Intensive Math-Algebra I
Mini-Lesson MA.912.A.2.3

Benchmark MA.912.A.2.3

Describe the concept of a function, use function notation, determine whether a given relation is a function, and link equations to functions.

Also assesses **MA.912.A.2.13** Solve real-world problems involving relations and functions

This benchmark will be assessed using **MC** and **FR** items.

Students will:
•Determine if a given relation is a function.
•Evaluate an equation given in function notation

Content Limits
•In items that require students to write a function, only continuous linear or quadratic functions of the form should be used.
•Relations can be given in various forms:
•Graphs (only continuous), Tables (no more than 8 rows), Sets of ordered pairs (no more than six), and Mapping diagrams (no more than 8 arrows).
• Items should utilize function notation as appropriate.

Fill-in response items may require that students provide an element of the range (or domain) for a point of interest.

Benchmark MA.912.A.2.3

I can…
- Use Function Notation
- Identify Functions
- Link equations to Functions

Vocabulary

- Dependent Variable
- Independent Variable
- Input
- Output
- Relation
- Function
- Linear Function
- Vertical Line Test

Essential Understanding

- The value of one variable may be uniquely determined by the value of another variable. Such relationships may be represented using tables, words, equations. Set of ordered pairs, and graphs.
- Many real-world functional relationships can be represented by equations. You can use an equation to find the solution of a given real- world problem.
- A function is a special type of relation in which each value in the domain is paired with exactly one value of the range.

PEARSON   Textbook pages: 240, 262, and 268

Benchmark MA.912.A.2.3

Example # 1

Problem   Representing a Linear Function

Camera Memory

Number of Photos, x	Memory (MB), y
0	512
1	509
2	506
3	503

Photography The table shows the relationship between the number of photos x you take and the amount of memory y in megabytes (MB) left on your camera's memory chip. Is the relationship a linear function? Describe the relationship using words, an equation, and a graph.

The amount y of memory left is uniquely determined by the number x of photos you take. You can see this in the table above, where each input value of x corresponds to

KNOW

The amount of memory left given the number of pictures taken, as shown in the table

NEED

Other representations that describe relationship

PLAN

Look for a pattern that you can describe in words to write the equation. Make a graph to show the pattern.

Memory is 512 MB before any photos are taken.

The independent variable x increases by 1 each time.

Number of Photos, x	Memory (MB), y
0	512
1	509
2	506
3	503

+ 1   − 3
+ 1   − 3
+ 1   − 3

The dependent variable y decreases by 3 each time x increases by 1.
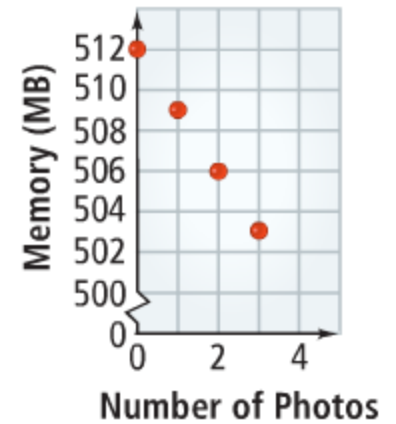
Intensive Mathematics - Algebra 1

Benchmark MA.912.A.2.3

Example # 1

Words   The amount of memory left on the chip is 512 minus the quantity 3 times the number of photos taken.

Equation $y = 512 - 3x$

Graph   You can use the table to make a graph. The points lie on a line, so the relationship between the number of photos taken and the amount of memory remaining is a linear function.

Got It?   **2. a.** Is the relationship in the table below a linear function? Describe the relationship using words, an equation, and a graph.

Input, x	0	1	2	3
Output, y	8	10	12	14

b. Reasoning Does the set of ordered pairs $(0, 2)$, $(1, 4)$, $(3, 5)$, and $(1, 8)$ represent a linear function? Explain.

Practice: Page 244: 11-13, 15, and 18

Benchmark MA.912.A.2.3

Example # 2

Problem   **Writing a Function Rule**

Insects You can estimate the temperature by counting the number of chirps of the snowy tree cricket. The outdoor temperature is about 40°F more than one fourth the number of chirps the cricket makes in one minute. What is a function rule that represents this situation?

Relate   temperature is 40°F more than $\frac{1}{4}$ of the number of chirps in 1 min

Define   Let T = the temperature. Let n = the number of chirps in 1 min.

Write T =   40   + $\frac{1}{4}$ · n

A function rule that represents this situation is $T = 40 + \frac{1}{4}n$.

