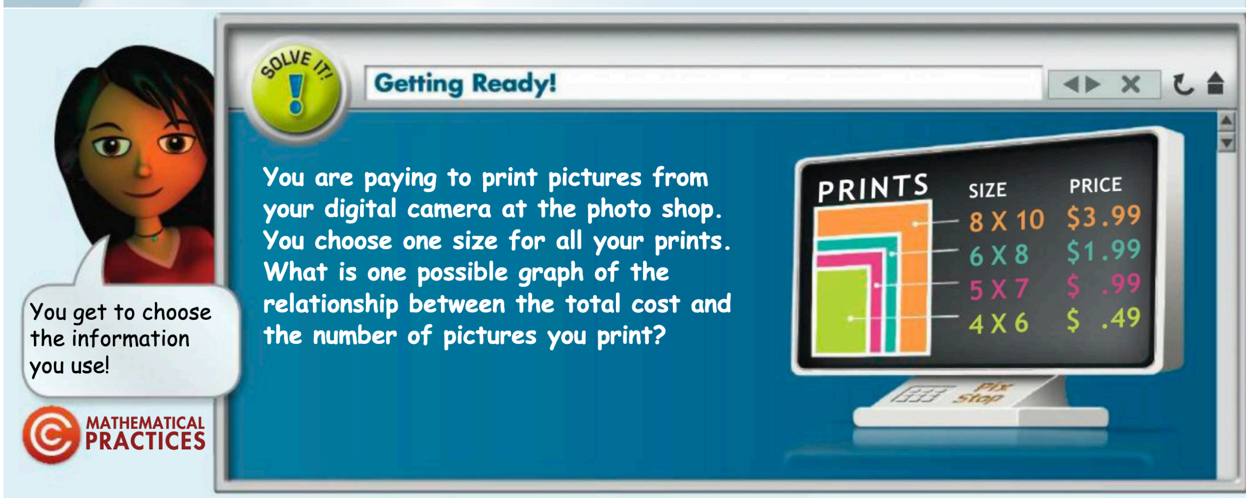
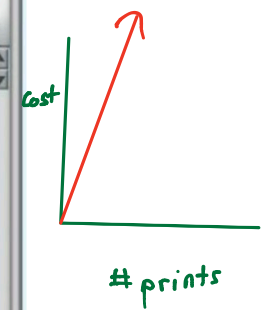
4-4 Graphing a Function Rule





The set of all solutions of an equation forms the equation's graph. A graph may include solutions that do not appear in a table. A real-world graph *should* only show points that make sense in the given situation.

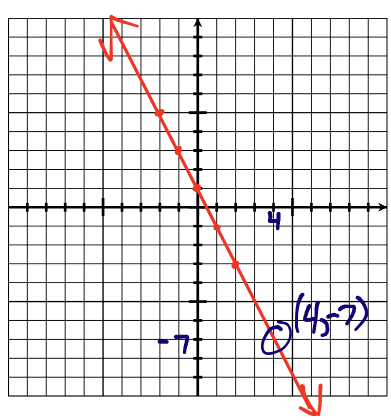
PROBLEM 1: GRAPHING A FUNCTION RULE

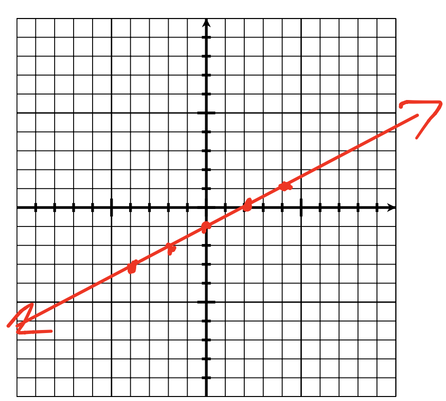
Graph each function.

