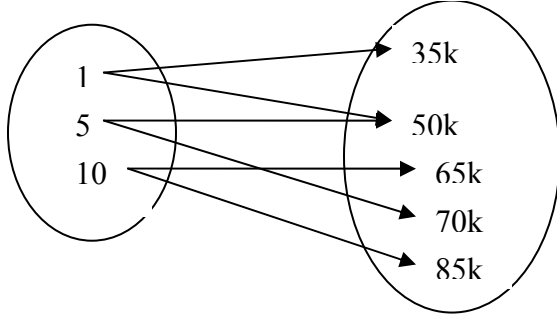
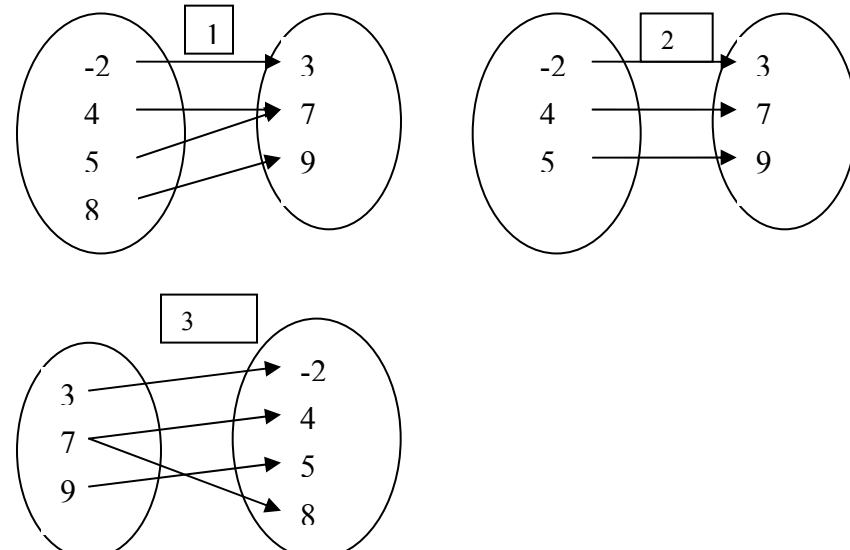


M²=Math Mediator Lesson 8: Relations and Functions

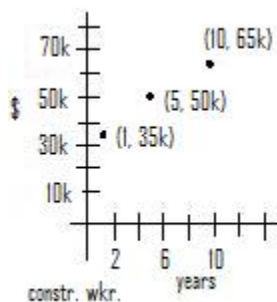
| <p>Introduction (12 minutes approx.)</p> | <p>This begins a new section of study, so there is no total recall given. You might choose to include one if it fits your curriculum.</p> <p>Make a table with two headings: Construction Worker and Mechanical Engineer</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2"><u>Construction Worker</u></th> <th colspan="2"><u>Mechanical Engineer</u></th> </tr> <tr> <th><u>Years Worked</u></th> <th><u>Salary</u></th> <th><u>Years Worked</u></th> <th><u>Salary</u></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>\$35k/yr</td> <td>1</td> <td>\$50k/yr</td> </tr> <tr> <td>5</td> <td>\$50k/yr</td> <td>5</td> <td>\$70k/yr</td> </tr> <tr> <td>10</td> <td>\$65k/yr</td> <td>10</td> <td>\$85k/yr</td> </tr> </tbody> </table> <p>This is a relational data table. The data presents a relation between years worked and salary for two career choices. Take a couple of minutes to discuss the pros and cons of these career choices. Construction worker does not require a college degree but it is hard laborious work that takes a toll on the body. Mechanical engineer requires a college degree and some challenging math courses.</p> <p>Back to the tabulated data: the data could be further displayed by ordered pairs and plotting on a chart. What would be the ordered pairs for Construction Worker? What would be the labels for the x-axis and y-axis?</p> <p>Using the construction worker data, we could make a circle with the numbers 1, 5, and 10 in it to represent the set of years worked. Next to it, we could make another circle with 35k, 50k and 65k for salary. The lines show mapping from the one set to the other. In this case, it is a one to one map.</p> <div style="text-align: center;"> <table border="0"> <tr> <td style="text-align: center;">Construction Worker Years Worked</td> <td style="padding: 0 20px;"></td> <td style="text-align: center;">Construction Worker Salary</td> </tr> <tr> <td style="text-align: center;"> </td> <td></td> <td></td> </tr> </table> </div> <p>The years worked set is called the “domain” because it is the input value, it is a <u>restricted set</u> of constant values that we are using for both construction worker and mechanical engineer to compare the output values, or “range” of the salaries. If the values are not defined, you can assume that the set is referring to all real numbers. The salary numbers set is called the “range”. Typically, in relationships with x and y as variables, the x value is the domain, and the y value is the range.</p> <p>Other common relations are: Points on a map (longitude, latitude); Song recording device (memory size, number of songs).</p> | <u>Construction Worker</u> | | <u>Mechanical Engineer</u> | | <u>Years Worked</u> | <u>Salary</u> | <u>Years Worked</u> | <u>Salary</u> | 1 | \$35k/yr | 1 | \$50k/yr | 5 | \$50k/yr | 5 | \$70k/yr | 10 | \$65k/yr | 10 | \$85k/yr | Construction Worker Years Worked | | Construction Worker Salary | | | |
|--|---|-------------------------------|------------------------|----------------------------|----|---------------------|---------------|---------------------|---------------|---|----------|---|----------|---|----------|---|----------|----|----------|----|----------|-------------------------------------|--|-------------------------------|--|--|--|
| <u>Construction Worker</u> | | <u>Mechanical Engineer</u> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <u>Years Worked</u> | <u>Salary</u> | <u>Years Worked</u> | <u>Salary</u> | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | \$35k/yr | 1 | \$50k/yr | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | \$50k/yr | 5 | \$70k/yr | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | \$65k/yr | 10 | \$85k/yr | | | | | | | | | | | | | | | | | | | | | | | | |
| Construction Worker Years Worked | | Construction Worker Salary | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>Practice (10 minutes approx.)</p> | <p>U-DO:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th><u>Memory Size</u></th> <th><u>Number of Songs</u></th> </tr> </thead> <tbody> <tr> <td>128 MB</td> <td>60</td> </tr> </tbody> </table> <p>Consider this data.</p> <ol style="list-style-type: none"> 1. Identify the domain and range. | <u>Memory Size</u> | <u>Number of Songs</u> | 128 MB | 60 | | | | | | | | | | | | | | | | | | | | | | |
| <u>Memory Size</u> | <u>Number of Songs</u> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 128 MB | 60 | | | | | | | | | | | | | | | | | | | | | | | | | | |

