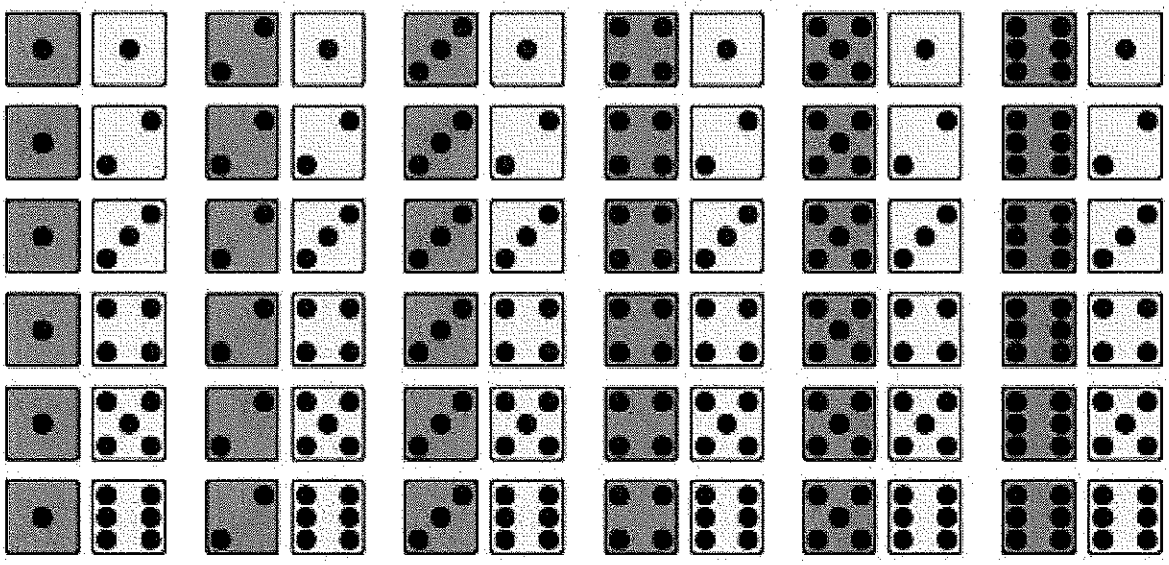
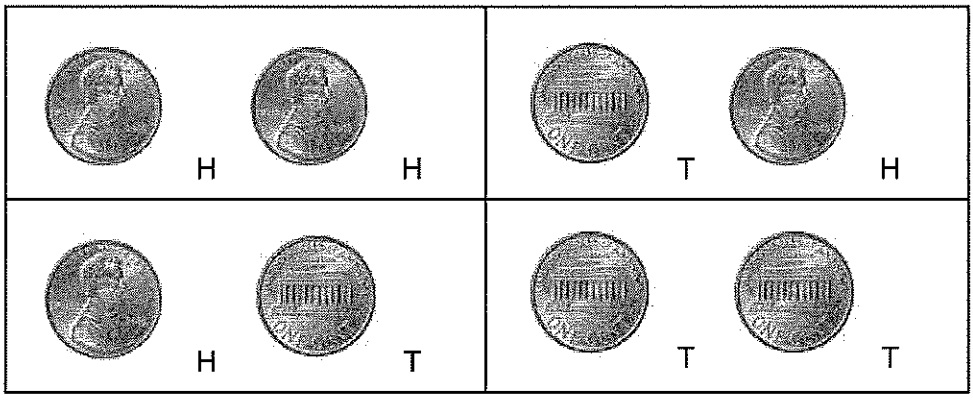
Topic 8: Data & Probabilities

Term	Meaning
Bivariate Data	
Scatter Plot	
Cluster	
Gap	
Outlier	
Trend Line/ Line of Best Fit	
Positive Association	
Negative Association	
Repeated Experiment	
Sample Space	

Outcome	
Theoretical Probability	
Experimental Probability	





Lesson 1: Construct Scatter Plots and Line Graphs

*Goal: Determine whether a **scatter plot or line plot** will better represent data*
***Construct scatter plots & line plots** to show the relationship between data*

Vocabulary

Statistics
The process of _____ , _____ and _____ data.

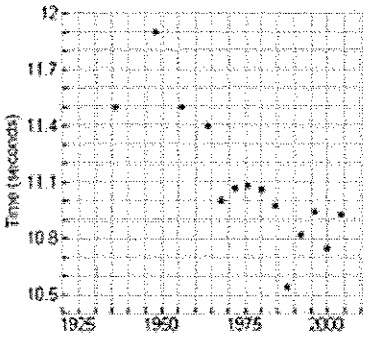
Single-Variable Data
A data set with only ____ type of data.

Two-Variable Data
A data set where ____ groups of numbers are _____ simultaneously.

Scatter Plot
A ____ of _____ graphed on a coordinate plane.

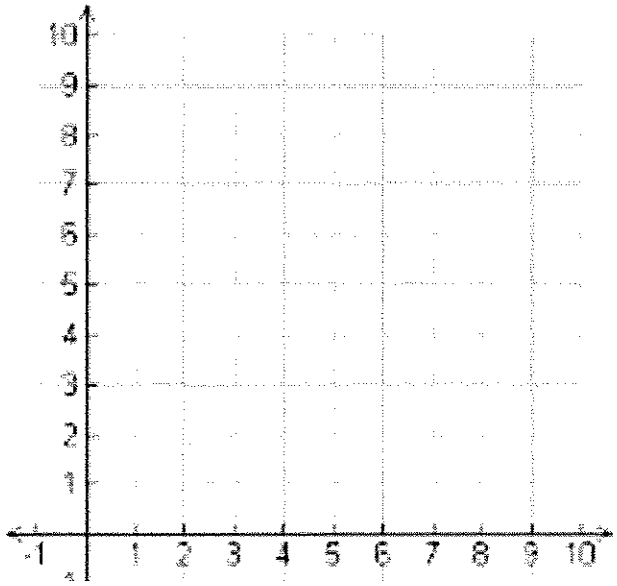
Year	Time (seconds)
1956	11.5
1972	11.07
2004	10.93
1976	11.08
1996	10.94
1988	10.54
1936	11.5
1980	11.06
1948	11.9
2000	10.75
1964	11.4
1984	10.97
1992	10.82
1968	11.0

