

# CBR + Relations and Functions

## Learning Goals

- define and determine Domain and Range
- define and determine if a relation is a function

## CBR Demonstration

### What you need

cord  
calculator  
CBR

### Set Up

1. Attach CBR to cable
2. Turn TI-Nspire **ON**
3. Attach Calculator to cord
4. Hit **ENTER** - two graphs will display

### menu

- 3: Graph
- 1: Show Graph
- 1: Graph 1

Now hit **ENTER**

The most important key on my calculator is...

**ENTER**

**After the first graph**

menu

3: Graph

1: Show Graph

1: Graph 1

#### Working with CBRs

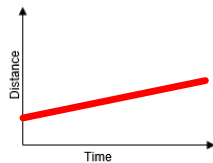
##### Distance-Time Graphs

A distance-time graph shows an object's distance from a reference point at any given time.

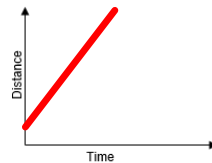
##### Let's Get Moving!

1. Use the CBR to create a graph following the instructions given:

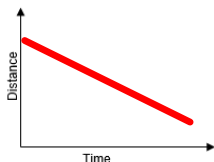
a) Walk a positive linear relation with a small slope.



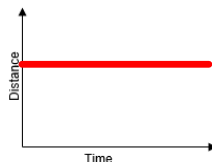
b) Walk a positive linear relation with a big slope.



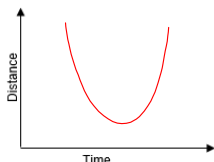
c) Walk a negative linear relation with a moderate slope.



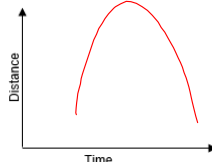
d) Walk a linear relation with NO slope.



e) Walk a positive parabola.



f) Walk a negative parabola.



2. Use the CBR to create a graph that resembles each graph shown below. In the space provided, explain how (describe the motion) you created each graph.

<p>distance</p> <p>time</p>	<p>distance</p> <p>time</p>
<p>A</p> <p>Description of motion:</p> <p><b>walk away fast</b> <b>stop</b></p>	<p>B</p> <p>Description of motion:</p> <p><b>walk away moderately</b> <b>stop</b> <b>walk away faster</b></p>
<p>distance</p> <p>time</p>	<p>distance</p> <p>time</p>
<p>C</p> <p>Description of motion:</p> <p><b>walk away</b> <b>walk back</b> <b>walk away</b> <b>walk back</b></p>	<p>D</p> <p>Description of motion:</p> <p><b>repetitive motion</b></p> <p><b>hoola hoop or</b> <b>bottle swing</b></p>

3. Use the CBR to try to make the letters of your first name.

C A R are problematic

**How Well Do You Know Your A, B, C's?**

Examine the following letters of the alphabet. Decide which one(s) you would be able to create on your graphing calculator by walking in front of a motion sensor. If you are able to create the letter, describe what the walk would look like. (Use phrases like "walk away from the sensor".) If you are unable to create the letter, explain why not.



Letter	Can you Create it? (check one)	Explain how to create it <b>or</b> Explain why you cannot create it
U	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
S	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
X	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
C	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
M	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

Now, classify all the letters of the alphabet as "walkable" or "not walkable".

Walkable	Not Walkable

What do you notice about the letters that are "not walkable"?

What do you notice about the letters  
that are **NOT WALKABLE?**

Can't go back in time.

### Relation

- a connection between a pair of quantities
- expressed in
  - Words
  - Table of Values
  - Graph
  - Equation
  - Set of ordered pairs

### Function

- is a relation
- each value of the independent variable corresponds with **only one** value of the dependent variable  
(*For every  $x$  there is only one  $y$* )

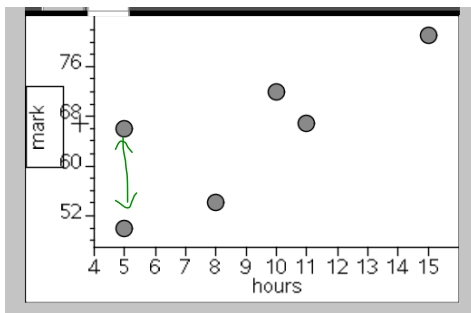
Every relation is **NOT** a function.

We can describe a relation using:

### Words

For a week prior to their physics exam, a group of friends collect data to see whether time spent studying had a correlation with their marks on the exam.

