Student Name: ____________	Contact Person Name: ____________
Date: ____________	Phone Number: ____________

Texas Assessment of Knowledge and Skills

Exit Level Math Review

Lesson 1

Ways to Represent a Function

TAKS Objective 1 – Describe functional relationships in a variety of ways

Lesson Objectives:

- Demonstrate an understanding of ways to represent a function
- Determine if a relation is a function
- Determine solutions to a function

Authors:

Tim Wilson, B.A.
Jason March, B.A., M.S.Ed

Editor:

Linda Shanks

Graphics:

Tim Wilson
Jason March

The Texas Assessment of Knowledge and Skills (TAKS) exit level exam covers ten learning objectives. These lessons are designed to teach math concepts specific to each objective as well as strategies to consider when approaching typical TAKS questions. To successfully complete the TAKS exit level exam, the student should be able to:

1) **Describe functional relationships in a variety of ways.**
2) **Demonstrate an understanding of the properties and attributes of functions.**
3) **Demonstrate an understanding of linear functions.**
4) **Formulate and use linear equations and inequalities.**
5) **Demonstrate an understanding of quadratic equations and other nonlinear functions.**
6) **Demonstrate an understanding of geometric relationships and spatial reasoning.**
7) **Demonstrate an understanding of two- and three-dimensional representations of geometric relationships and shapes.**
8) **Demonstrate an understanding of concepts and uses of measurement and similarity.**
9) **Demonstrate an understanding of percents, proportional relationships, probability, and statistics in application problems.**
10) **Demonstrate an understanding of the mathematical processes and tools used in problem solving.**

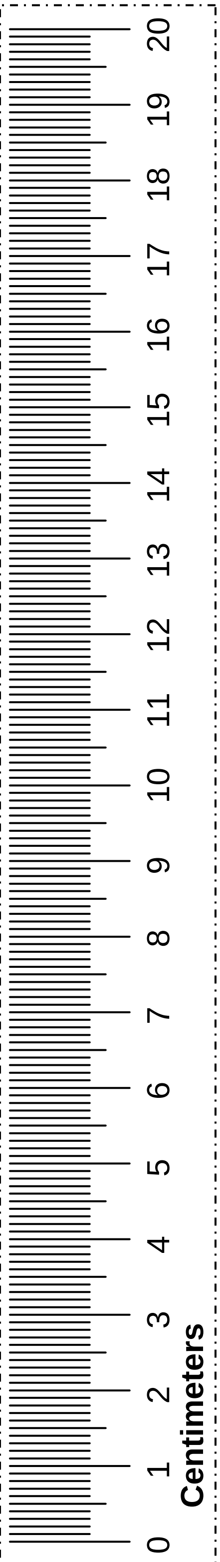
National PASS Center
Geneseo Migrant Center
3 Mt. Morris – Leicester Road
Leicester, NY 14481
(585) 658-7960
(585) 658-7969 (fax)
www.migrant.net/pass

Developed by the National PASS Center under the leadership of the National PASS Coordinating Committee with funding from the Region 20 Education Service Center, San Antonio, Texas, as part of the Mathematics Achievement = Success (MAS) Migrant Education Program Consortium Incentive project.

National PASS Center, 2010. This book may be reproduced without written permission from the National PASS Center.

Genesee Valley Educational Partnership
success stories written here

TAKS Mathematics Chart



Length

Metric	Customary
1 kilometer = 1000 meters	1 mile = 1760 yards
1 meter = 100 centimeters	1 mile = 5280 feet
1 centimeter = 10 millimeters	1 yard = 3 feet
	1 foot = 12 inches

Capacity and Volume

Metric	Customary
1 liter = 1000 milliliters	1 gallon = 4 quarts
	1 gallon = 128 fluid ounces
	1 quart = 2 pints
	1 pint = 2 cups
	1 cup = 8 fluid ounces

Mass and Weight

Metric	Customary
1 kilogram = 1000 grams	1 ton = 2000 pounds
1 gram = 1000 milligrams	1 pound = 16 ounces

