

Math Modeling: Test Review

Test I

Review:

- What is a function?

A relationship between two variables, typically x and y , is called a function, if there is a rule that assigns to each value of x one and only one value of y .

- Vertical Line Test

- ✓ The vertical line test is a way to determine whether or not the graph of a relation is a function. The vertical line test simply states that if a vertical line intersects the relation's graph in more than one place, the relation is NOT a function.
- ✓ If you think about it, the vertical line test is simply a restatement of the definition of a function which states that every x -value must have a unique y -value.

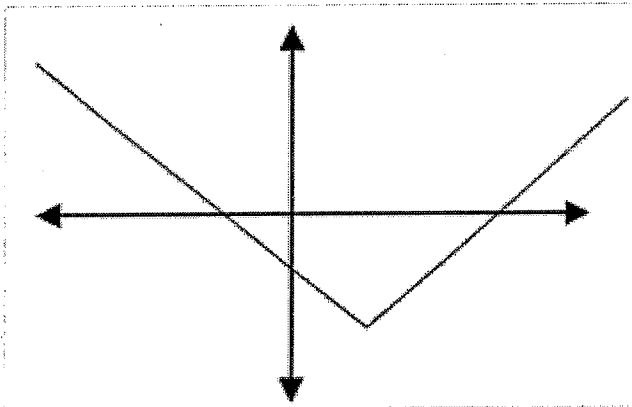
Example:

Determine if the following tables, graphs, or equations define y as a function of x .

1.

x	3	6	10	3
Y	-1	3	7	2

2.



3. $y^2 = 4x^3 - 10$

Review:

- What is the domain of a function?
 - ✓ The values that x may assume are called the domain of the function. We say those are the values for which the function is defined.
- How do we write the domain of a function in interval notation?
 - ✓ In interval notation, there are only 5 symbols to know:
 - Open parentheses ()
 - Closed parentheses []
 - Infinity $+\infty$
 - Negative Infinity $-\infty$
 - Union Sign U
- ✓ To use interval notation:
 - Use the open parentheses () if the value is not included in the graph.
 - This happens when the graph is undefined at that point... there's a hole or asymptote, or a jump
 - If the graph goes on forever to the left, the domain will start with ($-\infty$.
 - If the graph goes on forever to the right, end with ∞)
 - Use the brackets [] if the value is part of the graph
 - Whenever there is a break in the graph, write the interval up to the point. Then write another interval for the section of the graph after that part. Put a union sign between each interval to "join" them together.

Example:

Given the functions $f(x) = \frac{6}{x-2}$ and $g(x) = \sqrt{4-x}$

4. Find the domain of $f(x)$ and $g(x)$.

5. Find $f(15)$ and $g(-8)$.

6. Determine when $g(x) = 13$.

Review:

- What is the Average Rate of Change?
 - ✓ This is the same thing as the slope
 - ✓ The *slope* is the average rate of change of a line.
- How do we find the Average Rate of Change?
 - ✓ Average Rate of Change = slope = $m = \frac{y_2 - y_1}{x_2 - x_1}$
 - ✓ All we need to find the slope is two points,
 (x_1, y_1) and (x_2, y_2)
- What does it mean for $f(x)$ to increase and decrease?
 - ✓ These are the x-value intervals for which one of the following occurs:
 - a) $f(x)$ is increase – For this situation, we want the x-value interval between which the y-values are getting larger.
 - b) $f(x)$ is decreasing – For this situation, we want the x-value interval between which the y-values are getting smaller.

Example:

x	-2	-1	0	1	2
f(x)	10	7	2	1	9
avg rate change					

x	-2	-1	0	1	2
f(x)	10	7	2	1	9
avg rate change	-3	-5	-1	8	

7. When is $f(x)$ increasing?

8. When is $f(x)$ decreasing?

9. When is the average rate of change of $f(x)$ increasing?

10. When is the average rate of change of $f(x)$ decreasing?

Review:

- What is the equation of a line?
 - ✓ $y = mx + b$, where
 - m is the slope of the line
 - b is the y -intercept of the line
- How do we find the equation of a line?
 - If we are given one of the following two sets of data, we are able to find the equation of a line:
 - ✓ Two points
 - ✓ One point and the slope
 - With this information, we are able to use the Point-Slope Formula:

$$y - y_1 = m(x - x_1)$$

Example:

11. A local t-shirt company sold 850 shirts two weeks ago when they charged \$15 for each shirt. The following week they sold 1000 shirts when they lowered the price to \$12. Assuming that this rate of change continues, answer the following:

a. Find a linear function $s(p)$ that models the number of shirts sold for a price of p .

b. Predict the number of shirts the store would sell in a week if they charged \$20 for each shirt.

c. What price per shirt would cause the store to sell no shirts?

12. You drive for 1 hour at 70 mph and then stop for one hour for lunch. After lunch you drive another 2 hours at 75 mph to reach your friend's house 220 miles away.

a. Draw a graph of the situation described above showing the time traveled on the horizontal axis and the distance from the starting point on the y-axis.

b. Write a piece-wise function that matches your graph from part a.

13. We are given the following table showing the yearly salary based on years experience with the company for several employees.

Years of work	1	4	8	10	15
Salary	\$22,000	\$23,500	\$27,000	\$31,000	\$34,800

- a. Find the best fit linear function that models the salary for a worker after t years of service.

- b. Fill in the table below giving the predictions from your model in part (a).

Years of work	Actual salary	Predicted salary	Error	Squared error
1	22000			
4	23500			
8	27000			
10	31000			
15	34800			

c. Find the average error for your model from part (a)

d. Using your model predict the salary for someone with 12 years of service to the company.

Good Luck on Your Test 😊