### Graph



### Table of values

Hours Studied	Exam Score
10	72
8	54
5	66
11	67
15	81
5	50



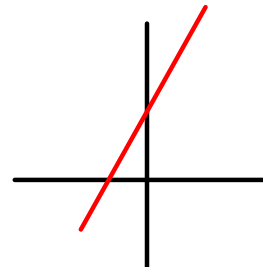
### Equation

$$y = 2x + 5$$

$$y = mx + b$$

Set of ordered pairs

$$(5, 50) (5, 66) \dots$$



Is this Relation a Function?

Relation

How to determine if a relation is function.

**Graph** - Vertical Line Test

**Table of Values, Set of Ordered Pairs**

- For each "x" there is only one "y"

**Equation** - What is it?

Most straight lines are Functions. → vertical line

All parabolas are Functions.

All circles are not Functions.

If you don't know what it is graph it on your TI-NSpire and use the Vertical Line test.



## Function or Not?

x	y
0	3
2	0
5	-1



x	y
6	5
8	4
9	4.5
11	5



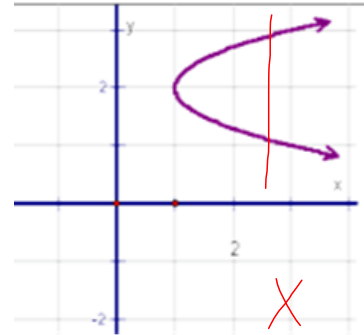
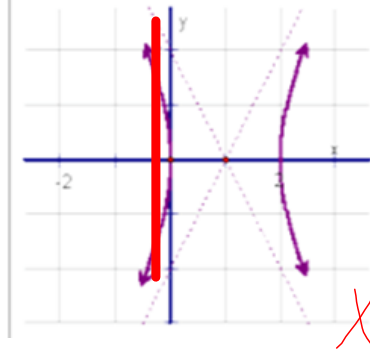
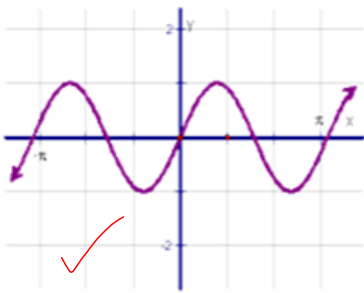
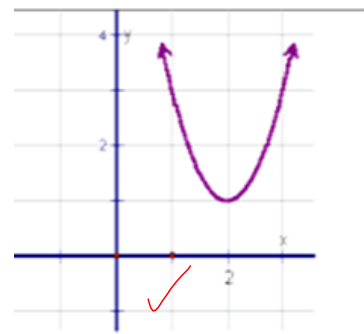
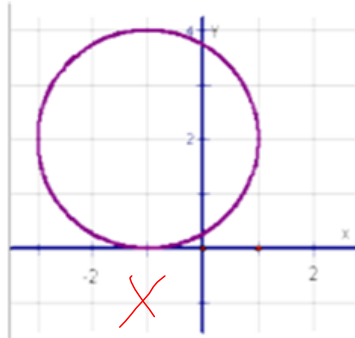
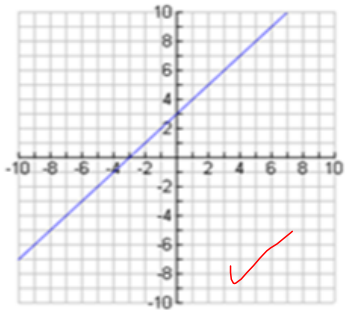
x	y
* 1	5
* 1	7
2	3
7	8



