COMMON CORE CLINICS
Grade 7
Mathematics

The Number System
### Module 1: The Number System

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Fractions and decimals can be used to show parts of a whole. For example, the fraction $\frac{17}{100}$ represents 17 out of 100 equal parts. The decimal $0.17$ is read as 17 hundredths, so it also represents $\frac{17}{100}$.

The word percent means “out of 100.” So, $17\%$ means 17 out of 100 and can be written as $\frac{17}{100}$. This means that $17\%$ is equivalent to both $\frac{17}{100}$ and $0.17$.

- To convert a fraction to a decimal, divide the numerator by the denominator.
- To convert a decimal to a fraction, use the place values of the digits to write an equivalent fraction.
- To convert a decimal to a percent, multiply by 100, and add a percent sign (%).
- To convert a percent to a decimal, divide by 100, and remove the percent sign.

Example 1

What fraction and decimal are equivalent to $6\%$?

Percent means “out of 100,” so $6\%$ means $\frac{6}{100}$.

Simplify: $\frac{6}{100} = \frac{6 \div 2}{100 \div 2} = \frac{3}{50}$

$\frac{6}{100}$ is read as “6 hundredths.” $0.06$ has a 6 in the hundredths place.

$6\% = \frac{6}{100} = \frac{3}{50} = 0.06$

Example 2

What percent is equivalent to $\frac{1}{3}$?

Divide the numerator by the denominator to convert $\frac{1}{3}$ to a decimal.

$\frac{1}{3} = 1 \div 3 = 0.3333...$

Multiply by 100, and add a percent sign.

$0.3333... \times 100 = 33.33...\% = 33\frac{1}{3}\%$

$\frac{1}{3} = 33.3%$
Guided Practice

1. Shade the grid below to show 0.8. What percent is equivalent to 0.8?

   **Step 1** Shade 0.8 of the model.
   - Eight tenths is equivalent to _______ hundredths, because 0.8 = _______.
   - To show 0.8, shade _______ of the 100 squares.

   ![Grid](image)

   **Step 2** Write a percent to represent the shaded part.
   - Since _______ out of 100 squares are shaded, _______ % is shaded.

   The grid is 0.8 shaded. _______ % is equivalent to 0.8.

2. A mayoral candidate received 12.5% of the votes in the general election. What fraction of the votes did she receive?

   **Step 1** Write 12.5% as a decimal.
   - \(12.5 \div 100 = \) _______

   **Step 2** Convert the decimal to a fraction and simplify.
   - The decimal shows _______ thousandths.
   - So, the fraction is _______.
   - Simplify the fraction: ________________________________

   The fraction of the votes the candidate received was _______.
Independent Practice

1. When using a fraction to name part of a whole, what do the numerator and denominator each show?

2. How can you convert a decimal to a fraction? Give an example.

3. How do you convert a percent to a fraction?

Shade each model to show the percent indicated. Then identify the equivalent fraction and decimal.

4. Shade to show 51%.
   fraction: ____________
   decimal: ____________

5. Shade to show 30%.
   fraction: ____________
   decimal: ____________
Find the simplest form of the fraction that is equivalent to each number.

6. \( \frac{1}{2} \) 

7. \( \frac{1}{20} \) 

8. \( \frac{1}{200} \)

9. \( \frac{3}{5} \) 

10. \( \frac{8}{10} \) 

11. \( \frac{13}{1} \) 

Find the decimal that is equivalent to each number.

12. \( \frac{11}{100} \) 

13. \( \frac{7}{8} \) 

14. \( \frac{2}{3} \) 

15. \( \frac{4}{10} \) 

16. \( \frac{5}{10} \) 

17. \( \frac{7}{10} \) 

Find the percent that is equivalent to each number.

18. \( \frac{23}{100} \) 

19. \( \frac{7}{10} \) 

20. \( \frac{9}{1000} \) 

21. \( 0.08 \) 

22. \( 0.111\ldots \) 

23. \( 1.25 \)

Solve each problem.