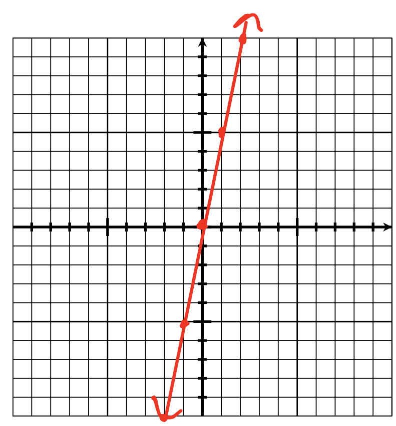
a) $y = -2x + 1$

b) $y = \frac{1}{2}x - 1$

c) $y = 5x$







x	$y=-2x+1$	y	
-2	$y=-2(-2)+1$ $=4+1$ $=5$	5	(-2,5)
-1	$y=-2(-1)+1$ $=2+1$ $=3$	3	(-1,3)
0	$y=-2(0)+1$ $=0+1$ $=1$	1	(0,1)
1	$y=-2(1)+1$ $=-2+1$ $=-1$	-1	(1,-1)
2	$y=-2(2)+1$	-3	(2,-3)

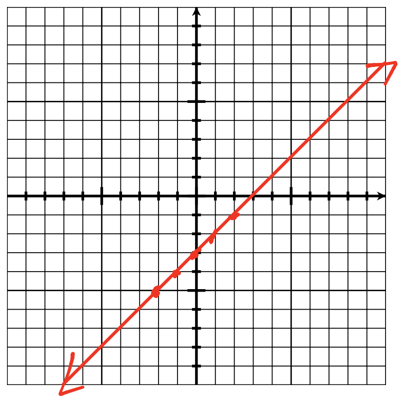
x	$y=\frac{1}{2}x-1$	y	
-4	$y=\frac{1}{2}(-4)-1$ $=-2-1$ $=-3$	-3	(-4,-3)
-2	$y=\frac{1}{2}(-2)-1$ $=-1-1$ $=-2$	-2	(-2,-2)
0	$y=\frac{1}{2}(0)-1$ $=0-1$ $=-1$	-1	(0,-1)
2	$y=\frac{1}{2}(2)-1$ $=1-1$ $=0$	0	(2,0)
4	$y=\frac{1}{2}(4)-1$ $=2-1$	1	(4,1)

x	$y=5x$	y	
-2	$y=5(-2)$ $=-10$	-10	(-2,-10)
-1	$y=5(-1)$ $=-5$	-5	(-1,-5)
0	$y=5(0)$ $=0$	0	(0,0)
1	$y=5(1)$ $=5$	5	(1,5)
2	$y=5(2)$ $=10$	10	(2,10)

$= -4 + 1$
$= -3$

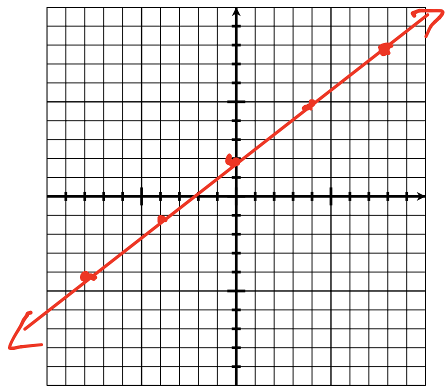
$= 1$

d) $y = x - 3$



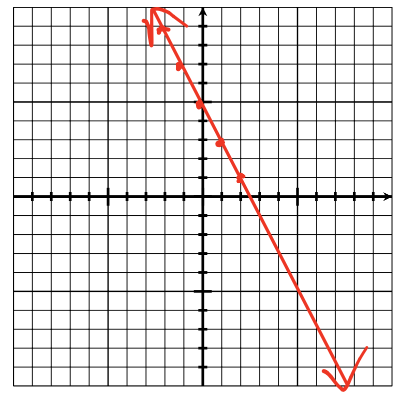
x	$y = x - 3$	y	
-2	$y = -2 - 3$ $= -5$	-5	$(-2, -5)$
-1	$y = -1 - 3$ $= -4$	-4	$(-1, -4)$
0	$y = 0 - 3$ $= -3$	-3	$(0, -3)$
1	$y = 1 - 3$ $= -2$	-2	$(1, -2)$
2	$y = 2 - 3$ $= -1$	-1	$(2, -1)$

