

Section 7.1 – Mean and Mode

What is a Measure of Central Tendency?

- ✎ A number used to describe the center of a set of data.
- ✎ Measures of central tendency tend to fall in the middle of a group of numbers.
- ✎ Three measures of central tendency:

- 1. Mean**
- 2. Mode**
- 3. Median**

What is the Mean?

The **mean** is what we commonly refer to as the **average**, and often used to assign student grades.

To find the mean, find the sum of all the numbers in a set of data and divide by the number of items.

Example 1:

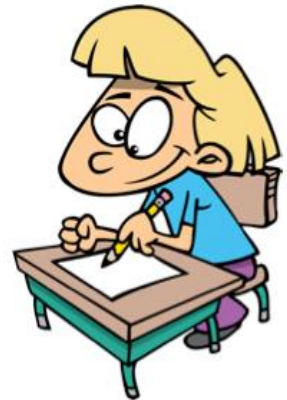
Five students received the following scores on their first math test:

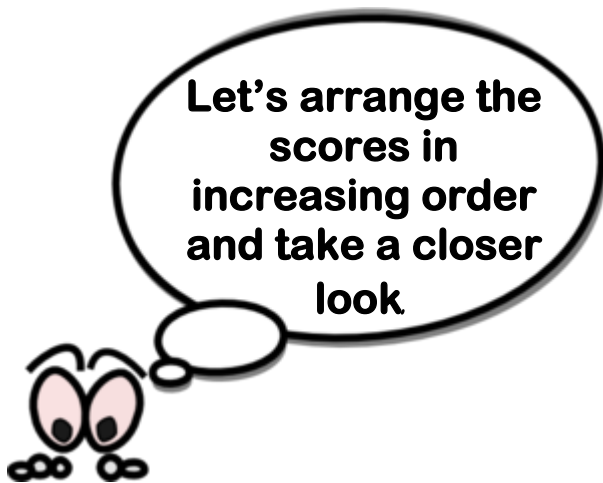
83%, 72%, 95%, 80%, 75%

What is the mean test score?

Step 1: Add all the scores together.

Step 2: Divide your answer by the number of scores. This is the average.





72% 75% 80% 83% 95%



a mean score of 81% tends to fall around the center of this set of numbers.

Example 2:

Four houses in the same subdivision sold for the following amounts:

House 1: \$369,000

House 2: \$425,500

House 3: \$449,000

House 4: \$389,900



What was the mean house price?

What is the Mode?

The **mode** of a set of data is the number that **occurs most often**.

A data set may have no mode, one mode or several modes.

Example 1:

Between January and March, school was cancelled seven times due to weather. The following data gives the number of days each storm lasted: 1, 4, 3, 3, 5, 2 and 3.

What is the **mode**? (What number occurs the most?) _____

What is the **mean**?

Example 2:

The number of people at the Bowering Park pool during different days are listed below.

101	76	88	88	95
80	88	74	71	

a) What is the mode?

b) What is the mean number of people?



Example 3:

The number of people who attended a Star Wars convention in May is recorded below. What is the mode?

S	M	T	W	T	F	S
55	34	35	48	62	78	106

**Example 4:**

Points scored by a Middle School Football team are listed. Find the mode.

21 35 14 17 28 14 7 21



Section 7.2 – Median and Range

What is Median?

Like the middle of the road, the **median** is the **middle number** when the data is **arranged in order** from least to greatest or vice versa.



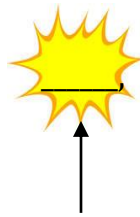
There are two cases we have to consider when looking for the median.

Case 1: Odd Number of Data Values

When there is an odd number of data values in a set, we can easily find the median.

For example: 6, 2, 8, 15, 12

First we must arrange in order: _____, _____, _____, _____, _____



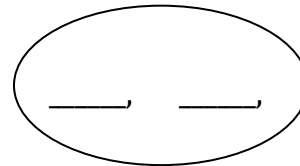
This is the middle number, therefore the median is _____.