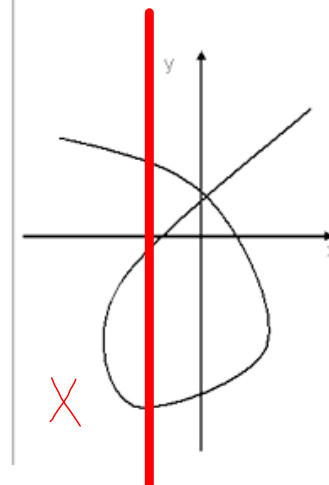
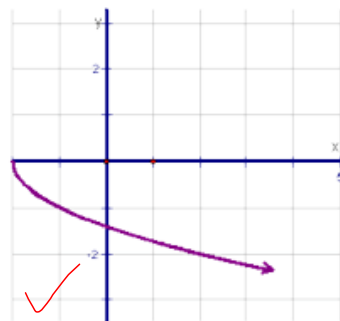
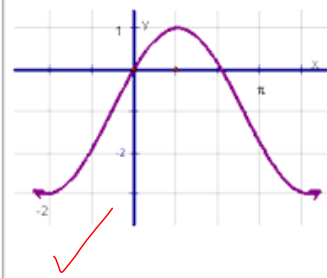
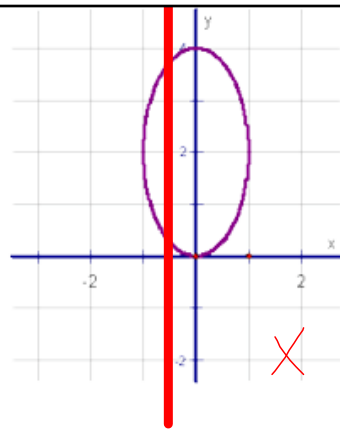
x	y
* -2.5	-1
* -2.5	0
* -2.5	-2
* -2.5	-3



# Function or Not?



# Function or Not?



Function or Not?

$$\{(1,3), (2,4), (3,6), (4,7)\}$$



$$\{(1,3), (3,4), (3,5), (4,8)\}$$

x



### On the Boards...

State - function or not

$$y = 2x + 5 \quad \text{yes - straight line}$$

$$y = x^2 + 5 \quad \text{yes - parabola}$$


$$x^2 + y^2 = 25 \quad \text{no - circle}$$

$$\{(1,9), (2,9), (3,9), (4,9), (5,9)\} \quad \text{yes}$$



## Seatwork

pg 10 # 1ac, 2, 4, 6, 7, 9

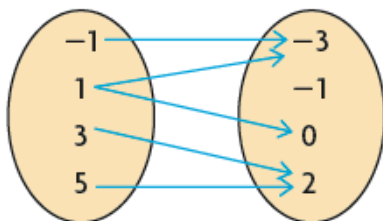


use TI-Nspire

1. State which relations are functions. Explain.

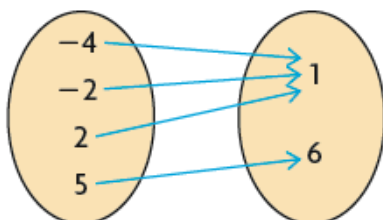
a)  $\{(-5, 1), (-3, 2), (-1, 3), (1, 2)\}$

b)

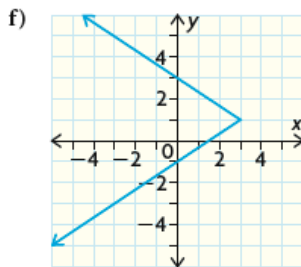
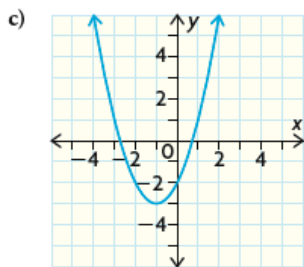
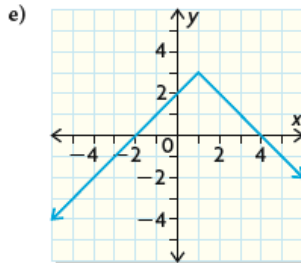
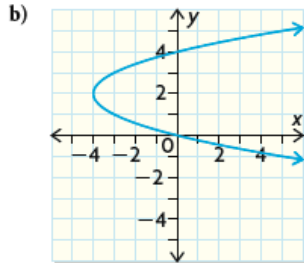
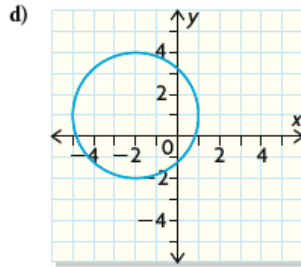
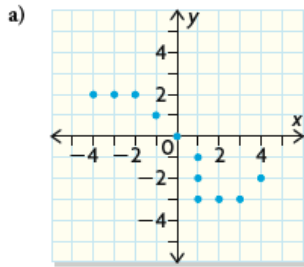


c)  $\{(0, 4), (3, 5), (5, -2), (0, 1)\}$

d)



2. Use a ruler and the vertical-line test to determine which graphs are functions.



4. The grades and numbers of credits for students are listed.

**K**

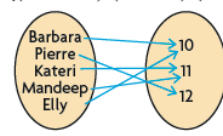
Student	Grade	Number of Credits
Barbara	10	8
Pierre	12	25
Kateri	11	15
Mandeep	11	18
Elly	10	16

- Write a list of ordered pairs and create a mapping diagram for the relation between
  - students and grades
  - grades and numbers of credits
  - students and numbers of credits
- State the domain and range of each relation in part (a).
- Which relations in part (a) are functions? Explain.