e) $y = \frac{3}{4}x + 2$



x	$y = \frac{3}{4}x + 2$	y	
-8	$y = \frac{3}{\cancel{4}}(-\cancel{8})+2$ $= -6 + 2$ $= -4$	-4	$(-8, -4)$
-4	$y = \frac{3}{\cancel{4}}(-\cancel{4})+2$ $= -3 + 2$ $= -1$	-1	$(-4, -1)$
0	$y = \frac{3}{4}(0) + 2$ $= 0 + 2$ $= 2$	2	$(0, 2)$
4	$y = \frac{3}{4}(4) + 2$	5	$(4, 5)$
8	$y = \frac{3}{4}(8) = 8$	8	$(8, 8)$

f) $y = 5 - 2x$



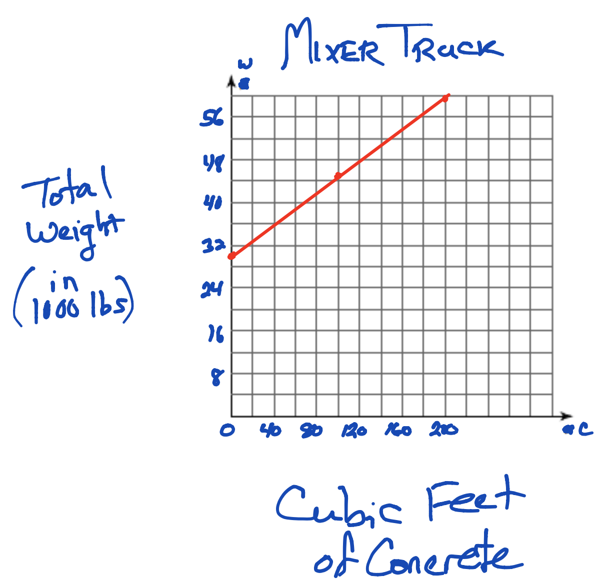
x	$y = 5 - 2x$	y
-2	$y = 5 - 2(-2)$	9
-1	$y = 5 - 2(-1)$	7
0	$y = 5 - 2(0)$	5
1	$y = 5 - 2(1)$	3
2	$y = 5 - 2(2)$	1

When you graph a real-world function rule, choose appropriate intervals for the units on the axis. Every interval on an axis should represent the same change in value. If all the data are nonnegative, show only the first quadrant.

PROBLEM 2: GRAPHING A REAL-WORLD FUNCTION RULE

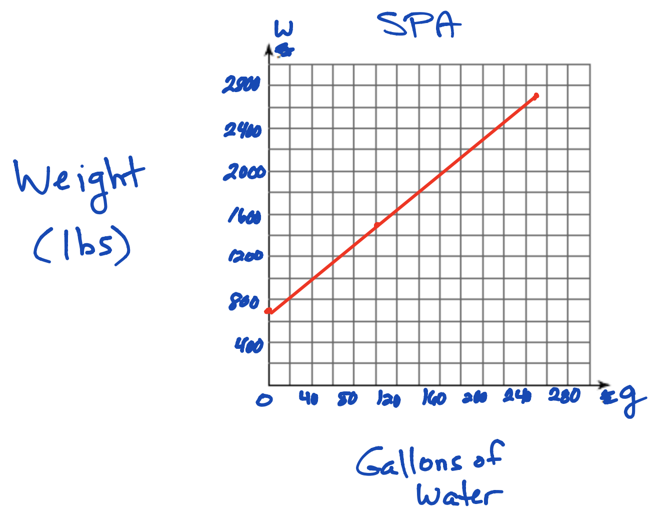
a) The function rule $w = 145c + 30{,}000$ represents the total weight *w*, in pounds, of a concrete mixer truck that contains *c* cubic feet of concrete. If the capacity of the truck is about 200 ft^3, what is a reasonable graph of the function rule?