Case 2: Even Number of Data Values

When there is an even number in the set, there will be two middle numbers. To find the median in this case, we have to find the mean of those two numbers.

For example: 65, 50, 80, 45, 90, 75

Arrange the values in order! _____, _____, _____, _____, _____, _____



There are two middle numbers so we need to find the mean of these two numbers – the answer is the median.

Example 1:

Find the median of each set of numbers.

a) 17 yd, 20 yd, 15 yd, 20 yd, 11 yd, 7 yd

b) 46, 53, 33, 53, 79

c) 20, 24, 20, 26, 24, 24, 26, 24, 29, 26, 21

Example 2:

Find the mean, median and mode of the following data set.

29, 14, 80, 59, 78, 30, 59, 69, 55, 50

Mean:

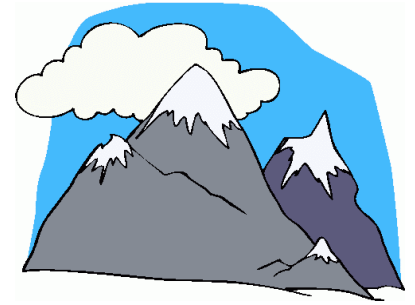
Median:

Mode: _____

What is Range?

The **range** is calculated by **subtracting the smallest value from the greatest value.**

Range is NOT a measure of central tendency – it shows the **spread of the data.**

**Example 1:**

Find the range.

a) 3, 12, 10, 9, 14

b) 50, 36, 44, 22, 19, 54, 59

Section 7.3 – The Effects of Outliers

What is an Outlier?

An outlier is a number in a set of data that differs significantly from the rest or “doesn’t fit in”.

For example:

Here are the math test scores in Mr. Stanford’s class:

97% 70% 66% 80% 98% 82% 64% 43% 70%

- a) Find the mean, median and mode of the test scores.

Mean:

Median:

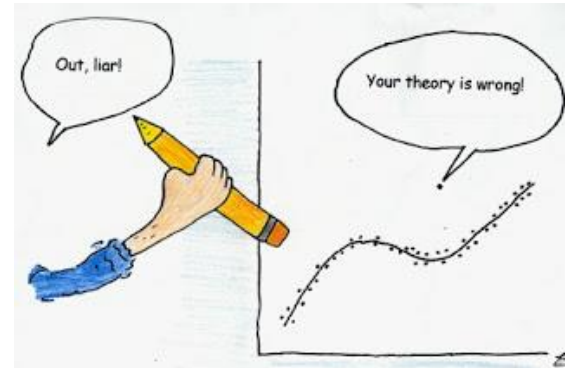
Mode: _____

- b) One student forgot they had a test and received 25%. Find the new mean, median and mode.

Mean:

Median:

Mode: _____



c) Would you consider 25% to be an outlier? Explain.

d) Which measure of central tendency was most affected by the outlier?

Sometimes the mean is not the best representation of the data if there is an outlier.

Outliers often exist due to personal errors. We should consider them, but ultimately they should be ignored.



Does an outlier affect the range?

Remember, range is how spread out the data is not a measure of central tendency.

Example:

Below are the commission earnings for the employees of *Cars To Go* during the month of December:

\$1120	\$1380	\$1250	\$120	\$1920
\$3500	\$1250	\$1500	\$1790	\$1860

- a) Does this data set contain any outliers? How can you tell?
- b) Suggest a reason for the outlier. Should the outliers be included when reporting the average commission earned? Why or why not?
- c) Calculate the mean, median and mode for these commissions.
- d) Which measure(s) of central tendency would you use to represent the average commission? Why?

Section 7.4 – Applications of Averages

As we saw in the previous section, it will sometimes make more sense to use one measure of central tendency over another to represent a set of data.