Source: Time Almanac



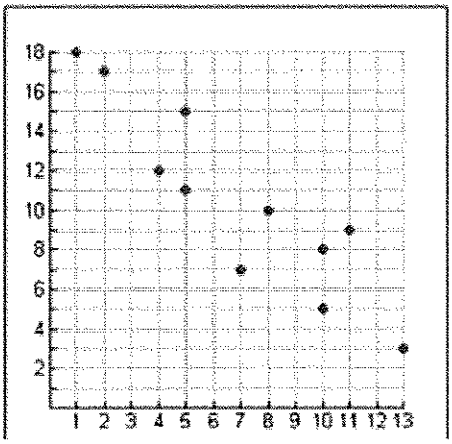
Make a scatter plot of the data set. Describe the pattern of the data.

x	1	3	5	2	8	4	5	4	2	6	7
y	3	3	7	2	8	5	5	6	4	6	8



Make a scatter plot of this data set. Describe the pattern of the data.

x	1	2	4	5	5	7	8	10	11	13
y	18	17	12	15	11	7	10	8	9	3



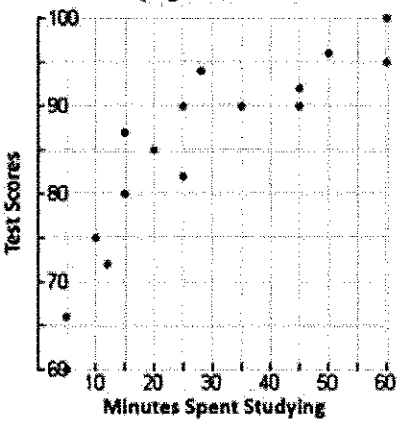
as __increases, __decreases

Association

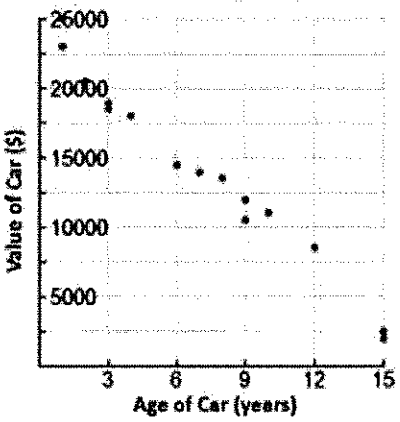
The relationship between two variables in a scatter plot.

There are 3 types of associations:

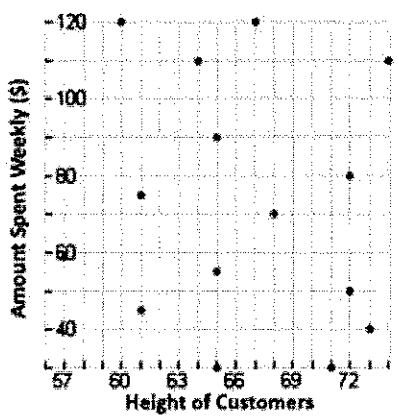
Positive Association



Negative Association

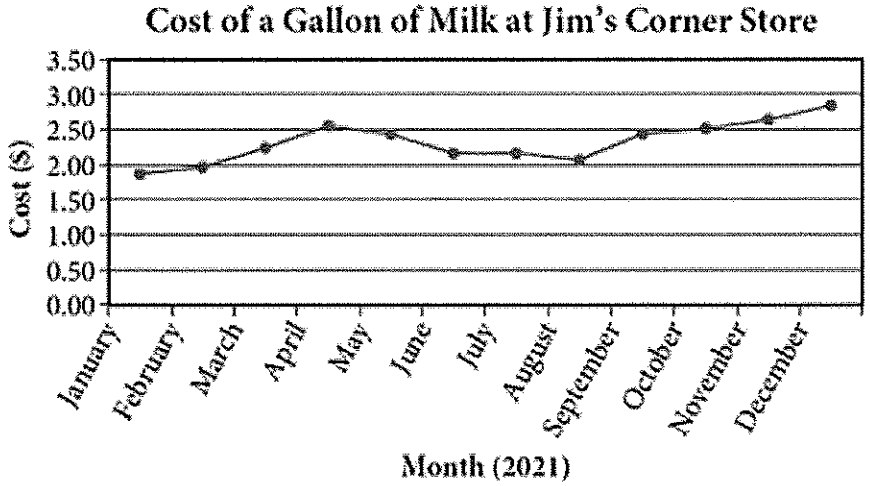


No Association



Line Graph

A graph that displays _____ data using connected _____ segments.

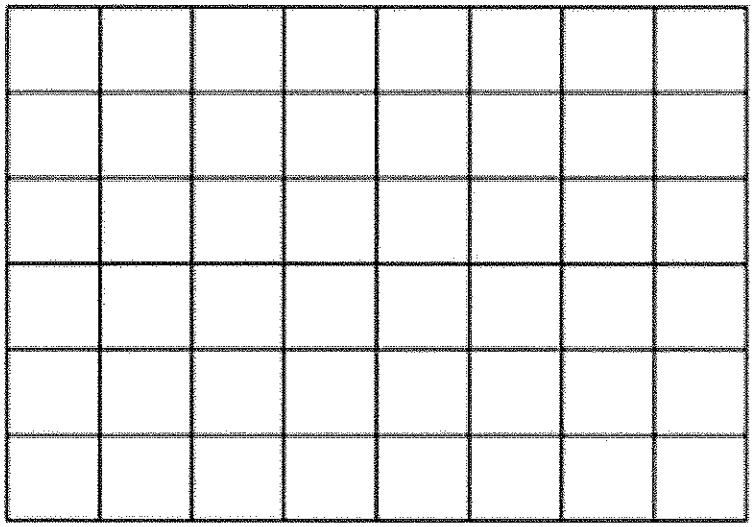


Example 2

Three friends started a clothing line called KoolCatz Business Attire in 2016. Their profit each year for 2016 to 2022 is listed in the table. Create a line graph for the data.