M²=Math Mediator Lesson 8: Relations and Functions

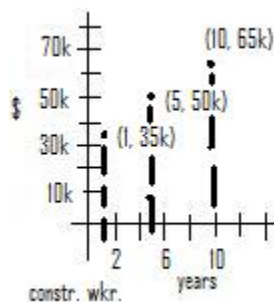
| | |
|---|---|
| | <p>256 MB 100 512 MB 250 1 GB 500</p> <p>2. Plot the data on an x,y graph.</p> |
| <p>Direct Instruction (5 minutes approx.)</p> | <p>Some relationships are not one to one, as was the case previously. If we keep the domain as years worked and change the range to include both salaries of construction workers and mechanical engineers, we would have one domain value mapping to two range values, like below:</p> <p style="text-align: center;">Years Worked Salary</p>  <p>This relationship is NOT a function. A function is: A relationship for which each input has exactly one output. The original relationship between years and construction worker salary was a function. It had a one to one mapping. However, a function can also have two to one mapping, but not one to two mapping.</p> |
| <p>Practice (5 minutes approx.)</p> | <p>Which are functions and why?</p>  <p>A: Numbers 1 and 2 are functions because for every input there is only one output mapped. In #3, the value 7 is mapped to two outputs, 4 and 8.</p> |
| <p>Direct Instruction;</p> | <p>Another way to represent this notion of a function, besides the method of mapping every input to only one result, is by plotting a relationship on the x-y</p> |

practice and assessment:
(13 minutes approx.)

Cartesian plane:

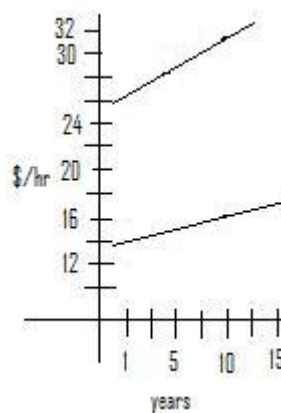
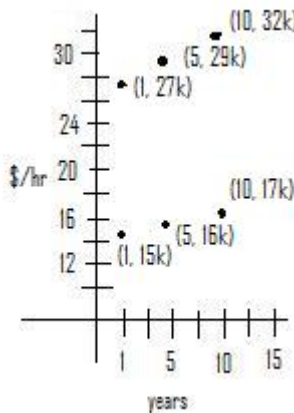
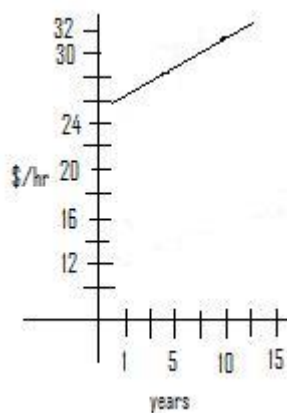


THEN EMPLOY THE VERTICLE LINE TEST TO DETERMINE IF THE RELATIONSHIP IS A FUNCTION OR NOT. IF ANY VERTICLE LINE INTERSECTS MORE THAN ONE POINT, THE RELATIONSHIP IS NOT A FUNCTION.