Time

1 year = 365 days

1 year = 12 months

1 year = 52 weeks

1 week = 7 days

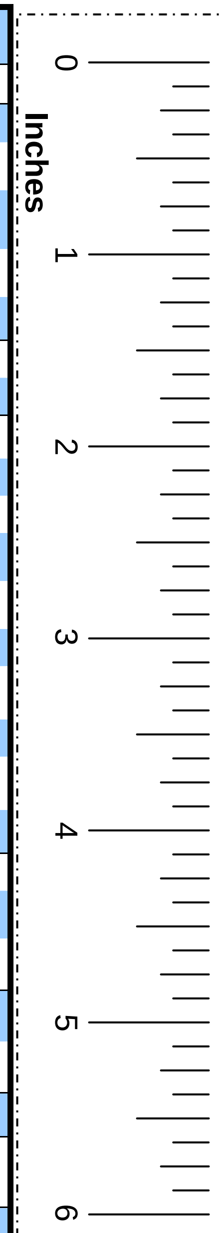
1 day = 24 hours

1 hour = 60 minutes

1 minute = 60 seconds

TAKS Mathematics Chart

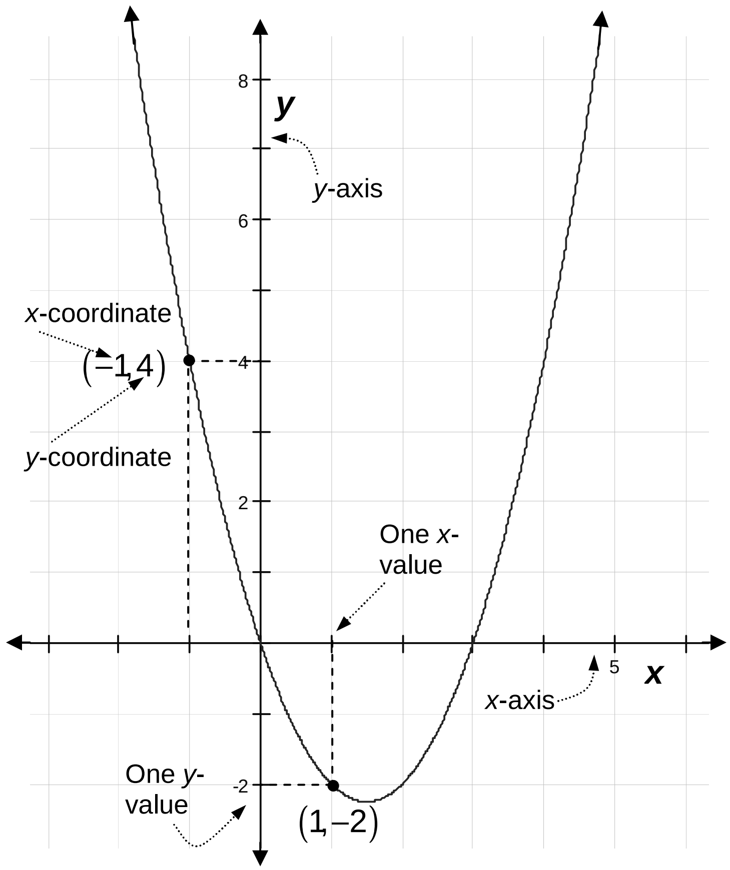
Perimeter	Rectangle	$P = 2l + 2w$ or $P = 2(l + w)$
Circumference	Circle	$C = 2\pi r$ or $C = \pi d$
Area	Rectangle	$A = lw$ or $A = bh$
	Triangle	$A = \frac{1}{2}bh$ or $A = \frac{bh}{2}$
	Trapezoid	$A = \frac{1}{2}(b_1 + b_2)h$ or $A = \frac{(b_1+b_2)h}{2}$
	Regular polygon	$A = \frac{1}{2}aP$
	Circle	$A = \pi r^2$
P represents the perimeter of the base of a three-dimensional figure.		
B represents the area of the base of a three-dimensional figure.		
Surface Area	Cube (total)	$S = 6s^2$
	Prism (lateral)	$S = Ph$
	Prism (total)	$S = Ph + 2B$
	Pyramid (lateral)	$S = \frac{1}{2}Pl$
	Pyramid (total)	$S = \frac{1}{2}Pl + B$
	Cylinder (lateral)	$S = 2\pi rh$
	Cylinder (total)	$S = 2\pi rh + 2\pi r^2$ or $S = 2\pi r(h + r)$
	Cone (lateral)	$S = \pi rl$
	Cone (total)	$S = \pi rl + \pi r^2$ or $S = \pi r(l + r)$
	Sphere	$S = 4\pi r^2$
Volume	Prism or Cylinder	$V = Bh$
	Pyramid or Cone	$V = \frac{1}{3}Bh$
	Sphere	$V = \frac{4}{3}\pi r^3$
Special Right	30°, 60°, 90°	$x,\ x\sqrt{3},\ 2x$
Triangles	45°, 45°, 90°	$x,\ x,\ x\sqrt{2}$
Pythagorean Theorem		$a^2 + b^2 = c^2$
Distance Formula		$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
Slope of a Line		$m = \frac{y_2 - y_1}{x_2 - x_1}$
Midpoint Formula		$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$
Quadratic Formula		$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Slope-Intercept Form of an Equation		$y = mx + b$
Point-Slope Form of an Equation		$y - y_1 = m(x - x_1)$
Standard Form of an Equation		$Ax + By = C$
Simple Interest Formula		$I = prt$