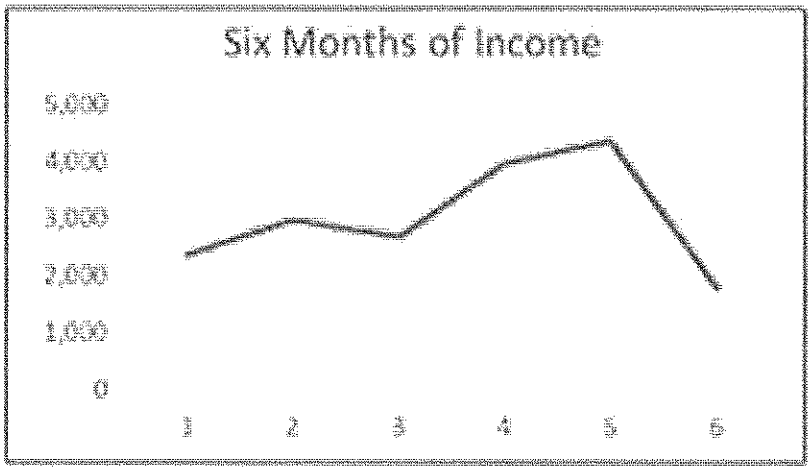
Year	2016	2017	2018	2019	2020	2021	2022
Profit ($)	12,000	18,000	25,000	38,000	40,000	39,000	52,000

KoolCatz Business Attire Profit



Mathias works at a job where he earns his income through commission based on sales. Create a line graph for his first six months on the job.

Month	1	2	3	4	5	6
Income	2,400	3,000	2,700	4,000	4,400	1,800



Determine which type of data display, a scatter plot or a line graph would be the most appropriate representation for each set of data. Explain your reasoning.

a. the weights and heights of giraffes at zoos across the country

b. the weight of a newborn baby over the first eight weeks of life

Determine which type of data display, a scatter plot or a line graph, would be the most appropriate representation for each set of data. Explain your reasoning.

a. the height of a sunflower over the first ten weeks after planting

b. the number of hours of screen time and the number of hours of sleep in 40 teenagers

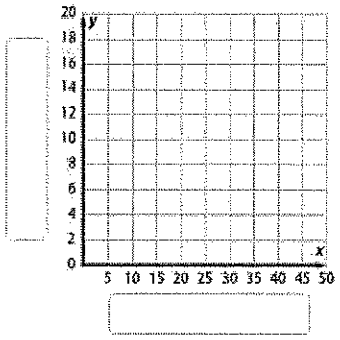
Extra Practice Questions:

Data with two variables are called _____data.

A scatter plot shows the _____between two sets of data.

A line plot/graph shows how data changes _____.

Weeks	Weight (pounds)
0	6
9	8.6
18	10
27	13.6
34	15
43	17.2
49	19.8



Is this data better represented by a scatter plot or line graph? Why?

Stock price	
Day	Price
Monday	$80
Tuesday	$90
Wednesday	$80
Thursday	$100

Students receiving scholarships	
Year	Students
2017	70
2018	30
2019	80
2020	20
2021	70

Bananas at Steve's house								
Time (days)	0	1	2	3	4	5	6	7
Bananas	10	8	7	6	5	4	2	0

Is this data better represented by a scatter plot or line graph? Why?

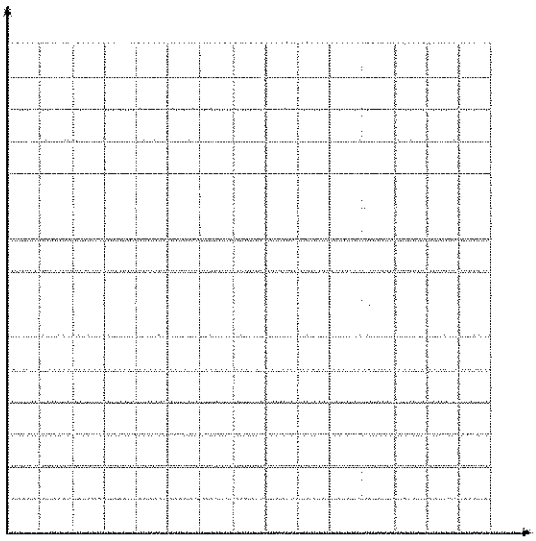
Lesson 2: Analyze Linear Associations

*Goal: Recognize whether the paired data have a **linear, nonlinear, or no association***
***Draw a trend line** to determine if association is positive, negative, strong, or weak*

Explain It!

Angus has a big test coming up. He decides to stay up and study.

Test #1 - went to bed at 9:15, got 80%
Test #2 - studied until 10:30, got 75%
Test #3 - studied until 11:00, got 72%
Test #4 - went to bed at 9:30, got 89%
Test #5 - studied until 10:45, got 84%
Test #6 - went to bed at 9:00, got 93%



Thinking and Reasoning

Communicate and Justify What other factors should Angus also take into consideration to make a decision? Defend your response.

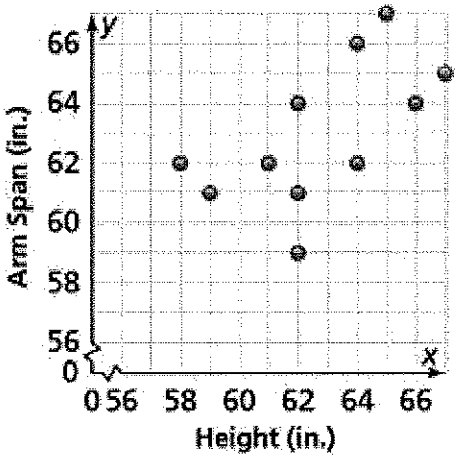
EXAMPLE 1 Linear Associations

Georgia and her classmates are measuring their height and arm span. They record their data in a table.

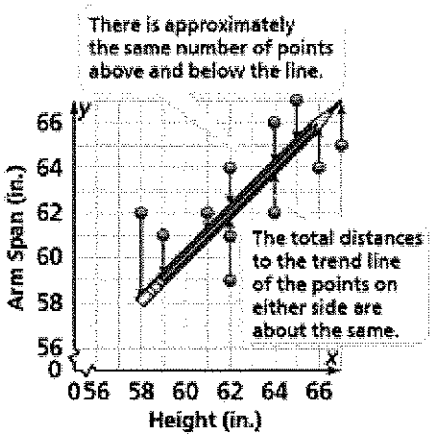
How can they determine what relationship, if any, exists between the two sets of measurements?

Student	1	2	3	4	5	6	7	8	9	10	11
Height (in.)	66	67	62	64	59	62	65	64	62	61	58
Arm Span (in.)	64	65	64	62	61	59	67	66	61	62	62

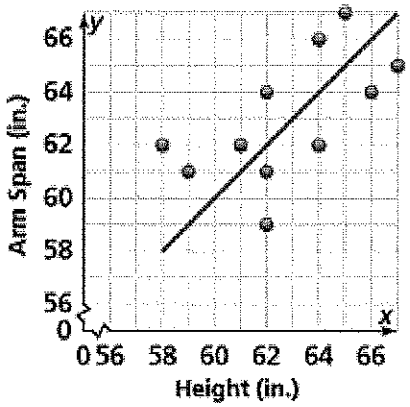
STEP 1 _____ points in a scatter plot.



