Review: Linear vs. Nonlinear

- Cut out each problem. Be sure NOT to cut off the number.
- Determine whether each relationship is linear or nonlinear.
- Place them in the appropriate box and glue them in place.

Linear Functions

1.

x	0	3	6	9
y	2	6	10	14

y=5

2.

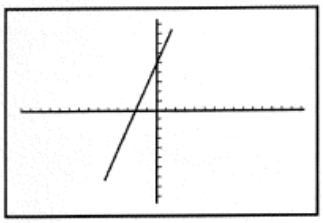
x	0	1	2	3
y	0	2	4	6

x=-2

4. $y = 2x$

5. $y = 2x + 5$

8.



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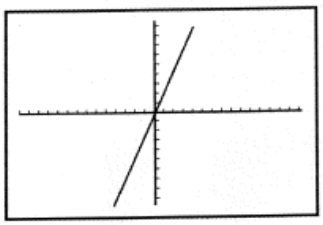

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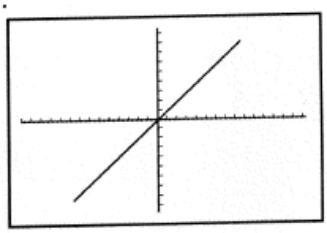


Nonlinear Functions

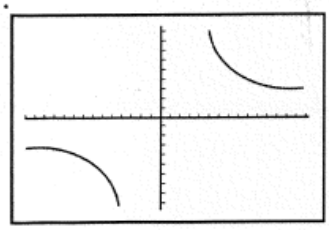
3.

x	1	2	4	5	10	20
y	20	10	5	4	2	1

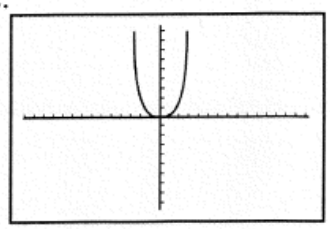
6. $y = \frac{20}{x}$

7. $y = x^2$

11.



12.



Direct & Inverse Variation

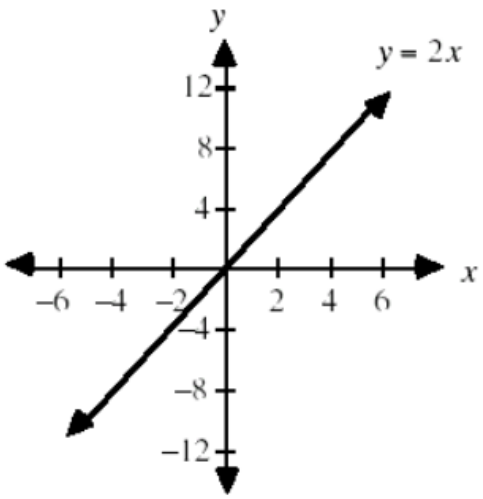
Patterns, Functions and Algebra

03: Identify functions as linear or nonlinear based on information given in a table, graph, or equation.

14: Differentiate and explain types of changes in mathematical relationships, such as linear vs. nonlinear, continuous vs. noncontinuous, direct variation vs. inverse variation.

Characteristics of Direct Variation:

1. Linear relationship.
2. In the form, y = kx, where k is the constant rate of change.
3. Graph passes through the origin.
4. As x increases, y increases.

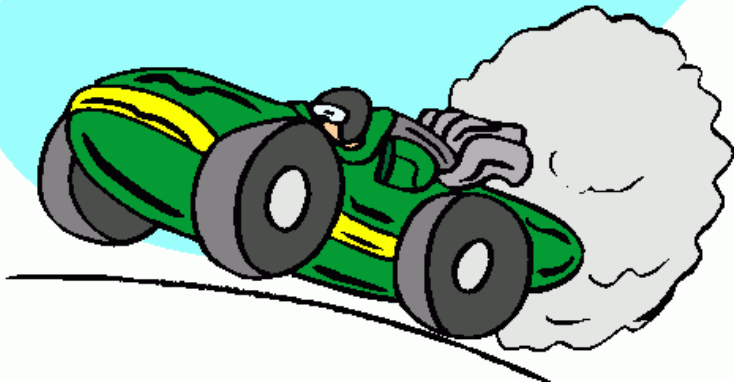


A direct variation is a situation in which two quantities -- such as hours and pay, or distance and time -- increase or decrease at the same rate.

The ratio between the quantities is constant; that is, as one quantity doubles, the other quantity also doubles.

Example

A racecar driver knows that completing 100 laps before making a pit stop is better than completing only 80, because distance is directly proportional to time when driving at a constant speed. The longer she drives, the more distance she'll cover.



X Marks the Spot

Directions: on a piece of scrap paper, you will write as many X's as possible while your partner times you.