c	$w = 145c + 30000$	w
0	$w = 145(0) + 30000$ $= 30000$	$30{,}000$
100	$w = 145(100) + 30000$ $= 14500 + 30000$ $= 445000$	$44{,}500$
200	$w = 145(200) + 30000$ $= 29000 + 30000$ $= 59000$	$59{,}000$



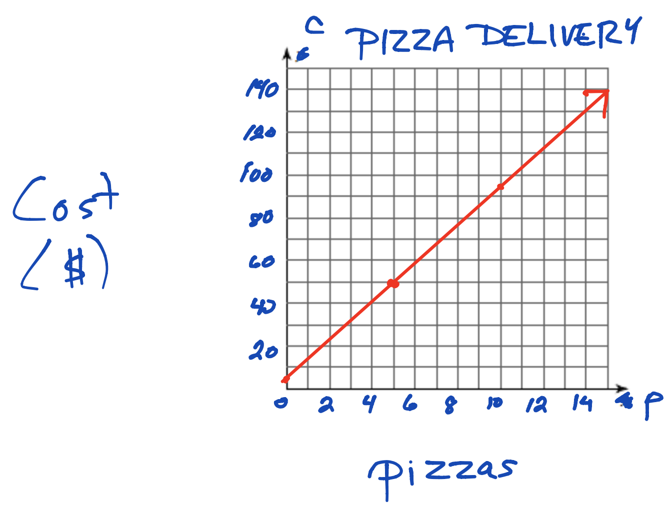
b) The function rule $w = 8g + 700$ represents the total weight *w*, in pounds, of a spa that contains *g* gallons of water. What is a reasonable graph of the function rule, given that the capacity of the spa is 250 gal?

g	$w = 8g + 700$	w
0	$w = 8(0) + 700$ $= 700$	700
100	$w = 8(100) + 700$ $= 1500$	1500
250	$w = 8(250) + 700$ $= 2700$	2700



c) The cost *c*, in dollars, for delivered pizza depends on the number *p* of pizzas ordered. This situation is represented by the function rule $c = 5 + 9p$.

p	$c = 5 + 9p$	c
0	$c = 5 + 9(0)$ $= 5$	5
5	$c = 5 + 9(5)$ $= 50$	50
10	$c = 5 + 9(10)$ $= 95$	95



d) The height *h*, in feet, of an acorn that falls from a branch 100 ft above the ground depends on the time *t*, in seconds, since it has fallen. This is represented by the rule $h = 100 - 16t^2$. About how much time does it take for the acorn to hit the ground? Use a graph and give an answer between two consecutive whole-number values of *t*.

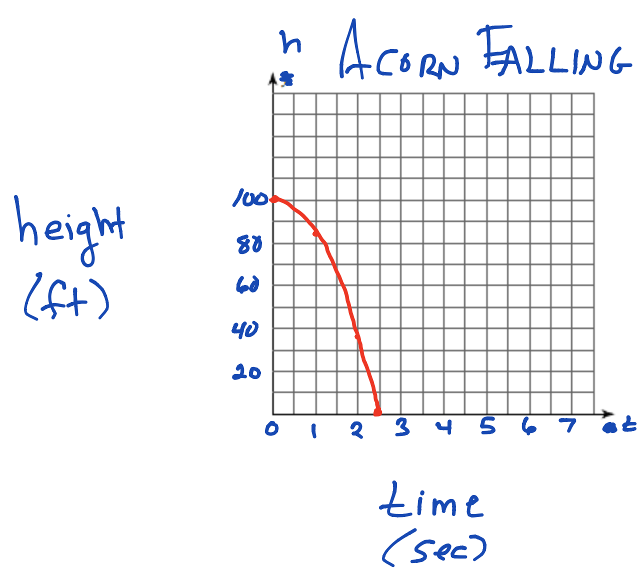
t	$h = 100 - 16t^2$	h
0	$h = 100 - 16(0)^2$ $= 100$	100
1	$h = 100 - 16(1)^2$ $= 84$	84
2	$h = 100 - 16(2)^2$ $= 36$	36