STEP 2 Use a pencil to find a line that passes through the middle of the plotted points. This line is called a _____.

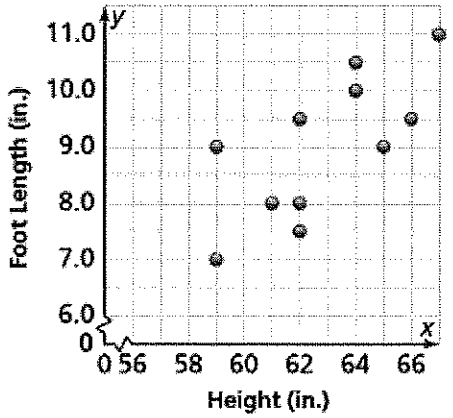


STEP 3 Look at the slope of the line. The slope is _____.



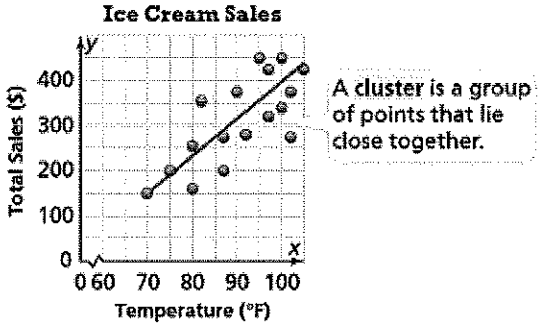
Georgia can draw a trend line on the scatter plot to determine that there is a _____ relationship between height and arm span.

Try It! Georgia and her classmates also measured their foot length. Use a pencil to find the trend line. Sketch the trend line for the scatter plot.



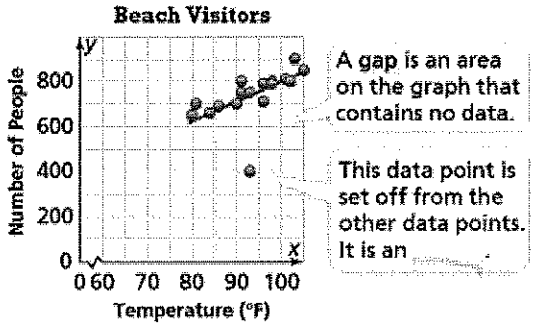
The Johanssens own an ice cream shop near the beach. They use scatter plots to compare their sales by daily high temperature to the number of beach-goers by daily high temperature. Describe the associations shown.

As the temperature increases, ice cream sales increase. The association is positive.



Some of the points are far from the trend line. This shows a _____ **association.**

As the temperature increases, the number of beachgoers also increases. The association is positive.

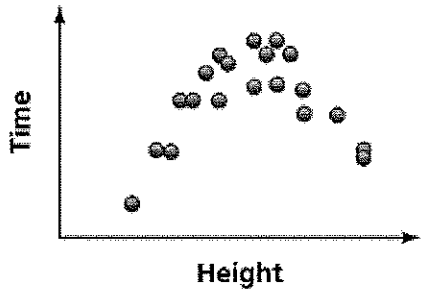


Nearly all of the points are close to the trend line. This shows a _____ **association.**

EXAMPLE 3 Recognize Nonlinear Associations

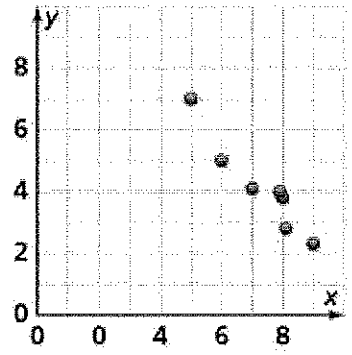
Does the scatter plot show a linear or nonlinear association?

The points in the scatter plot form a curve so the scatter plot shows a nonlinear association between the variables.

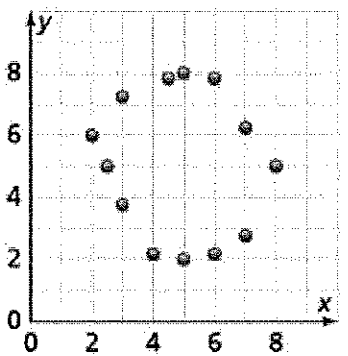


Try It! For each scatter plot, identify the association, if any, between the variables.

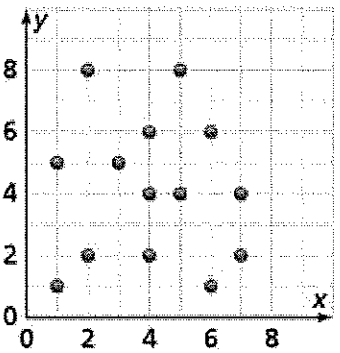
a.



b.

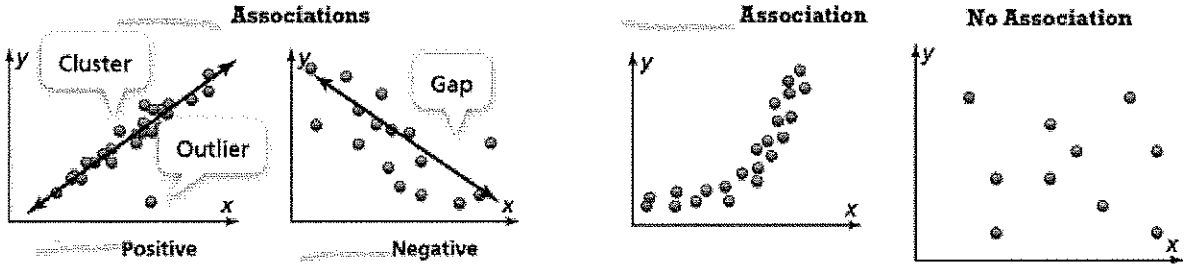


c.