MEAN

- Use when data has no outliers

MEDIAN

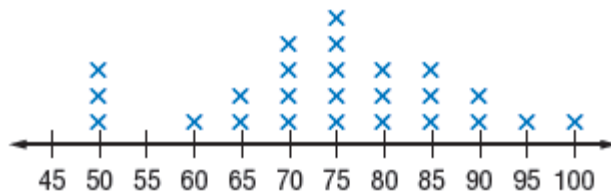
- Use when data has outliers & no big gaps in the middle of data.
- For example, when a student normally performs well but had one failure

MODE

- Use when data has many identical numbers, like shoe or clothing sizes.

Example 1:

The line plot below shows the price of athletic shoes.

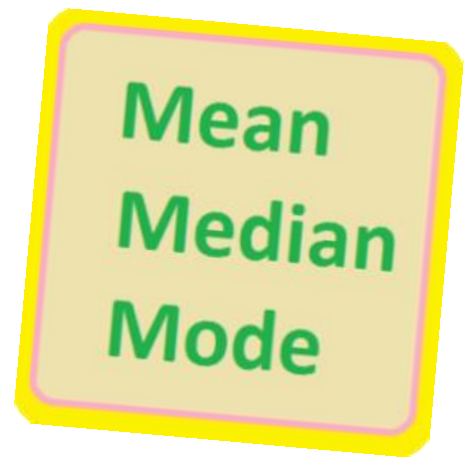


Which measure would best describe the data? Why?

Example 2:

State the measure of central tendency that would best describe each situation.

1. The most popular hockey team.
2. These test scores: 31, 95, 97, 84, 82, 78
3. The most popular baseball cap size.
4. The mass of a five year old.
5. Typical cost of a video game.
6. Temperature in St. John's

**Example 3:**

During the week, the daily low temperatures were 9°C , 7°C , 12°C , 7°C and 14°C . If Saturday's low temperature of 13°C is added, which statement about the data would be true?

- a) The mean would decrease.
- b) The median would decrease.
- c) The mode would increase.
- d) The mode would decrease.

Example 4:

Sarah has these marks on her Science tests: 82%, 75%, 81% and 92%.

What mark will she need to get on her next test if she wants an average of 85%?



Section 7.5 – Different Ways to Express Probability

What is Probability?

Probability is the likelihood that something will happen.

It is most often expressed as a fraction and is defined by:

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

An outcome is the possible result of an experiment.

Let's consider a coin toss.

What is the probability that the coin will land on tails?

There is/are _____ tail(s) on a coin and _____ total outcomes.

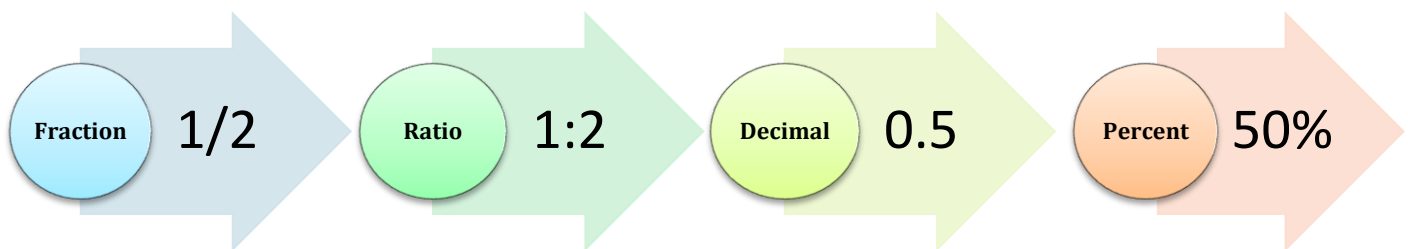
favorable *possible*



We write:

$$P(\text{tails}) = \frac{(\# \text{ of favorable})}{(\text{total } \# \text{ possible})} \text{ or } \text{ — }$$