Assign the following roles in your group:

The 'X' Maker - a student who draws x's without stopping for 30 seconds.

Timer: keeps track of the time and announces it every five seconds.

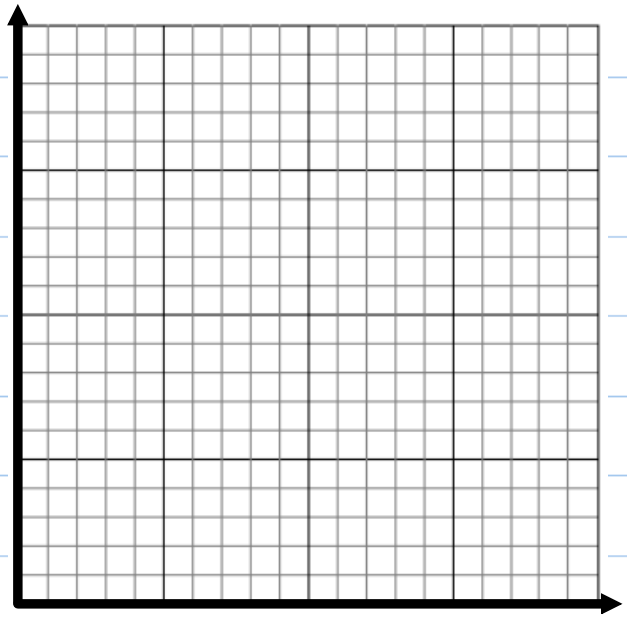
Counter: counts the number of X's drawn and says the count when the timer announces five seconds.

Recorder: responsible for recording the total number of x's drawn every five seconds.

Marks the Spot

1. Record the data in the table below:

Number of Seconds	Number of "X's"
0	0
5	
10	
15	
20	
25	
30	



2. Plot the data points on the grid

Marks the Spot

3. Describe the relationship between the number of seconds and the number of X's.

4. Explain why it may be expected that this data collection activity to produce linear-like results.

5. How could the data collection process be changed so that non-linear results would be obtained?

6. Explain why the activity produced a direct variation relationship.

7. How could the data collection process be changed so that the results would still be linear, but not a direct variation?

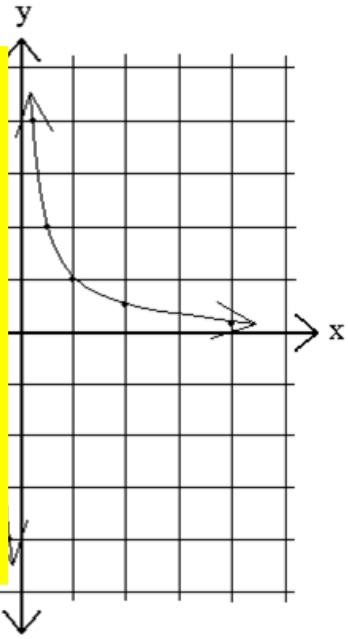
Inverse Variation

An inverse variation is a situation in which one quantity increases while another quantity decreases.

It can be written as an equation.

$$y = \frac{k}{x} \quad or \quad xy = k$$

It is a nonlinear relationship.



$y = \frac{10}{x}$ $xy = 36$

An inverse variation is a situation in which one quantity increases while another quantity decreases -- such as the number of diners and serving size for a given amount of food, or speed and travel time for a given distance.

The product of the quantities remains constant; that is, as one quantity doubles, the other quantity is cut in half.

Example

A caterer who takes a watermelon to a picnic knows that each person will receive more watermelon if there are fewer attendees, but each person will receive less watermelon if there are more attendees. That's because the amount of watermelon for each person varies inversely as the number of attendees. The more people, the less each person gets.

Example

A truck driver knows that driving at 75 miles per hour will get her to her destination faster than driving at 65 mph, because time is inversely proportional to speed. As her speed increases, her travel time decreases.

Identify each as direct variation or inverse variation.
Justify your answer.

The number of hours you baby sit and the amount of money you earn.

The number of hours it takes to do a science project and the number of people working together on the project.

The number of minutes spent running and the total distance ran.

The number of people at a party and the amount of pizza that each person will get to eat if there are 10 pizzas ordered.

The number of hours you baby sit and the amount of money you earn.

Direct Variation; the longer you baby sit, the more money you earn

The number of hours it takes to do a science project and the number of people working together on the project.

Inverse Variation; the more people working on a project the less time that each person has to work.

The number of minutes spent running and the total distance ran.