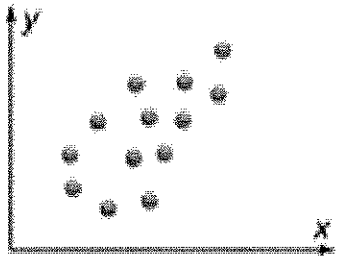


KEY CONCEPT

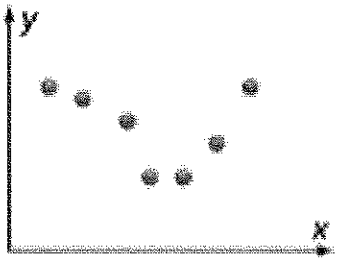
Scatter plots can show a linear association, a nonlinear association, or no association. For scatter plots that suggest a linear association, you can draw a trend line to show the association. You can assess the strength of the association by looking at the distances of plotted points from the trend line.



2. **Look for Relationships** How does a trend line describe the strength of the association?



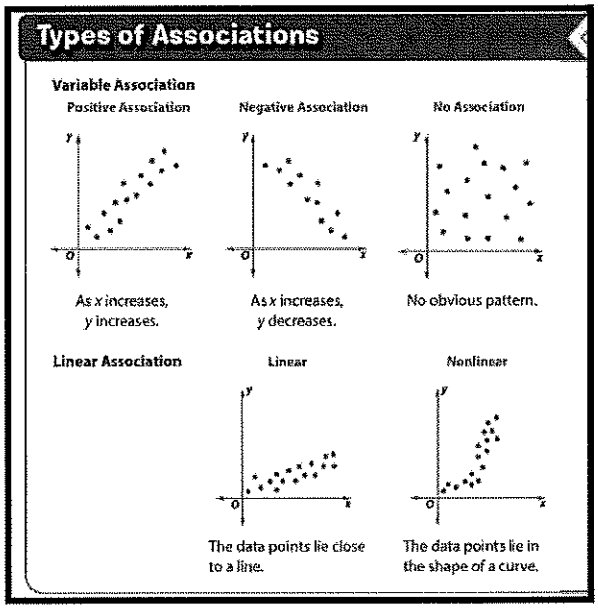
5. Describe the association between the two sets of data in the scatter plot.



Extra Practice Problems

After plotting points in a scatter plot, you can find the _____ or the

_____ through the middle of the points.



You can analyze the shape of a scatter plot to investigate patterns. If there is a

_____or _____ association, then it can be classified as

_____or _____.

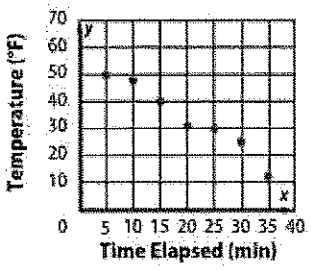
You can also see clusters, gaps, or outliers in a set of data.

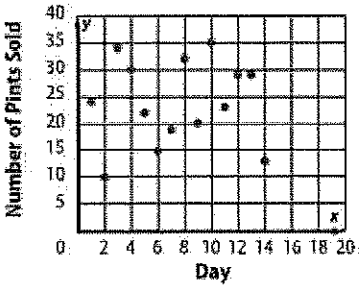
Cluster:

Gap:

Outlier:

Interpret the scatter plots below based on the shape of the distribution

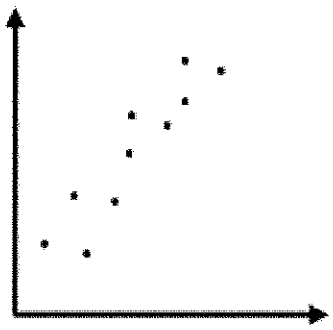


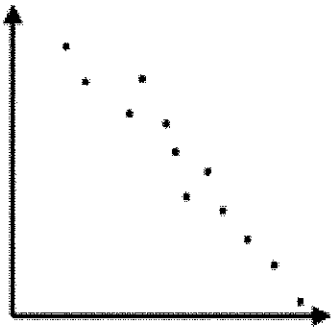


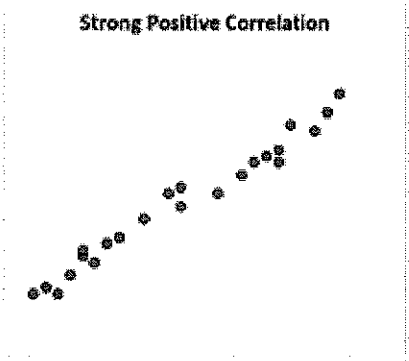
Lesson 3: Connect Linear Models

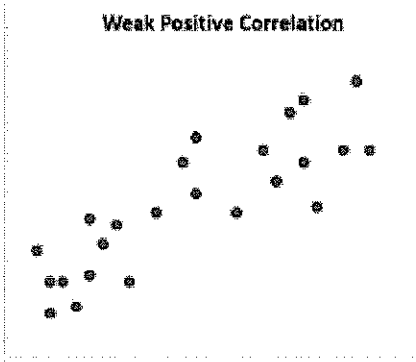
*Goal: Use the slope and y-intercept of a trend line to **write a linear equation** to represent the trend line*
***Use the line to describe** the relationship between variables*

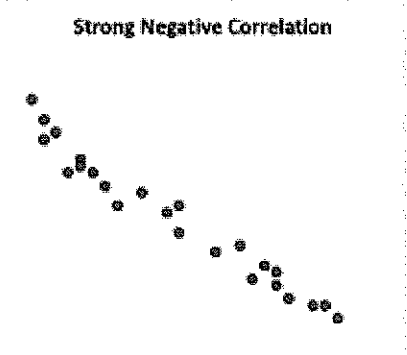
Practice drawing trend lines in the graphs below.