Got It?   **1.** A landfill has 50,000 tons of waste in it. Each month it accumulates an average of 420 more tons of waste. What is a function rule that represents the total amount of waste after m months?

Practice: Page 265: 12-18
          Page 266: 24, 27, and 28

Intensive Mathematics - Algebra 1

PEARSON   Textbook page: 262 and 263

Benchmark MA.912.A.2.3

Example # 3

Another way to decide if a relation is a function is to analyze the graph of the relation using the **vertical line test.** If any vertical line passes through more than one point of the graph, then for some domain value there is more than one range value. So the relation is not a function.
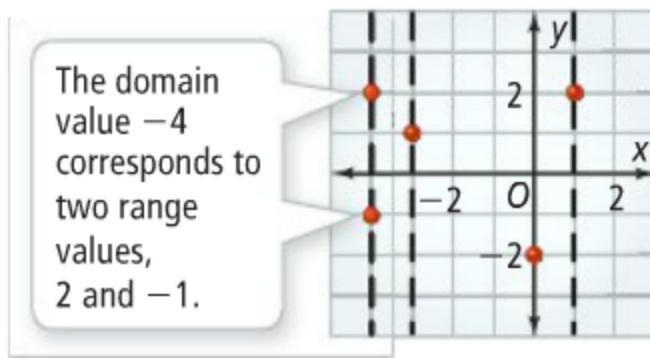
Problem **Identifying Functions Using the Vertical Line Test**
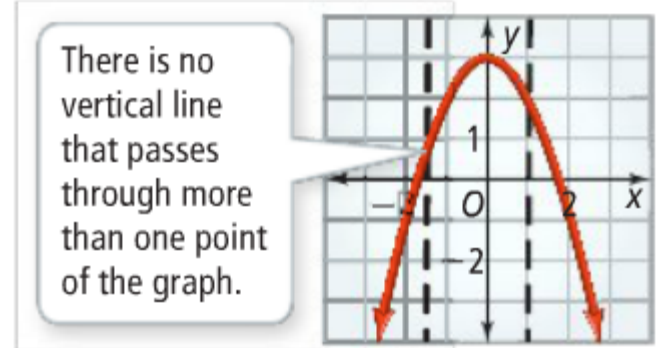
Is the relation a function? Use the vertical line test.

THINK

Use a pencil as a vertical line. See if the pencil intersects more than one point at any time.

A $\{(-4, 2), (-3, 1), (0, -2), (-4, -1), (1, 2)\}$ **B** $y = -x^2 + 3$

The domain value -4 corresponds to two range values, 2 and -1.

The relation is not a function.

There is no vertical line that passes through more than one point of the graph.

The relation is a function.

Got It? **2.** Is the relation a function? Use the vertical line test.

    a. $\{(4, 2), (1, 2), (0, 1), (-2, 2), (3, 3)\}$ **b.** $\{(0, 2), (1 -1), (-1, 4), (0, -3), (2, 1)\}$

Practice: Page 271: 12-15

Intensive Mathematics - Algebra 1

PEARSON   Textbook page: 269

Benchmark MA.912.A.2.3

Example # 4

You have seen functions represented as equations involving x and y, such as $y = -3x + 1$. Below is the same equation written using **function notation.**

$$f(x) = -3x + 1$$

Notice that $f(x)$ replaces y. It is read "f of x." The letter f is the name of the function, not a variable. Function notation is used to emphasize that the function value $f(x)$ depends on the independent variable x. Other letters besides f can also be used, such as g and h.

Problem **Evaluating a Function**

Reading The function $w(x) = 250x$ represents the number of words $w(x)$ you can read in x minutes. How many words can you read in 8 min?

THINK

How is this function like ones you've seen before?
The function w(x)= 250x can be written as y = 250x.
Remember: that w(x) does not mean w times x.

$w(x) = 250x$

$w(8) = 250(8)$ Substitute 8 for x.

$w(8) = 2000$ Simplify.

You can read 2000 words in 8 min.

Practice: Page 271: 16 and 17

PEARSON   Textbook page: 269

FOCUS

Small Group Practice

1. A New York City taxi charges $3 per ride plus an additional $0.50 per mile. Which function below shows how to calculate the total cost of a taxi ride that is x miles long?