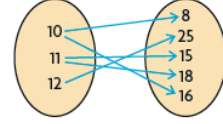
6. Describe the graphs of the relations  $y = 3$  and  $x = 3$ . Are these relations functions? Explain.
7. Identify each type of relation and predict whether it is a function. Then graph each function and use the vertical-line test to determine whether your prediction was correct.
- a)  $y = 5 - 2x$                       c)  $y = -\frac{3}{4}(x + 3)^2 + 1$
- b)  $y = 2x^2 - 3$                       d)  $x^2 + y^2 = 25$
8. a) Substitute  $x = 0$  into each equation and solve for  $y$ . Repeat for  $x = -2$ .
- i)  $3x + 4y = 5$                       iii)  $x^2 + y = 2$
- ii)  $x^2 + y^2 = 4$                       iv)  $x + y^2 = 0$
- b) Which relations in part (a) appear to be functions?
- c) How could you verify your answer to part (b)?
9. Determine which relations are functions.
- a)  $y = \sqrt{x + 2}$                       c)  $3x^2 - 4y^2 = 12$
- b)  $y = 2 - x$                           d)  $y = -3(x + 2)^2 - 4$

1. a) Function; each  $x$ -value has only one  $y$ -value  
 b) Not a function; for  $x = 1, y = -3$  and  $0$   
 c) Not a Function; for  $x = 0, y = 4$  and  $1$   
 d) Function; each  $x$ -value has only one  $y$ -value
2. a) Not a function    c) Function    e) Function  
 b) Not a function    d) Not a function    f) Not a function
3. For  $y = x^2 - 5x$ , each  $x$ -value gives a single  $y$ -value. For  $x = y^2 - 5y$ , each  $x$ -value gives a quadratic equation in  $y$ , which may have two solutions.
4. a) {(Barbara, 10), (Pierre, 12), (Kateri, 11), (Mandeep, 11), (Elly, 10)}

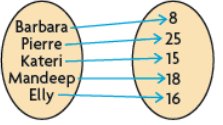
Answers



{(10, 8), (12, 25), (11, 15), (11, 18), (10, 16)}



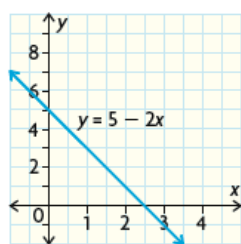
{(Barbara, 8), (Pierre, 25), (Kateri, 15), (Mandeep, 18), (Elly, 16)}



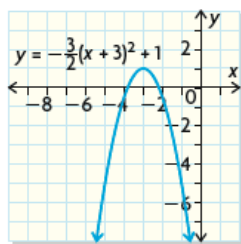
- b) students, grades: domain = {Barbara, Pierre, Kateri, Mandeep, Elly}, range = {10, 11, 12} grades, credits: domain = {10, 11, 12}, range = {8, 15, 16, 18, 25} students, credits: domain = {Barbara, Pierre, Kateri, Mandeep, Elly}, range = {8, 15, 16, 18, 25}
- c) Only grades-credits relation is not a function; it has repeated range values for single domain values.

6.  $y = 3$ : horizontal line; function (passes vertical-line test).  
 $x = 3$ : vertical line; not a function (fails vertical-line test)

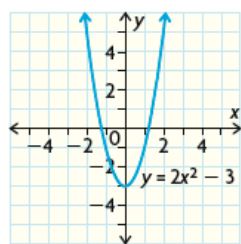
7. a) Linear, function



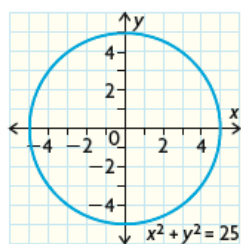
c) Quadratic, function



b) Quadratic, function



d) Circle, not a function



8. a) i) 1.25; 2.75 ii)  $\pm 2$ ; 0 iii) 2; -2 iv) 0;  $\pm\sqrt{2}$   
 b) Functions: (i), (iii)  
 c) Graph relation and apply vertical-line test, or solve equation for  $y$  and check for multiple values
9. Functions: (a), (b), (d)