3 $\quad h = 100 - 16(3)^2$

$= 100 - 16(9)$

$= 100 - 144$

$= -44$



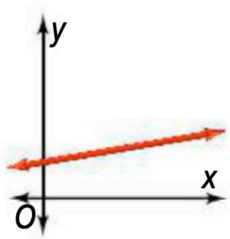
In the last problem with the acorn, the height could be any distance from 0 to 100 ft, such as 87 ½ ft or .09 ft. You can connect date points from the table because any point between the data points has meaning.

Some graphs may be composed of isolated points. For example, in the Solve It problem you graphed only points that represent printing whole numbers of photos.

KEY CONCEPT: CONTINUOUS AND DICRETE GRAPHS

Continuous Graph

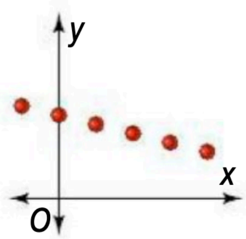
A **continuous graph** is a graph that is unbroken.



measurements (time, height, distance, temp)

Discrete Graph

A **discrete graph** is composed of distinct, isolated points.



number of items

PROBLEM 3: IDENTIFYING CONTINUOUS AND DISCRETE GRAPHS

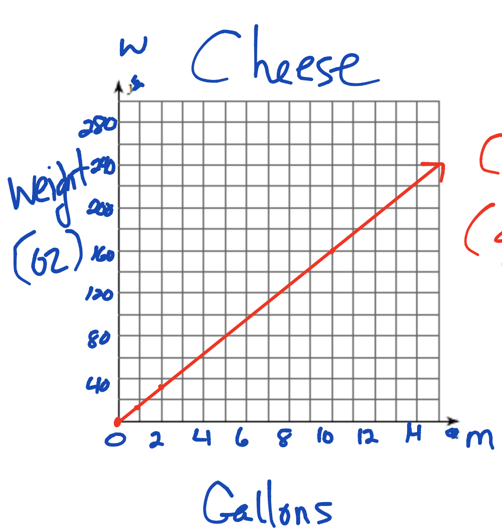
A local cheese maker is making cheddar cheese to sell at a farmer's market. The amount of milk used to make the cheese and the price at which he sells the cheese are shown below. Write ~~a function rule~~ for each situation. Graph each function. Is the graph *continuous* or *discrete*?

a) **1 gal of milk makes 16 oz of cheddar cheese**
The weight *w* of cheese, in ounces, depends on the Number of gallons *m* of milk used.
So, $w = 16m$.

m	w=16m	w
0	w=16(0)	0
1	w=16(1)	16
2	w=16(2)	32

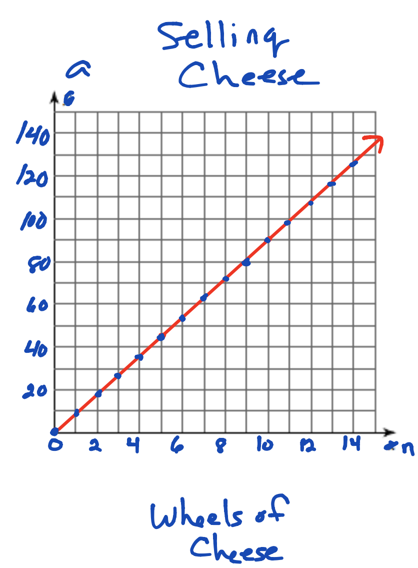
b) **Each wheel of cheddar cheese costs $9**
The amount *a* of money made from selling cheese Depends on the number *n* of wheels sold.
So, $a = 9n$.

n	a=9n	a
0	a=9(0)	0
5	a=9(5)	45
10	a=9(10)	90



Continuous (graphing measurements)

Money Made ($)



Discrete (# items)

Determine if each would produce a ***continuous*** *or* ***discrete*** *graph.*

c) The amount of water w in a wading pool, in gallons, depends on the amount of time t, in minutes, the Wading pool has been filling.