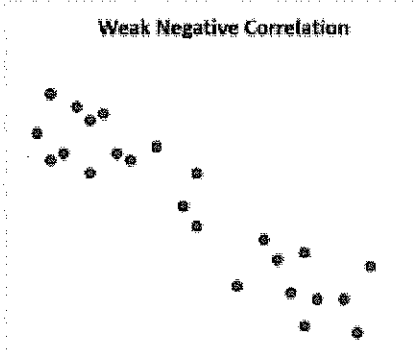


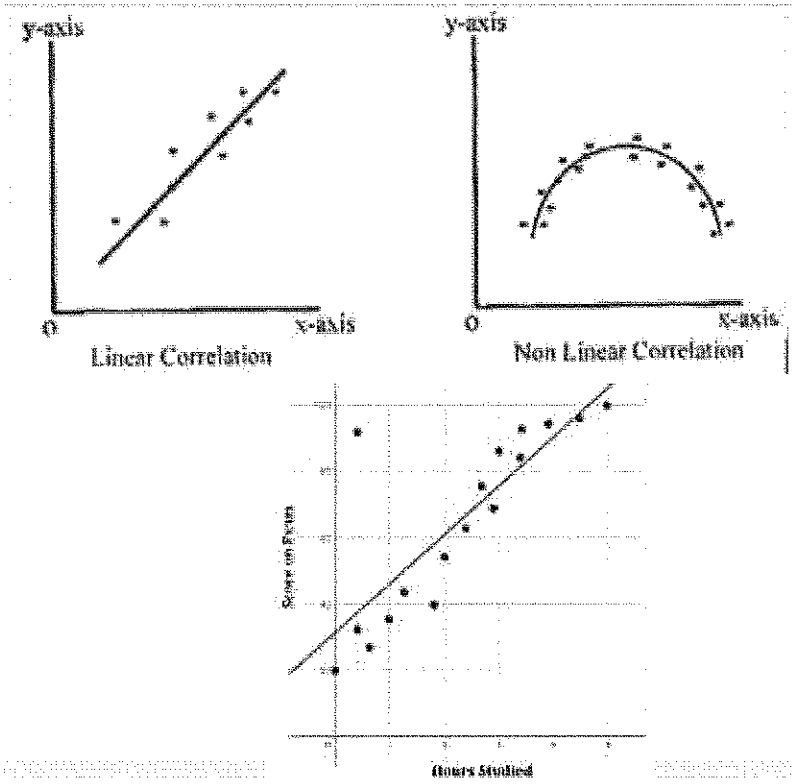








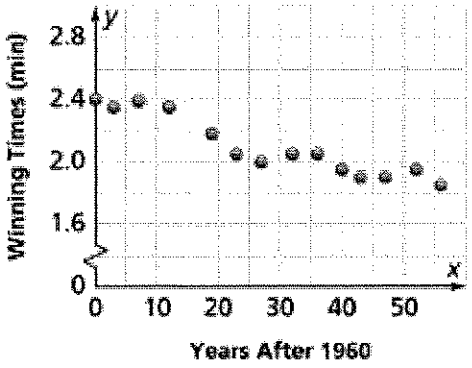




Topic 8

EXAMPLE 1 Represent a Scatter Plot with a Linear Equation

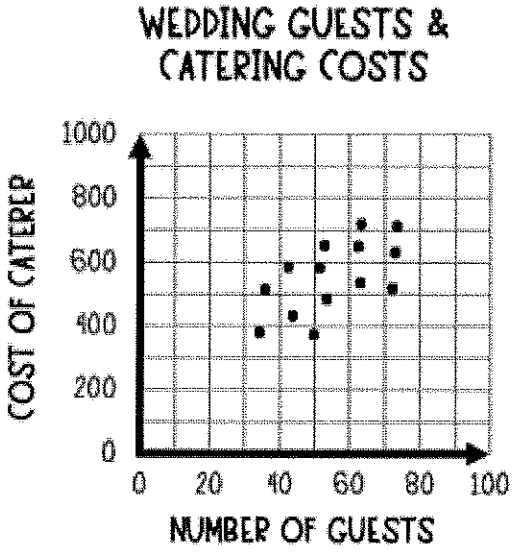
Michaela is a speed skater and hopes to compete in future Olympic games. She researched the winning times of the past 50 years. If the trend in faster speeds continues at the same rate, what equation can she use to predict future winning times?



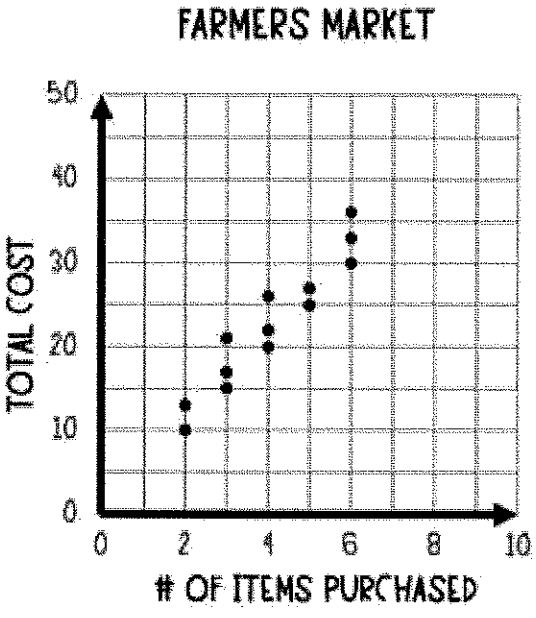
Use Patterns and Structure

What relationship might there be between the two measurements?

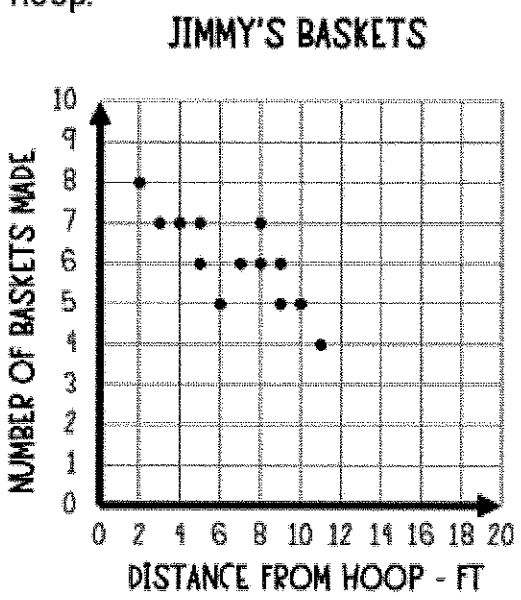
2. The graph shows the number of guests and the cost of catering for 14 weddings.



3. The graph below shows the number of items purchased and the total cost that 13 people spent at the farmers market.



4. The graph below shows the number of baskets Jimmy made when he was a certain amount of feet from the basketball hoop.



Mrs. Casias Math 2021

Extra Class Practice:

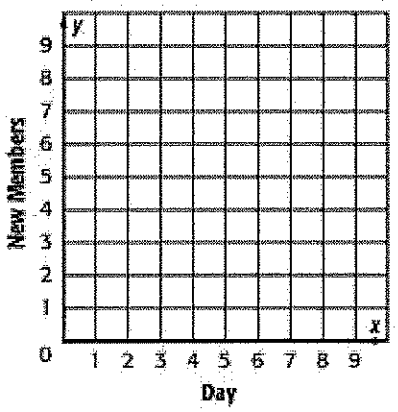
The line of best fit for a data set is _____.