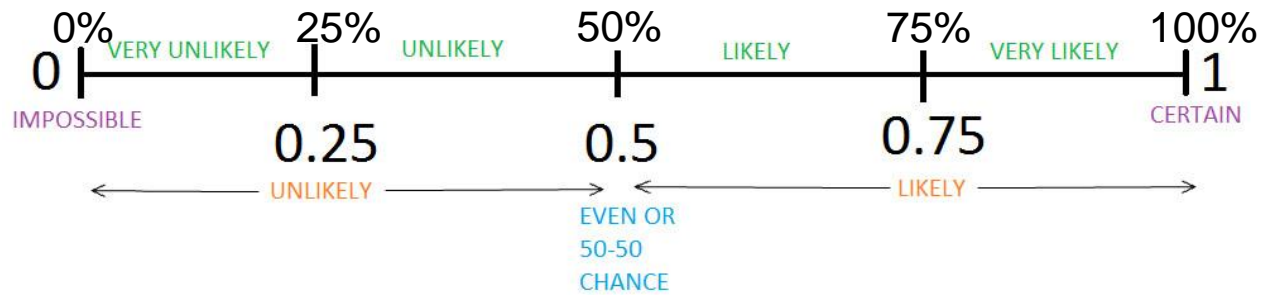
Probability can similarly be expressed as a ratio or written as a decimal or a percent.



Probability can vary between 0 and 1. A zero probability means the event **will definitely not** occur – it is **impossible**. It has a 0% chance of happening.

A probability of 1 means the event **will definitely** occur – it is **certain**. It has 100% chance of happening.

We can use a scale like the one below:



Example 1:

1. State the probability of each event:

- a) All rivers will dry up next week.
- b) A coin will land heads up when tossed.
- c) You will eat some food today.
- d) The sun will set tomorrow.
- e) A cat will give birth to a rhinoceros.
- f) It will snow in the Sahara.
- g) The next baby born will be a boy.
- h) It will rain in Newfoundland tomorrow.

Example 2:

Write each answer as a fraction, ratio, decimal and percent.

1. A bag contains 100 Starburst candy – 60 Strawberry, 25 Lemon, 10 Cherry and 5 Orange.



Find the probability of each.

- a) P (Strawberry)

<u>Fraction</u>	<u>Ratio</u>	<u>Decimal</u>	<u>Percent</u>
	↔	↔	↔

- b) P (cheese)

<u>Fraction</u>	<u>Ratio</u>	<u>Decimal</u>	<u>Percent</u>
	↔	↔	↔

- c) P (Lime)

This is an **impossible event**. It cannot happen.

- d) P (Strawberry, Cherry, Lemon, Orange)

This is **certain** to happen since there are no other options in the bag.

Example 2:

20 cookies were placed in a cookie jar – 2 Chocolate Chip, 5 Oreo, 6 Oatmeal, 3 Macaroons and 4 Double Chocolate.

Find the probability of each:



a) P (Chocolate Chip)

<u>Fraction</u>	↔	<u>Ratio</u>	↔	<u>Decimal</u>	↔	<u>Percent</u>

b) P (Rainbow Chip)