A **function** is a set of ordered pairs (*x*, *y*) in which each *x*-coordinate is paired with exactly one *y*-coordinate.

Functions can be represented in a variety of ways.

We can **graph** a function on a set of **axes**. The graph to the right is a function. Every single *x*-value has only one corresponding *y*-value. No *x* has more than one *y*.

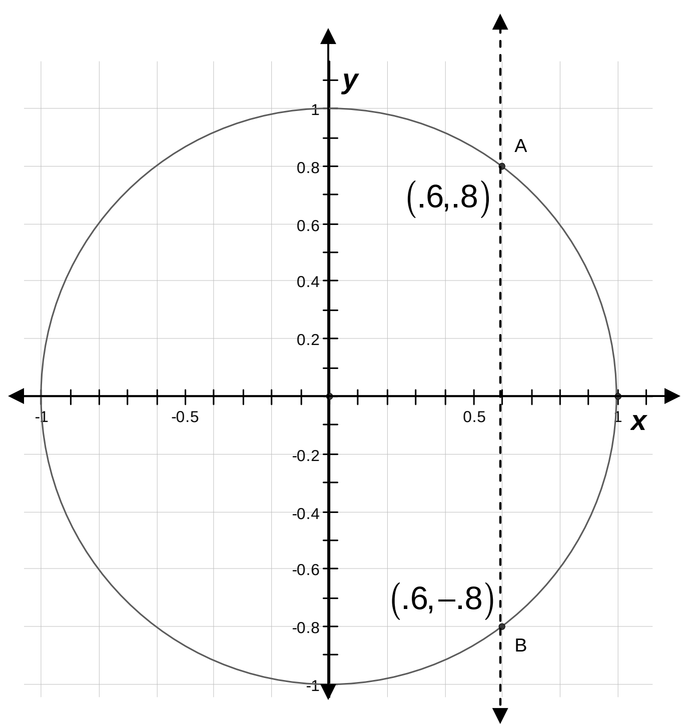


The coordinates of each point on the graph are written as an ordered pair, (x, y). The first number is the *x*-coordinate. The second number is the *y*-coordinate.

A circle is not a function.

A function must pass the **vertical line test**.

- A vertical line can intersect the graph of a function exactly once.



The vertical line drawn through the circle intersects at <u>two</u> points, *A* and *B*. Therefore, the circle is not a function. The vertical line shows that one *x*-value, 0.6, corresponds with two *y*-values (0.8, and -0.8). Note that the first graph passes the vertical line test. It is a function.

Functions can also be expressed as a **list** of ordered pairs.

Function	Non-function
$\{(0,1),(1,3),(3,0),(5,3)\}$	$\{(-2,1),(1,3),(0,-5),(1,0)\}$
Every *x*-value goes to exactly one *y*-value. This is a function.	The *x*-value 1 goes to two different *y*-values. This is not a function.

When analyzing a list of ordered pairs if at least one *x*-coordinate repeats, and its y-values differ, then it is <u>not</u> a function.

Similar to a list of ordered pairs is a **table** of ordered pairs.

Function

x	*y*
0	1
1	3
3	0
5	3

Every *x*-value goes to one *y*-value. This is a function.

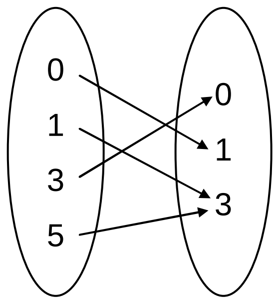
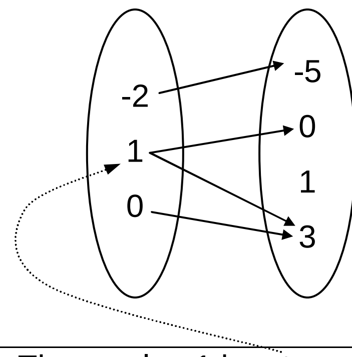
Non-function

x	*y*
-2	1
1	3
0	-5
1	0

The *x*-value 1 goes to two different *y*-values. This is not a function.