1. Draw a line that fits the data (in the middle of the linear relationship)
2. Judge the closeness of the data points to the line, then you can use that line to make predictions about the data.
3. You can identify the slope of your line and the y-intercept to write the equation of the line (y=mx+b)

Exercises

1. **OUTDOOR CLUB** The table shows the number of new members to join the Outdoor Club.

Day	1	2	3	4	5	6
New Members	3	6	4	3	6	4

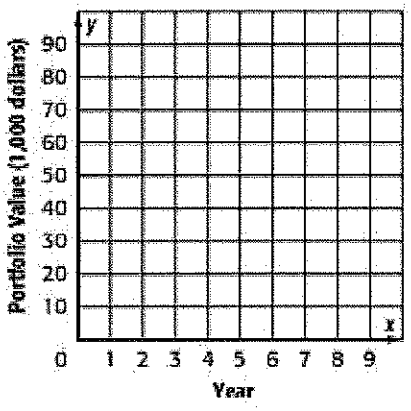


   a. Construct a scatter plot of the data. Then draw and assess a line that seems to best represent the data.

   b. Use the line of best fit to make a conjecture about the number of new members to join the club on the eighth day.

2. **PORTFOLIO** The table shows the value of Heather's portfolio, in thousands of dollars, at the end of each year.

Year	1	2	3	4	5	6
Value	90	70	80	60	80	60



   a. Construct a scatter plot of the data. Then draw and assess a line that seems to best represent the data.

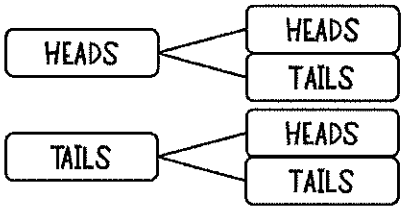
   b. Use the line of best fit to make a conjecture about the value of Heather's portfolio at the end of year 8.

SAMPLE SPACES
Guided Notes

ESSENTIAL QUESTION
What are sample spaces and how can they be represented?

SAMPLE SPACES & TREE DIAGRAMS

- A sample space lists all the possible _____ of an event.
  - ➢ Ex: The sample space of flipping a coin is _____.
- A _____ is a way to display a sample space & the total possible outcomes of more than one event happening.
  - ➢ Ex: A coin is flipped twice.



1. At Leander High school, students can take Spanish, Latin or French for a language credit and Choir, Theatre or Dance for a fine arts credit. What are the possible outcomes? How many total outcomes are possible?

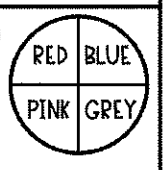
2. Tim is deciding what to have for breakfast. To drink he can have coffee or orange juice, and to eat he can have a bagel, cereal, or yogurt. Create a tree diagram & list all the possible outcomes.

3. Joe is shopping for a car. It comes in red, blue, or silver. He can choose between a two-door or 4-door version, and a manual or automatic transmission. Create a tree diagram to show the sample space & determine how many total outcomes are possible.

4. A two-sided coin is flipped three times. Create a tree diagram to show the sample space.

5. An ice cream shop sells vanilla, chocolate, and cookies & cream ice cream. Customers can choose from a waffle or sugar cone and either hot fudge or caramel topping. Create a tree diagram to show the sample space.

6. James rolls a standard 6-sided die. If he rolls a 3 or less, then he flips a coin. If he rolls a 4 or more, then he spins the spinner shown. Create a tree diagram to show the sample space.



Lesson 4: Determine Outcomes of Repeated Experiments

*Goal: Determine **all possible outcomes** of experiments*
***Record sample spaces** using tables, tree diagrams or lists*

Extra Problems for Class Practice:

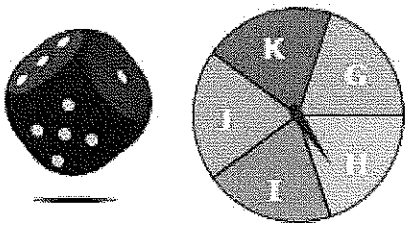
_____: the chance that some event will occur

Repeated experiment:

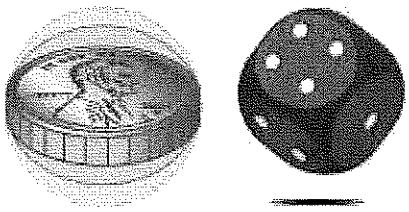
An outcome is the _____

The _____ shows all of the possible outcomes.

You roll a die and spin this spinner, how many possible outcomes are there?



You flip a coin and roll the die. How many outcomes are possible?



Lesson 5: Use Theoretical Probability to Make Predictions

*Goal: Find and use **theoretical probability** to solve real world problems related to experiments*

Find a Sample Space

The set of all of the possible outcomes in a probability experiment is called the **sample space**. Organized lists, tables, and **tree diagrams** can be used to represent the sample space.

Examples

1. The three students chosen to represent Mr. Balderick's class in a school assembly are shown. All three of them need to sit in a row on the stage. Use a list to find the sample space for the different ways they can sit in a row.

Students
Adrienne
Carlos
Greg

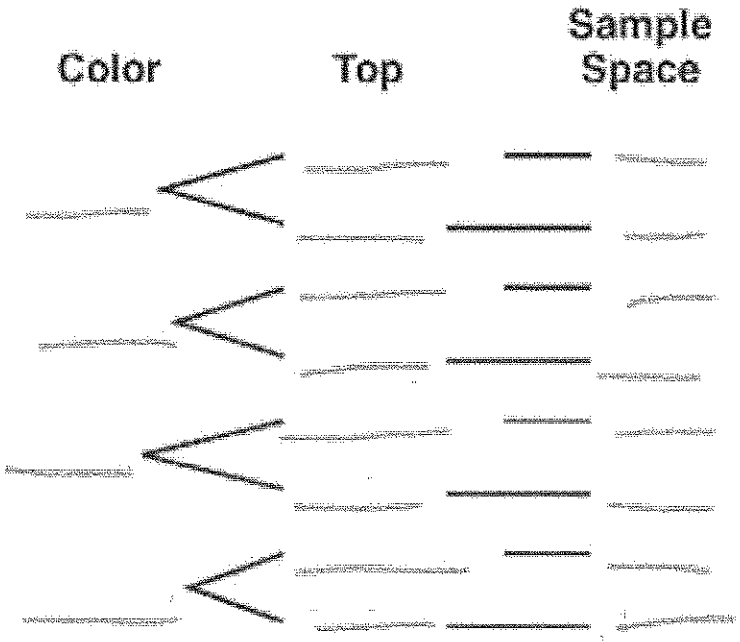
Use A for Adrienne, C for Carlos, and G for Greg. Use each letter exactly once.

