

**Activities/
Resources
for
Unit V:
Proportions, Ratios,
Probability, Mean and
Median**

What is a Ratio?

A ratio is a comparison of two numbers. We generally separate the two numbers in the ratio with a colon (:). Suppose we want to write the ratio of 8 and 12. We can write this as 8:12 or as a fraction $\frac{8}{12}$, and we say the ratio is *eight to twelve*.

Examples:

Jeannine has a bag with 3 videocassettes, 4 marbles, 7 books, and 1 orange.

1) What is the ratio of books to marbles?

Expressed as a fraction, with the numerator equal to the first quantity and the denominator equal to the second, the answer would be $\frac{7}{4}$.

Two other ways of writing the ratio are 7 to 4, and 7:4.

2) What is the ratio of videocassettes to the total number of items in the bag?

There are 3 videocassettes, and $3 + 4 + 7 + 1 = 15$ items total.

The answer can be expressed as $\frac{3}{15}$, 3 to 15, or 3:15.

Comparing Ratios

To compare ratios, write them as fractions. The ratios are equal if they are equal when written as fractions.

Example:

Are the ratios 3 to 4 and 6:8 equal?

The ratios are equal if $\frac{3}{4} = \frac{6}{8}$.

These are equal if their cross products are equal; that is, if $3 \times 8 = 4 \times 6$. Since both of these products equal 24, the answer is yes, the ratios are equal.

Remember to be careful! Order matters!

A ratio of 1:7 is not the same as a ratio of 7:1.

Examples:

Are the ratios 7:1 and 4:81 equal? No!

$\frac{7}{1} > 1$, but $\frac{4}{81} < 1$, so the ratios can't be equal.

Are 7:14 and 36:72 equal?

Notice that $\frac{7}{14}$ and $\frac{36}{72}$ are both equal to $\frac{1}{2}$, so the two ratios are equal.

What is a Proportion?

A proportion is an equation with a ratio on each side. It is a statement that two ratios are equal.

$\frac{3}{4} = \frac{6}{8}$ is an example of a proportion.

When one of the four numbers in a proportion is unknown, cross products may be used to find the unknown number. This is called solving the proportion. Question marks or letters are frequently used in place of the unknown number.

Example:

Solve for n : $\frac{1}{2} = \frac{n}{4}$.

Using cross products we see that $2 \times n = 1 \times 4 = 4$, so $2 \times n = 4$. Dividing both sides by 2, $n = 4 \div 2$ so that $n = 2$.

Proportions

For each proportion, find the unknown number n .

$$1) \frac{n}{24} = \frac{5}{8}$$

$$2) \frac{2}{n} = \frac{5}{25}$$

$$3) \frac{4}{7} = \frac{8}{n}$$

$$4) \frac{n}{24} = \frac{5}{6}$$

$$5) \frac{n}{3} = \frac{7}{12}$$

$$6) \frac{11}{6} = \frac{33}{n}$$

$$7) \frac{3}{5} = \frac{n}{7}$$

$$8) \frac{8}{n} = \frac{5}{2}$$

$$9) \frac{\frac{1}{3}}{\frac{1}{6}} = \frac{n}{12}$$

$$10) \frac{1.5}{25} = \frac{0.3}{n}$$

$$11) \frac{n}{24} = \frac{3}{8}$$

$$12) \frac{2}{n} = \frac{9}{27}$$

$$13) \frac{3\frac{1}{2}}{7} = \frac{5}{n}$$

$$14) \frac{n}{2.4} = \frac{1.5}{6}$$

$$15) \frac{n}{3} = \frac{5}{12}$$

$$16) \frac{5.2}{6} = \frac{1.3}{n}$$

$$17) \frac{\frac{2}{3}}{\frac{1}{4}} = \frac{n}{\frac{5}{8}}$$

$$18) \frac{0.6}{n} = \frac{5}{\frac{1}{2}}$$

$$19) \frac{\frac{1}{3}}{\frac{1}{6}} = \frac{n}{0.09}$$

$$20) \frac{4\frac{1}{2}}{25} = \frac{3\frac{3}{8}}{n}$$

Answers

1) $n = 15$

2) $n = 10$

3) $n = 14$

4) $n = 20$

5) $n = \frac{7}{4}$

6) $n = 18$

7) $n = \frac{21}{5}$

8) $n = \frac{16}{5}$

9) $n = 24$

10) $n = 5$

11) $n = 9$

12) $n = 6$

13) $n = 10$

14) $n = 0.6$

15) $n = 1.25$ or $\frac{5}{4}$

16) $n = 1.5$

17) $n = \frac{5}{3}$

18) $n = 0.06$ or $\frac{3}{50}$

19) $n = 0.18$

20) $n = 18.75$ or $\frac{75}{4}$

Probability

Problem: A spinner has 4 equal sectors colored yellow, blue, green and red. What are the chances of landing on blue after spinning the spinner? What are the chances of landing on red?



Solution: The chances of landing on blue are 1 in 4, or one fourth.