Continuous

d) The cost c for baseball tickets, in dollars, depends on the number n of tickets bought.

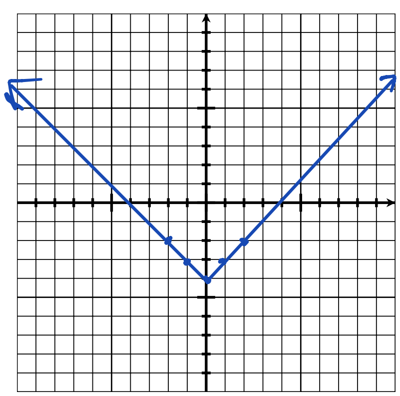
discrete

The function rules graphed in PROBLEMS 1-3 represent linear functions. You can also graph a nonlinear function rule. When a function rule does not represent a real-world situation, graph it as a continuous function.

PROBLEM 4: GRAPHING A NONLINEAR FUNCTION

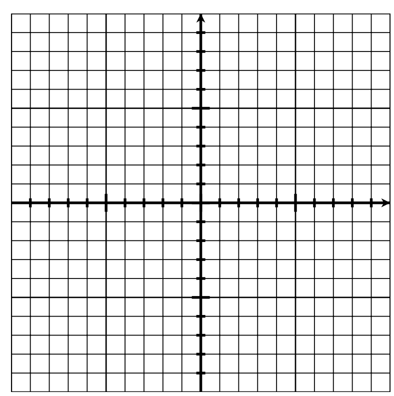
Graph each function.

a) $y = |x| - 4$

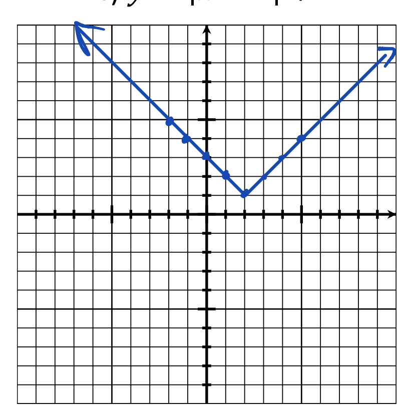


x	$y=\|x\|-4$	y
-2	$y=\|-2\|-4$ $= 2-4$	-2
-1	$y=\|-1\|-4$ $=1-4$	-3
0	$y=\|0\|-4$ $=0-4$	-4
1	$y=\|1\|-4$ $=1-4$	-3
2	$y=\|2\|-4$ $=2-4$	-2

b) $y = x^2 + 1$



c) $y = |x - 2| + 1$



x	$y=\|x-2\|+1$	y
-2	$y=\|-2-2\|+1$ $=\|-4\|+1$ $=4+1$	5
-1	$y=\|-1-2\|+1$ $=\|-3\|+1$ $=3+1$	4
0	$y=\|0-2\|+1$ $=\|-2\|+1$ $=2+1$	3
1	$y=\|1-2\|+1$ $=\|-1\|+1$ $=1+1$	2
2	$y=\|2-2\|+1$ $=0+1$	1
5	$y=\|5-2\|+1$ $=\|3\|+1$ $=3+1$	4

x	$y=-(x+1)^2+5$	y
-2	$y=-(-2+1)^2+5$ $=-(-1)^2+5$ $=-(1)+5$	4
-1	$y=-(-1+1)^2+5$ $=0+5$	5
0	$y=-(0+1)^2+5$ $=-(1)^2+5$ $=-(1)+5$	4
1	$y=-(1+1)^2+5$ $=-(2)^2+5$ $=-4+5$	1
2	$y=-(2+1)^2+5$ $=-(3)^2+5$ $=-(9)+5$	-4

PARABOLA

d) $y = -(x + 1)^2 + 5$