ACG AGC CAG CGA GAC GCA

So, the sample space consists of __outcomes.

2. **A car can be purchased in blue, silver, red, or purple. It also comes as a convertible or hardtop. Use a table or a tree diagram to find the sample space for the different styles in which the car can be purchased.**

Color	Top
blue	convertible
blue	hardtop
silver	convertible
silver	hardtop
red	convertible
red	hardtop
purple	convertible
purple	hardtop



Using either method, the sample space consists of 8 outcomes.

Got It? **Do this problem to find out.**

a. The table shows the sandwich choices for a picnic. Find the sample space using a list, table, or tree diagram for a sandwich consisting of one type of meat and one type of bread.

Meat	Bread
ham turkey	rye sourdough white

Find Probability

A **compound event** consists of two or more simple events. The probability of a compound event, just as with simple events, is the fraction of outcomes in the sample space for which the compound event occurs.

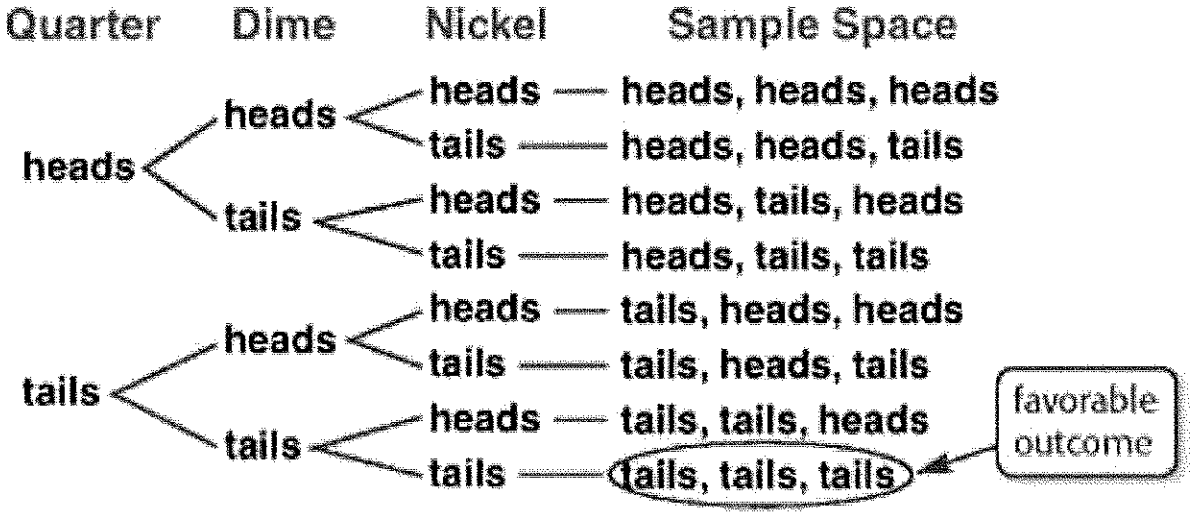
Example

Tools Tutor

3. Suppose you toss a quarter, a dime, and a nickel. Find the sample space. What is the probability of getting three tails?

Make a tree diagram to show the sample space.

Make a tree diagram to show the sample space.



$P(3 \text{ tails}) = \frac{\text{number of } \_\_\_\_ \text{ outcomes}}{\text{number of } \_\_\_\_ \text{ outcomes}}$

Now, let's take 1/8 and turn it into a fraction. Remember, every fraction is a division problem, so divide 1 by 8 in your calculator to get your answer. Type it here.

Type your answer...

Now, take that decimal in your calculator and turn it into a percent. You do that by moving the decimal 2 places to the RIGHT and adding a "%" of the end. Enter you answer here.

b. The animal shelter has both male and female Labrador Retrievers in yellow, brown, or black. There is an equal number of each kind. What is the probability of choosing a female yellow Labrador Retriever? Show your work in the space below.

4. To win a carnival prize, you need to choose one of 3 doors labeled 1 through 3. Then you need to choose a red, yellow, or blue box behind each door. What is the probability that the prize is in the blue or yellow box behind door 2?

Outcomes	
door 1	red box
door 1	yellow box
door 1	blue box
door 2	red box
door 2	yellow box
door 2	blue box
door 3	red box
door 3	yellow box
door 3	blue box

The table shows that there are 9 total outcomes. Two of the outcomes are favorable.

So, the probability that the prize is in a blue or yellow box behind door 2 is —.

Now, take that fraction 2/9 and turn it into a decimal and round your answer to the nearest thousandths place. Remember, that every fraction is a division problem, so divide 2 by 9 on your calculator.

Type your answer...

Now, take that decimal and turn it into a percent. You will move the decimal 2 spaces to the RIGHT and add a "%" sign.

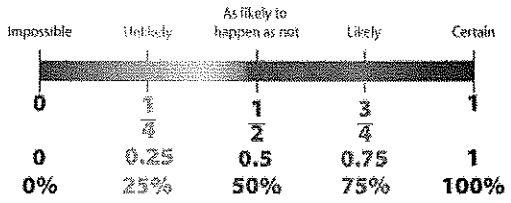
Extra Problems for Class Practice:

The probability of an event is written as a ratio showing the # of favorable outcomes over the # of possible outcomes.

$$P_{(event)} = \frac{\text{\# of favorable outcomes}}{\text{\# of possible outcomes}}$$

* Can be written as a _____, _____, or _____

Theoretical Probability is based on _____ during an experiment



Find the Probability of a coin landing on tails

Find the probability of rolling even on a die

Yesterday a bakery had 50 customers and 11 bought cinnamon rolls. Based on those results, if they expect 100 customers today, how many cinnamon rolls should they bake?

Find the Probability of a compound event ** It consists of 2 or more simple events**

- Make a Tree Diagram to show all possible outcomes.
- Use the Tree Diagram to compare favorable to possible outcomes.

Suppose you flip a Quarter, Dime and Nickel. What is the probability of getting 3 tails?

Q **D** **N**