The chances of landing on red are 1 in 4, or one fourth.

This problem asked us to find some probabilities involving a spinner. Let's look at some definitions and examples from the problem above.

Definition	Example
An experiment is a situation involving chance or probability that leads to results called outcomes.	In the problem above, the experiment is spinning the spinner.
An outcome is the result of a single trial of an experiment.	The possible outcomes are landing on yellow, blue, green or red.
An event is one or more outcomes of an experiment.	One event of this experiment is landing on blue.
Probability is the measure of how likely an event is.	The probability of landing on blue is one fourth.

In order to measure probabilities, mathematicians have devised the following formula for finding the probability of an event.

Probability Of An Event
$P(A) = \frac{\text{The Number Of Ways Event A Can Occur}}{\text{The total number Of Possible Outcomes}}$

The probability of event A is the number of ways event A can occur divided by the total number of possible outcomes. Let's take a look at a slight modification of the problem from the top of the page.

Experiment 1: A spinner has 4 equal sectors colored yellow, blue, green and red. After spinning the spinner, what is the probability of landing on each color?



Outcomes: The possible outcomes of this experiment are

yellow, blue, green, and red.

Probabilities: $P(\text{yellow}) = \frac{\text{\# of ways to land on yellow}}{\text{total \# of colors}} = \frac{1}{4}$

$$P(\text{blue}) = \frac{\text{\# of ways to land on blue}}{\text{total \# of colors}} = \frac{1}{4}$$

$$P(\text{green}) = \frac{\text{\# of ways to land on green}}{\text{total \# of colors}} = \frac{1}{4}$$

$$P(\text{red}) = \frac{\text{\# of ways to land on red}}{\text{total \# of colors}} = \frac{1}{4}$$

Experiment 2: A single 6-sided die is rolled. What is the probability of each outcome? What is the probability of rolling an even number? of rolling an odd number?



Outcomes: The possible outcomes of this experiment are 1, 2, 3, 4, 5 and 6.

Probabilities: $P(1) = \frac{\text{\# of ways to roll a 1}}{\text{total \# of sides}} = \frac{1}{6}$

$$P(2) = \frac{\text{\# of ways to roll a 2}}{\text{total \# of sides}} = \frac{1}{6}$$

$$P(3) = \frac{\text{\# of ways to roll a 3}}{\text{total \# of sides}} = \frac{1}{6}$$

$$P(4) = \frac{\text{\# of ways to roll a 4}}{\text{total \# of sides}} = \frac{1}{6}$$

$$P(5) = \frac{\text{\# of ways to roll a 5}}{\text{total \# of sides}} = \frac{1}{6}$$

$$P(6) = \frac{\text{\# of ways to roll a 6}}{\text{total \# of sides}} = \frac{1}{6}$$

$$P(\text{even}) = \frac{\text{\# ways to roll an even number}}{\text{total \# of sides}} = \frac{3}{6} = \frac{1}{2}$$

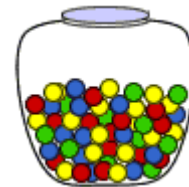
$$P(\text{odd}) = \frac{\text{\# ways to roll an odd number}}{\text{total \# of sides}} = \frac{3}{6} = \frac{1}{2}$$

Experiment 2 illustrates the difference between an outcome and an event. A single outcome of this experiment is rolling a 1, or rolling a 2, or rolling a 3, etc. Rolling an

even number (2, 4 or 6) is an event, and rolling an odd number (1, 3 or 5) is also an event.

In Experiment 1 the probability of each outcome is always the same. The probability of landing on each color of the spinner is always one fourth. In Experiment 2, the probability of rolling each number on the die is always one sixth. In both of these experiments, the outcomes are equally likely to occur. Let's look at an experiment in which the outcomes are not equally likely.

Experiment 3: A glass jar contains 6 red, 5 green, 8 blue and 3 yellow marbles. If a single marble is chosen at random from the jar, what is the probability of choosing a red marble? a green marble? a blue marble? a yellow marble?



Outcomes: The possible outcomes of this experiment are red, green, blue and yellow.

Probabilities:
$$P(\text{red}) = \frac{\# \text{ of ways to choose red}}{\text{total \# of marbles}} = \frac{6}{22} = \frac{3}{11}$$

$$P(\text{green}) = \frac{\# \text{ of ways to choose green}}{\text{total \# of marbles}} = \frac{5}{22}$$

$$P(\text{blue}) = \frac{\# \text{ of ways to choose blue}}{\text{total \# of marbles}} = \frac{8}{22} = \frac{4}{11}$$

$$P(\text{yellow}) = \frac{\# \text{ of ways to choose yellow}}{\text{total \# of marbles}} = \frac{3}{22}$$

The outcomes in this experiment are not equally likely to occur. You are more likely to choose a blue marble than any other color. You are least likely to choose a yellow marble.