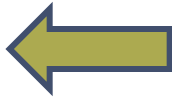A. f(x) = $3x + $0.50

B. f(x) = $3x − $0.50

C. f(x) = $0.50x + $3

D. f(x) = $0.50x − $3
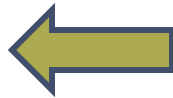
2. Given the function $f(x) = 2x + 2$, what is the value of x if $f(x) = 6$?
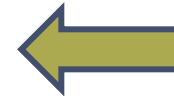
A. x = 4

B. x = 2

C. x = 14

D. x = 3

3. The students in Adam's science class are measuring the speed of a slow-moving snail. The snail moves at a constant rate, and after the investigation, the students use their data to create the following graph.

Based on this graph, which function would best represent the snail's speed if x = time and f(x) = distance?

f (x) = distance

x = time
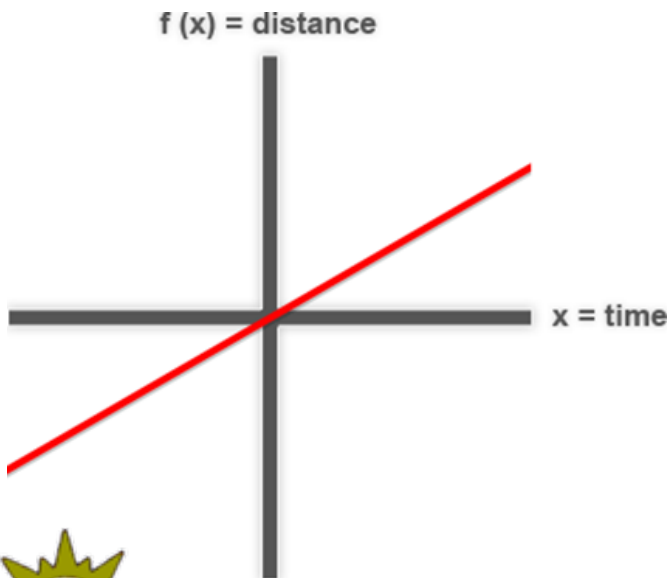
A. $f(x) = 3x$

B. $f(x) = 2x^2$

C. $f(x) = -3x$

D. $f(x) = 3x + 2$

4. Jack wants to cook three microwave pizzas for himself and his two sisters at the same time. The instructions on the box say to cook one pizza for four minutes and add three minutes for each additional pizza. Which of the following is a function that describes the relationship between x, the number of pizzas being microwaved, and f (x), the total time it takes to cook x pizzas.

A. f(x) = 3x + 1
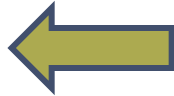
B. f(x) = 4 + 3x

C. f(x) = 4 (x + 3)

D. f(x) = 4 (3x + 1)

5. Sammy is excited about a sale at the video game store. When one video game is purchased at full price, $30, any additional game will cost only $12. The total amount spent on video games can be described by the function $f(x) = \$18 + \$12x$, where x represents the number of video games purchased. If Sammy buys 3 video games, what is the value of $f(x)$?

A. $36

B. $42

C. $54

D. $66
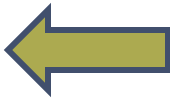
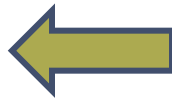6. An ice cream shop charges $5 for an ice cream cone with one scoop of ice cream and an additional $0.75 for each extra scoop of ice cream. Which function represents the total cost of an ice cream cone with x extra scoops of ice cream?

A. f(x) = $5x + $0.75

B. f(x) = $5x − $0.75

C. f(x) = $0.75x + $5

D. f(x) = $0.75x − $5

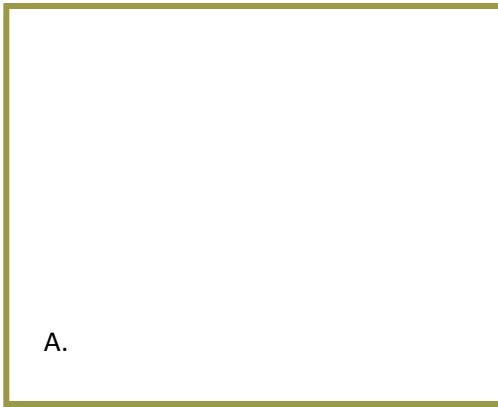7. Given the function $f(x) = 5 - 2x$, what is the value of x if $f(x) = 3$?

A. x = 3

B. x = 1

C. x = −1

D. x = 11

8. Alejandro drove to his grandmother's house. He used the cruise control in his car to keep his speed constant. Which graph shows his speed as he drove to his grandmother's house?
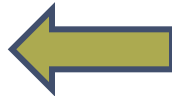
A.

B.

C.

D.