<u>Fraction</u>	↔	<u>Ratio</u>	↔	<u>Decimal</u>	↔	<u>Percent</u>

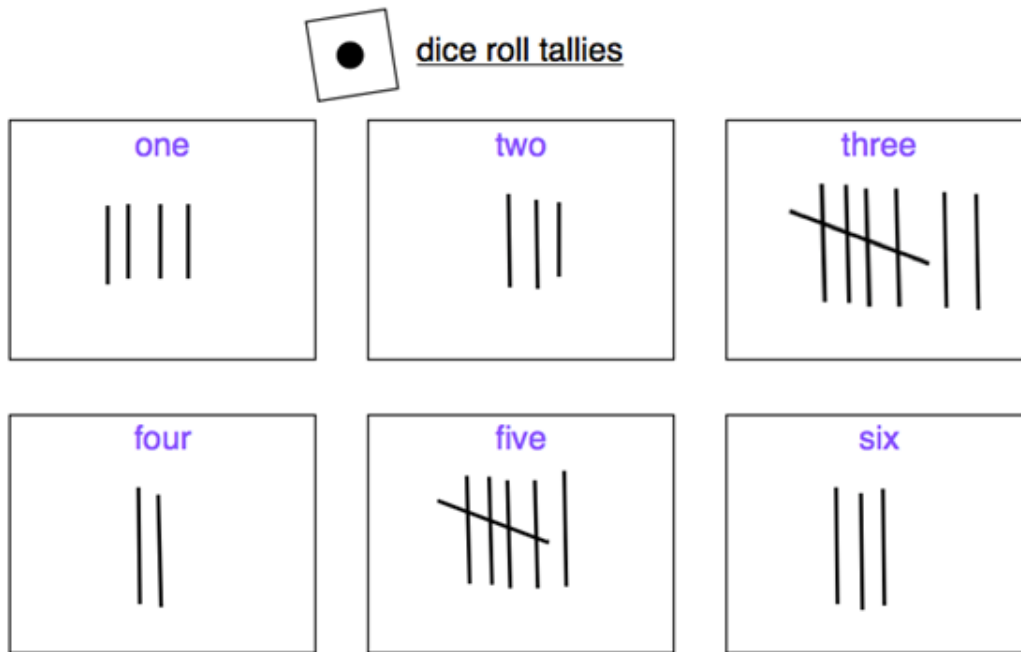
c) P (Macaroon or Double Chocolate)

<u>Fraction</u>	↔	<u>Ratio</u>	↔	<u>Decimal</u>	↔	<u>Percent</u>

d) P (Cookie)

Example 3:

Max rolled a die 25 times.



We can see that the probability of Max rolling a 5 is

$$P(5) = \frac{6}{25} \quad \text{or} \quad 24\%$$

This is called **experimental probability** since the probability is based on a actual experiment.

In theory, we would expect Max to roll a five 1 out of every 6 times, which would be $\frac{1}{6}$ or 16.7% .

This is called **theoretical probability**. It is what we would expect to happen without actually conducting an experiment.

Based on Max's results, find each probability. Express your answer as a fraction, ratio and percent.

a) $P(2)$

b) $P(6)$

c) $P(\text{an even number})$

d) $P(\text{a number greater than 1})$

e) What is the theoretical probability of rolling a 4?

Section 7.6 – Tree Diagrams

What is an Independent Event?

An event is independent if its result is not affected by the outcome of another event.

For example, let's consider tossing a coin and rolling a die. The outcome on the die will not be affected by the fact that we tossed heads or tails on the coin.

We can draw a **tree diagram** to determine the total number of outcomes. When we list all the possible combinations, this is called the sample space.

Coin

Dice

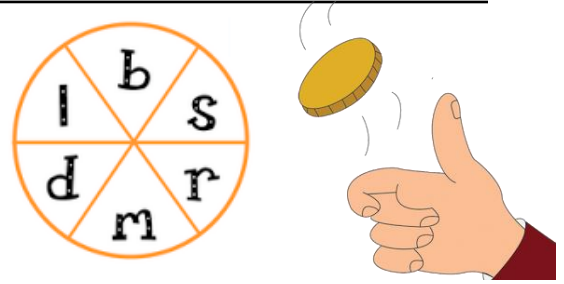
Outcomes



This is the **sample space**.

Example 1:

A coin is tossed and a spinner is spun.



Draw a tree diagram to list all the possible outcomes.

Coin 1**Spinner****Outcomes**

$P(\text{d, Tails}) =$

$P(\text{s or r, Heads}) =$

What is the sample space for spinning the colored spinner twice?

First Spin**Second Spin****Outcomes**

$P(\text{same letter}) =$

$P(\text{different letters}) =$

Example 2:

Three dogs need new collars.

There are three different colored collars: Red, Blue and Green



How many different combinations can be made?
Draw a tree diagram to show all the possibilities.

Dog**Collar****Outcomes**

<u>Dog</u>	<u>Collar</u>	<u>Outcomes</u>