Summary: The probability of an event is the measure of the chance that the event will occur as a result of an experiment. The probability of an event A is the number of ways event A can occur divided by the total number of possible outcomes. The probability of an event A, symbolized by $P(A)$, is a number between 0 and 1, inclusive, that measures the likelihood of an event in the following way:

- If $P(A) > P(B)$ then event A is more likely to occur than event B.
- If $P(A) = P(B)$ then events A and B are equally likely to occur.

Mean, Mode, and Median

Mean, median, and mode are three different kinds of averages.

Mean: The mean of a collection of numbers is their arithmetic average, computed by adding them up and dividing by their number.

Median: The middle value of a set of values.

Mode: The most frequently occurring value of a group of values.

Mean probably is the kind of average you're most familiar with. Mean is the average of a group of numbers. To find the mean of your math test scores, for example, your teacher adds all your scores and then divides the answer by the number of math tests you took.

Median is another kind of average. Median is the middle number in a list of numbers that have been arranged in order. To find your median math test score, for example, your teacher would list all your math test scores in order from smallest to largest or from largest to smallest, and then find the number that appears in the middle of the list. (If two numbers share the middle of the list, the median is halfway between those two numbers.)

Mode is the third kind of average. Mode means the number that occurs most frequently. To find the mode of the your test scores, for example, your teacher would list all your math test scores in order from smallest to largest or from largest to smallest, and then find the number that appears on the list most frequently.

Assessment

There are 5 students shown below. The data shows how many answers each student got correct on a quiz of 10 questions. Find mean, median, and mode of this data collection.

NAME	SCORE
Chad	7
Karla	10
Maria	7
Steve	7
Tomas	9

ANSWERS:

Mean: $7 + 10 + 7 + 7 + 9 = 40$; 40 divided by $5 = 8$

Median: the middle number in this collection of data (7, 7, 7, 9, 10) is 7

Mode: the most commonly represented number in this collection of data (7, 7, 7, 9, 10) is 7

Name _____

Date _____

"M&M's"® Candies Worksheet

Without opening or touching your bag of "M&M's"® Candies, estimate how many are inside and record below. Predict how many of each color you will have. (If your estimated total is 10 "M&M's"® Candies in your bag then your total prediction of "M&M's"® Candies colors should also add to 10.) Then open your bag and find your actual total and how many you have of each color. Record your results below.

Estimated total=	Actual total=
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Colors:	Prediction:	Actual Amount:
Red		
Orange		
Yellow		
Green		
Blue		
Dark Brown		
Total=		

Use the graph below to record the number of "M&M's"® Candies in each package for your class.

18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

For the chart above:

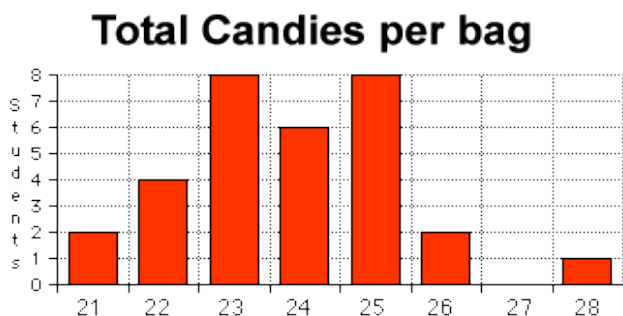
Find the mode:

Find the median:

Find the mean:

Page 2: Mean, Median, Mode

Example only for chart on pg. 1:

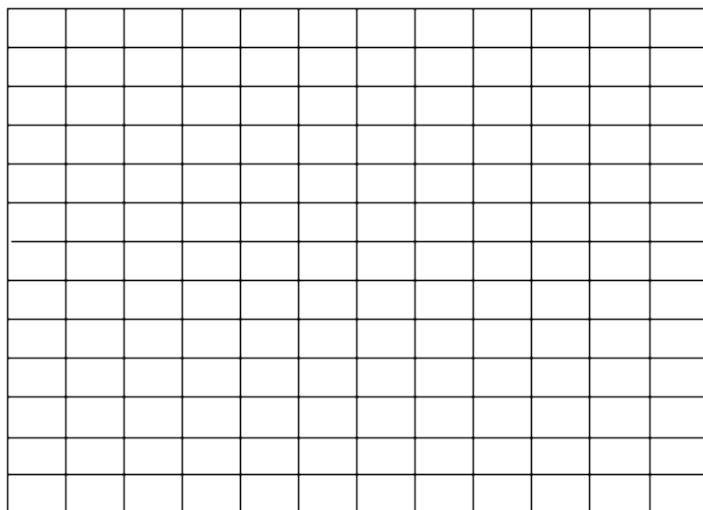


Mode: 23, 25

Median: 24

Mean: 23.8

Chart the number of each color that you have:



Red Orange Yellow Green Blue Brown

Number of:

Red = Orange = Yellow = Green = Blue = Brown =

Total number of "M&M's"® Candies = _____

Using the information above, convert each color into a fraction.

Red =	Orange =	Yellow =
Green =	Blue =	Brown =

Using the information above, convert each color into a percentage.

Red =	Orange =	Yellow =
Green =	Blue =	Brown =