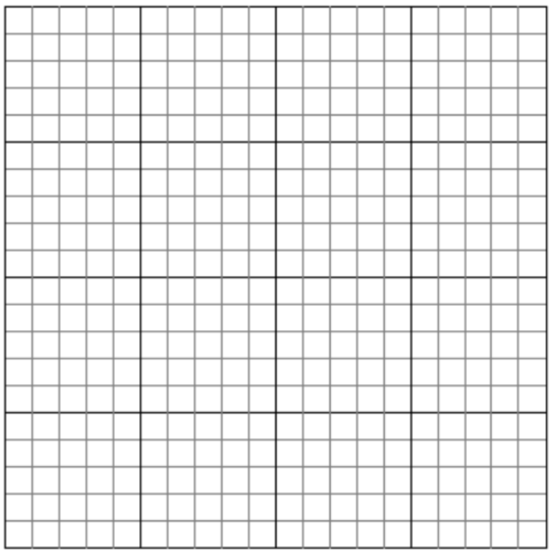
Direct Variation; the longer you run, the greater the distance.

The number of people at a party and the amount of pizza that each person will get to eat if there are 10 pizzas ordered.

Inverse Variation; the more people at the party, the less pizza that each person gets to eat.

Length - Width - Area Problem

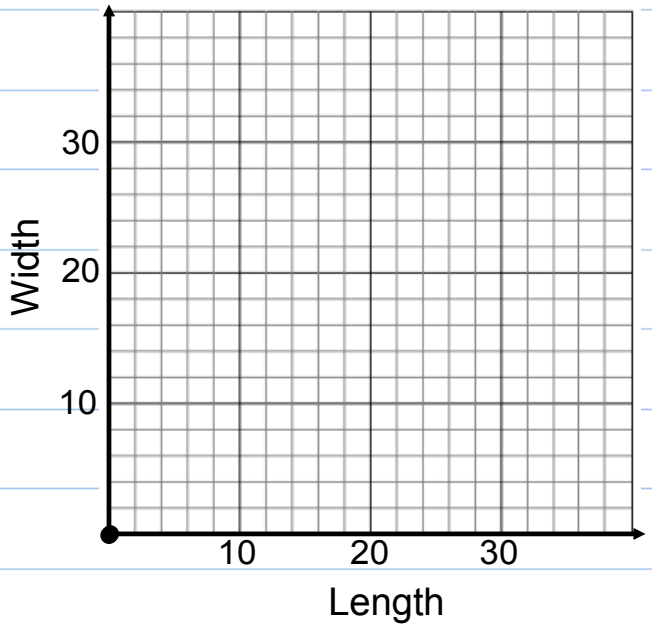
1. A rectangle has are area of 24 square units. Represent all possible rectangles with integral dimensions on the grid.



Length - Width - Area Problem

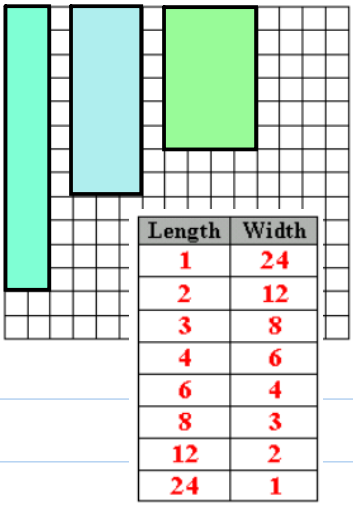
2. Record the dimensions for all the rectangles in the table.

x	y



3. Describe the relationship between the rectangles length and width values.

Length - Width - Area Problem

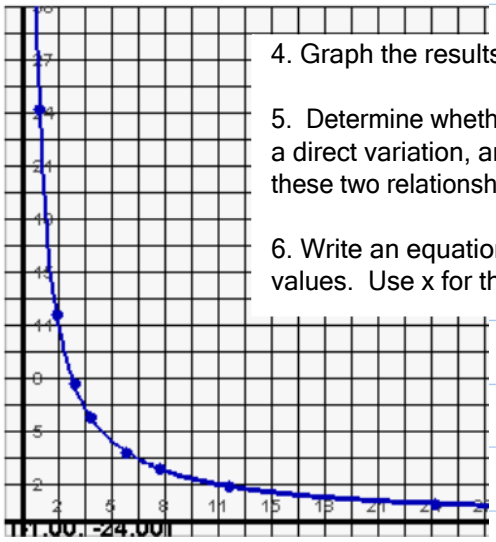


Length	Width
1	24
2	12
3	8
4	6
6	4
8	3
12	2
24	1

1. A rectangle has are area of 24 square units. Represent all possible rectangles with integral dimensions on the grid below.

2. Record the dimensions for all the rectangles in the table.

3. Describe the relationship between the rectangles length and width values.



4. Graph the results of your table.

5. Determine whether the table of values represents a direct variation, an inverse variation, or neither of these two relationships.

6. Write an equation that models the table of values. Use x for the length and y for the width.