In this case, the three points constitute a function. They are a relationship and they are a function. Notice that these points are not connected by a line. I don't even know if they can be connected by a line and we have no information that tells us how or if there are points in between these given points.

Question: do you think that there should be points in between these points using common sense and the relationship given of years worked and salary? Yes, of course there should be points in between. Some research into salaries would produce information to help fill in the points. Who or where could you go to find out this type of information? The school should have a career resource center. People that gather this information are statisticians and human resource people. They sometimes work for the government and most all big companies have human resource people that need to track this information if they employ construction workers, in order to know if they are paying them fairly.



The first plot of a line is a function, it passes the vertical line test.

The second plot of points is not a function, it does not pass the VLT.

The third plot of two lines is not a function, it does not pass the VLT.

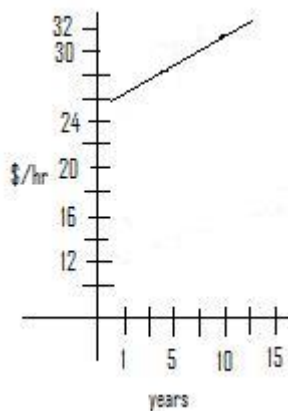
Exercise:
(10 minutes approx.)

Determine if these relationships are functions or not:

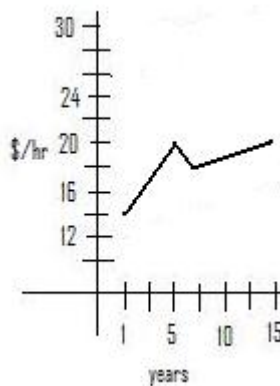
1. Two beauticians made the following salaries:
 - a. Year 1 earned \$20k, year 5 earned \$25k and year 10 earned \$30k.
 - b. Year 1 earned \$18k, year 5 earned \$22k and year 10 earned \$30k.

M²=Math Mediator Lesson 8: Relations and Functions

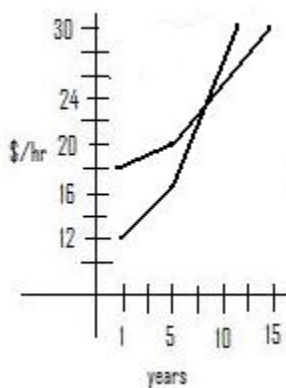
2. State the domain and range of these number pairs and determine if they are functions or not:
- $\{(3,1), (2,3), (1,2), (3,2)\}$
 - $\{(5,2), (6,1), (7,2), (8,1)\}$
 - $\{(8,5), (7,4), (6,3), (5,2)\}$ extra credit to describe this relationship with an equation.



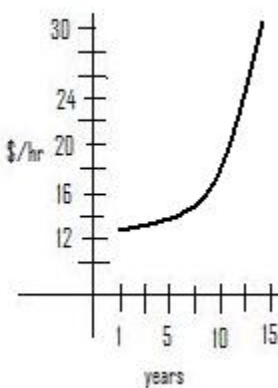
3.



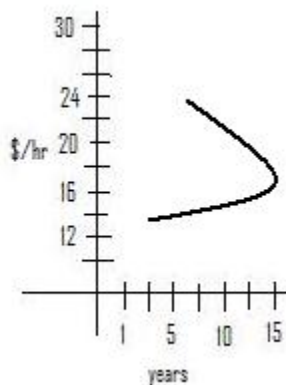
4.



5.



6.



7.

- Ans: 1) Not function; 2a) Not function; 2b) Yes function; 2c) Yes, function $y = x - 3$ for $x = \{8, 7, 6, 5\}$; 3) Yes; 4) Yes; 5) No; 6) Yes; 7) No.

Wrap-up and

Wrap up closing comments and housekeeping. Assign homework as you feel needed to help students develop study and working on their own habits.

M²=Math Mediator Lesson 8: Relations and Functions

| | |
|--|---|
| homework assignment (5 minutes approx.) | <ol style="list-style-type: none">1. Which are functions and why or why not? The representation is $D \rightarrow R$ or Domain mapped to Range:<ol style="list-style-type: none">a. States \rightarrow capitalsb. School lockers \rightarrow studentsc. Students \rightarrow agesd. Brothers \rightarrow sisters2. Let $A = \{(10,3), (7,2), (-2, 5), (x, 1)\}$. Name all possible values that 'x' cannot be in order for this relation A to be a function? |
|--|---|