When analyzing a table, see if any *x*-coordinates repeat. If at least one repeats, and its *y*-values differ, it is not a function.

In a table, the corresponding values are written next to each other. In a **mapping**, the corresponding values are connected with arrows.

Function	Non-function
	
Each *x*-value has one arrow extending from it. This is a function.	The *x*-value 1 has two arrows extended from it. This is not a function.

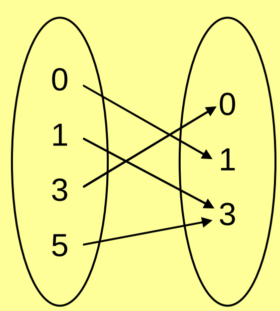
When analyzing a mapping, look at all the *x*-coordinates (the oval the arrows are extended <u>from</u>) and see if two or more arrows extend from the same value. If two or more arrows extend from the same value, it is not a function.

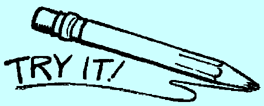
FACT

The following are all the same function. Each x-value goes to the same y-value.

$$\{(0,1),(1,3),(3,0),(5,3)\}$$

x	*y*
0	1
1	3
3	0
5	3

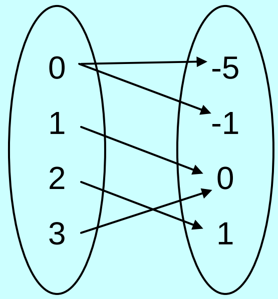




Determine if the following examples are functions.

1) $\{(0,0),(1,0),(2,2)\}$

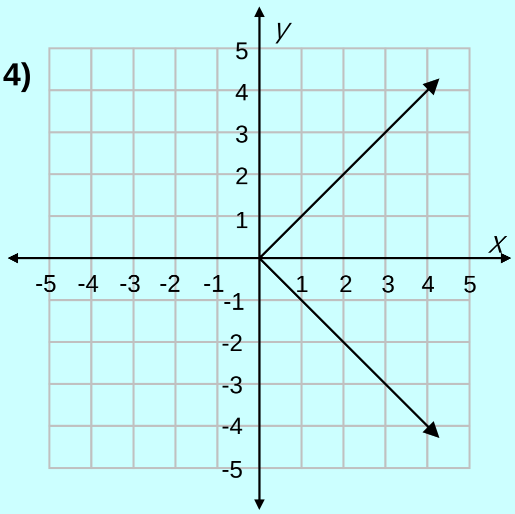
2)



3)

x	*y*
-1	0
0	1
1	0
2	1

4)

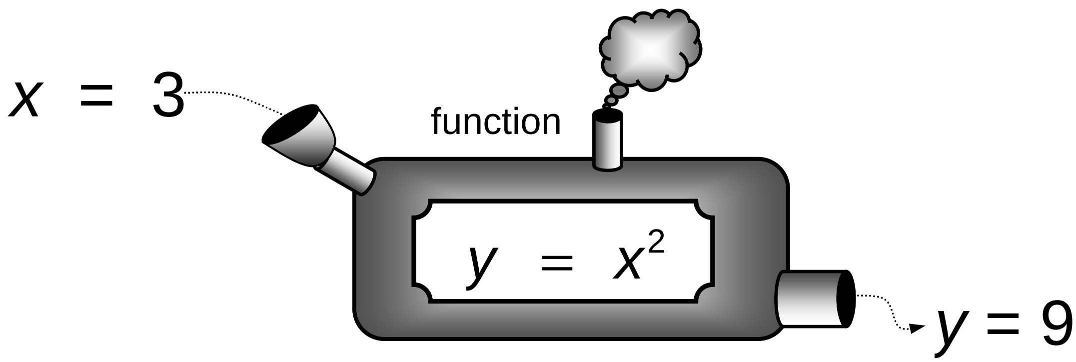


Functions can be written as an **equation**.