9. At a local grocery store, watermelons are sold for $4 each plus an additional $0.25 per pound. Write a function that describes the relationship between x, the number of pounds of a watermelon, and f(x), the total cost of the watermelon.

A. $f(x) = \$4.25x$

B. $f(x) = \$4 + \$0.25x$ ⬅
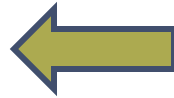
C. $f(x) = \$4 (\$0.25x + 1)$

D. $f(x) = \$4x (\$0.25x + 4)$

10. The cost of a New York City taxi fare can be described by the function $f(x) = \$3 + \$0.50x$, where x represents the number of miles the taxi drives. What is the value of $f(x)$ for a 12-mile taxi ride?

A. $3.50

B. $9.00 ⬅

C. $15.50

D. $38.40

MA.912.A.2.3

Mini - Assessment

1. The Yellow Cab Company charges $4.25 for the first half mile and then by the mile as shown in the table below.

YELLOW CAB COMPANY

Miles (*m*) (after the first half mile)	Total Cost (*t*)
1	7.25
2	10.25
3	13.25
4	16.25
5	19.25

Which equation represents c the **cost per mile** as a function of t , the total cost, where m is the number of miles driven after the first half mile?

A. $c = \dfrac{t+4.25}{m}$

B. $c = \dfrac{t-4.25}{m}$

C. $c = \dfrac{m-4.25}{t}$

D. $c = \dfrac{m \div 4.25}{t}$

2. Tri-Americas Airlines charge $280 for a one way ticket from Miami, FL to Lima, Peru and $25 per bag of luggage checked on the plane. The function below can be used to determine , the ticket price and the luggage surcharge, where represents the number of bags of luggage checked.

$$f(n) = 280 + 25n$$

If the total cost of a round trip cost $660, how many bags of luggage where checked onto the plane each way?

F. 2
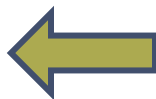
G. 4

H. 6

I. 8

3. As an Indy race car races laps around the track, the methanol burned as fuel increases. The table below shows the amount of methanol used for the number of laps raced.

Indy Race Cars

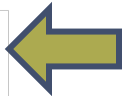| Number of Laps Raced (L)	Gallons of Methanol Used (g)
10	6.6
20	13.2
30	18.8
40	26.4
50	33

Which equation represents g, the gallons of methanol used, as a function of L, number of laps raced?

A. $g = 6.6\,L$

B. $g = 0.66\,L$

C. $g = \dfrac{0.66}{L}$

D. $g = \dfrac{6.6}{L}$

4. For one child, the South Florida Fair charges $12.75 for admission and $1.25 for each ride the child takes. The function below can be used to determine $f(r)$, the spent for a child at the fair, where represents the number of rides taken.

$$f(r) = 12.75 + 1.25\,r$$

If the total cost for one child at the fair for the day was $22.75, how many rides did the child take?

						8

For one child, a summer camp charges $140 per week and $5.50 per hour for each hour a child spends in extended camp time. The function can be used to determine $f(h) = 140 + 5.5h$, the weekly fee for summer camp and extended camp, where h represents the number of hours spent in extended camp time.

$$f(h) = 140 + 5.5h$$

If the weekly charges for one child totaled $195.00, what was the total number of hours the child spent in extended camp?

					1	0

232,892,208 lessons delivered
KHANACADEMY
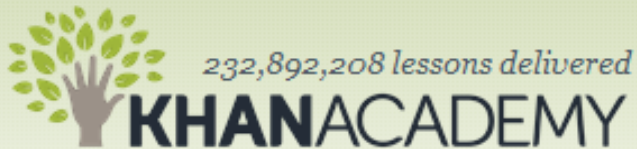
Review Video

Relationships and Valid Functions

Home Learning

MA.912.A.2.3: Functions and Relations

1. Is the relation described by the values also a function? Justify your answer.

x	y
-4	0
-2	2
0	5
-2	-3
4	-5
6	7
8	10

A. Yes, because all the output values are different.
B. Yes, because it is not linear.
C. No, because there is an input value that has two different output values.
D. No, because it is not linear.

2. Identify the mapping diagram that represents the relation and determine whether the relation is a function.
$$\{(-8, -6), (-5, 2), (-8, 1), (7, 3)\}$$
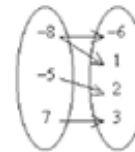
A.

The relation is a function

B.

The relation is not a function

C.

The relation is a function

D.

The relation is a function

3. Evaluate $f(x) = -x + 1$ for $x = -2$.

A. -3
B. 1
C. 2
D. 3