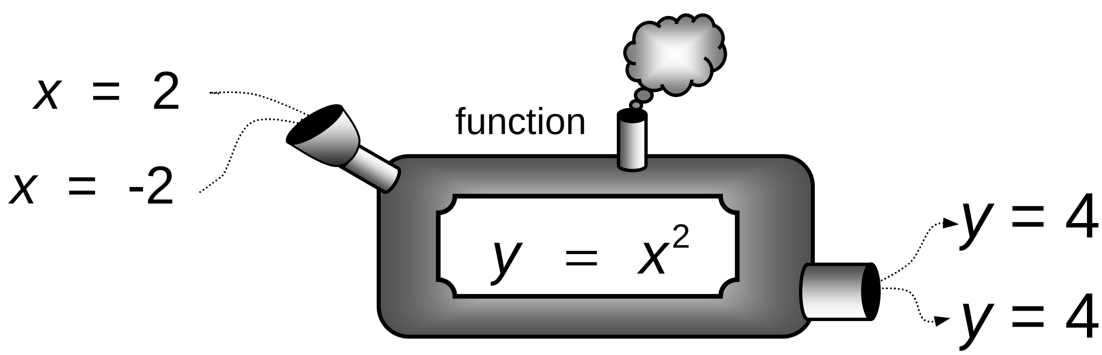
> An **equation**, or **formula**, is a mathematical sentence that describes how one amount depends on another.

Traditionally, equations use the variables *x* and *y*. In the equation $y = 2x$, the value of *y* depends on the value of *x*. For instance, if $x = 4$, then $y = 2(4) = 8$. If $x = 0$, then $y = 2(0) = 0$. In this case, *x* is the **independent variable**, and *y* is the **dependent variable**. The values we **input** for *x* change the values of *y*, the **output**.

To better understand these terms, think of a function as a machine. A number is put into the function machine for *x*. The equation tells the machine what to do with the number. A new number comes out for *y*.



Each input has a unique output. In other words, a function <u>cannot</u> have two different outputs for the same input. However, two different inputs may generate the same output. That's okay.



This visual helps us understand some properties about functions. Let's try an example where we relate a function to a real-life situation.

Example

During a sale at a department store, all jeans are 50% off the original price. Which statement best describes the functional relationship between the sale price of a pair of jeans and the original price.

A The sale price is dependent on the original price.

B The original price is dependent on the sale price.

C The sale price and the original price are independent of each other.

D The sale price is dependent on the number of pairs of jeans purchased.

Solution

A The sale price is dependent on the original price.

In order to calculate how much an item costs on sale, you need to know how much it cost originally.

Let x = the original price

y = the sale price

The function is $y = .5x$

Function notation is the last representation we will examine. It is very similar to the equation form of a function, except the function is labeled with a letter such as *f*, *g*, or *h*.

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

Here, *f* is not a variable. The notation $f(x)$ is interpreted as "the function, called *f*, uses *x* as a variable." We read the above function aloud as, "*f* of *x* equals *x* squared."

When you input 2 into the function $f(x) = x^2$, it is represented as follows:

$$f(2) = 2^2 = 4$$

The function $f(x) = x^2$ is the same as the equation $y = x^2$. Thus, $y = f(x)$.

Example

Which of the following ordered pairs is a solution to the function $g(x) = 3x^2 - 9$?

A $(1,6)$ **B** $(0,-3)$ **C** $(3,18)$ **D** $(2,9)$

Solution

We will substitute each *x*-value (first number) of our answer choices to see if the function output matches that choice's *y*-value (second number). For instance, if we check $g(1)$, and find it equals 6, then choice **A** is correct. When substituting, we must use the correct order of operations.

FACT

PEMDAS helps us remember the correct order of operations.

PEMDAS

Parentheses, Exponents, Multiplication and Division from left to right, Addition and Subtraction from left to right.

Check choice **A** (1,6):

$$\begin{aligned} g(1) &= 3(1)^2 - 9 && \text{Exponent} \\ &= 3(1) - 9 && \text{Multiply} \\ &= 3 - 9 && \text{Subtract} \\ g(1) &= -6 \neq 6 \end{aligned}$$

Choice **A** $(1,6)$ is not a solution.

Check choice **B** (0,-3):

$$\begin{aligned} g(0) &= 3(0)^2 - 9 && \text{Exponent} \\ &= 3(0) - 9 && \text{Multiply} \\ &= 0 - 9 && \text{Subtract} \\ g(0) &= -9 \neq -3 \end{aligned}$$

Choice **B** $(0,-3)$ is not a solution.

Check choice **C** (3,18):

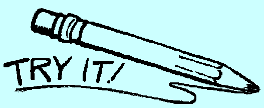
$$
\begin{aligned}
g(3) &= 3(3)^2 - 9 \\
&= 3(9) - 9 \\
&= 27 - 9 \\
g(3) &= 18
\end{aligned}
$$

Exponent

Multiply

Subtract

Since $g(3) = 18$, choice **C** $(3,18)$ is the answer.



Answer the following questions about functions.

5) Tommy's Cab Company charges $3 plus $.50 for every mile driven. Let *C* represent the total charge, and *m* represent the miles driven. Which of the following equations represents the dependent variable in terms of the independent variable?

A $C = 3.5m$

B $m = 3.5C$

C $m = 3 + .5C$

D $C = 3 + .5m$

6) Which of the following ordered pairs is a solution to the function below?

$$f(x) = \frac{3}{2}x + 3$$

A $(1, 4.5)$

B $(2, 7)$

C $(-1, 0.5)$

D $(0, 1)$

Review

Know these concepts:

1. In a function, each *x*-value can have only one corresponding *y*-value.

2. A function is a dependence of one variable on another.

- **a.** The independent variable is usually *x*.
- **b.** The dependant variable is usually *y*.

3. Functions can be represented with:

- **a.** a graph
- **b.** a list
- **c.** a table
- **d.** a mapping
- **e.** an equation
- **f.** function notation

4. An ordered pair is a solution to a function if the input produces the output after substitution into the function.

Practice Problems
Lesson 1

Directions: Write your answers in your math journal. Label this exercise TAKS Review – Lesson 1.

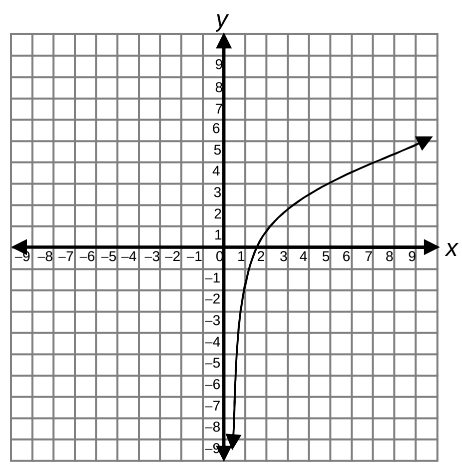
1) Which of the following examples is not a function?

A $f(x) = 3x - 2$

B $\{(0,0),(1,0),(1,1),(2,3)\}$

C $y = \frac{2}{3}x - \frac{1}{2}$

D



2) Mike's phone plan costs him $.10 per minute of talking. Which statement best describes the functional relationship between the number of minutes Mike talks and how much it costs Mike for the phone plan?

A The number of minutes talked on the phone is dependent on how much Mike pays.

B The cost of the phone plan is dependent on how long Mike talks on the phone.

C The number of minutes and the cost of the plan are independent of each other.

D The number of minutes talked depends on how many friends Mike has.

3) Which of the following ordered pairs is a solution to the function below?

$f(x) = x^2 + 3x$

A $(0,3)$ **B** $(3,0)$ **C** $(3,3)$ **D** $(0,0)$

4) Which is equivalent to the following function?

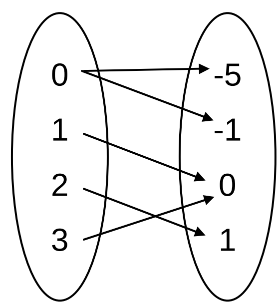
$\{(0,0),(1,0),(2,1),(3,1)\}$

A

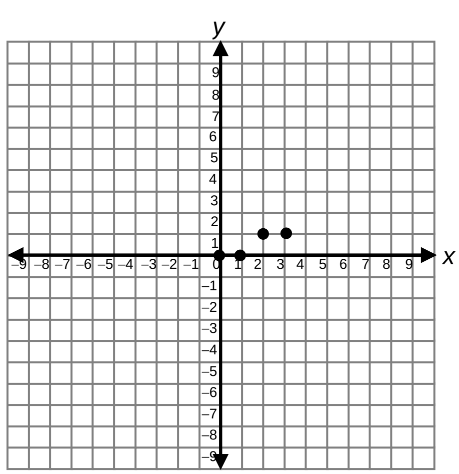
x	y
0	2
1	3
2	4
3	5

B $f(x) = 2x$

C



D



1) Function

2) Not a function

3) Function

4) Not a function

5) **D**

6) **A**

NOTES

End of Lesson 1