24. At Jill's school, 25% of the students play on a school sports team. What fraction of the students play on a school sports team?

\[ \frac{1}{4} \]

25. The decimal 0.002 represents the portion of lightbulbs in a shipment that were defective. What percent of the lightbulbs were defective?

\[ 0.2\% \]

26. Five-eighths of the cards in Max's card collection are baseball cards. What percent of the cards in the collection are baseball cards?

\[ 62.5\% \]
Module 2

Ratios and Proportional Relationships; Expressions and Equations

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Ratios and Rates

A \textbf{ratio} is a comparison of two numbers, called terms. For example, if there are 2 red apples and 3 green apples in a basket, we can write this as a ratio using words (2 to 3), as a fraction $\frac{2}{3}$, or with a colon (2:3). Ratios can be used to compare parts to parts, parts to a whole, or a whole to a part.

A \textbf{rate} is a special kind of ratio that compares two quantities of different units. For example, a speed such as $\frac{40 \text{ miles}}{2 \text{ hours}}$ is a rate. If the second quantity in the ratio is 1 unit, the rate is called a \textbf{unit rate}. For example, the speed mentioned earlier could be expressed as the unit rate, $\frac{20 \text{ miles}}{1 \text{ hour}}$ or 20 miles per hour.

\textbf{Example 1}

There are 10 boys and 14 girls in the school chorus. What is the ratio of boys to all students in the chorus?

The ratio of boys to all students is a comparison of a part to a whole.

$$\frac{\text{boys}}{\text{total students}} = \frac{10 \text{ boys}}{10 \text{ boys} + 14 \text{ girls}} = \frac{10}{24}$$

Simplify: $\frac{10}{24} = \frac{5}{12}$

The ratio of boys to all students is $\frac{5}{12}$. This can also be written as 5:12 or 5 to 12.

\textbf{Example 2}

June pays $1.95 for $\frac{1}{2}$ pound of peanuts. What is the unit price per pound?

Write the ratio.

$$\frac{1.95}{\frac{1}{2} \text{ lb}} = 1.95 \div 0.5 = 3.90 \text{ or } \frac{3.90}{1}$$

A unit price is an example of a unit rate. So, divide to find the unit price.

$$\frac{1.95}{0.5} = 1.95 \div 0.5 = 3.90 \text{ or } \frac{3.90}{1}$$

This represents a unit price of $\frac{3.90}{1 \text{ lb}}$.

The unit price is $\frac{3.90}{1 \text{ lb}}$ or $3.90$ per pound.

\textbf{COUNT}

Count the number of boys and girls in your class. Write the ratio of girls to boys in your class.
Guided Practice

1 Francisco’s bedroom has a width of 12 feet and a length of 15 feet. What is the length-to-width ratio of his bedroom?

Write the length-to-width ratio.

\[
\frac{\text{length}}{\text{width}} = \frac{15 \text{ ft}}{12 \text{ ft}} = \frac{15}{12}
\]

Simplify: __________

The length-to-width ratio is ____ to ____.

This can also be written as ____ or ____:____.

2 Katia walks \(\frac{1}{2}\) mile in \(\frac{1}{6}\) hour. What is her unit rate of speed?

Step 1 Write the ratio as a complex fraction.

\[
\frac{\frac{1}{2} \text{ mi}}{\frac{1}{6} \text{ h}} \text{ or } \frac{\frac{1}{2}}{\frac{1}{6}}
\]

Step 2 Divide to find the unit rate.

\[
\frac{\frac{1}{2}}{\frac{1}{6}} = \frac{1}{2} \div \frac{1}{6}
\]

The reciprocal of \(\frac{1}{6}\) is ____, so:

\[
\frac{1}{2} \div \frac{1}{6} = \frac{1}{2} \cdot \frac{6}{1} = \frac{6}{2} = \frac{3}{1}
\]

The unit rate is ____ miles per hour.
Independent Practice

1. What is a ratio and what are the three ways to write a ratio?

2. What is a rate?

3. What is a unit rate? Give an example.

Simplify each ratio, if possible. Then write it in two different ways.

4. 3 to 4

5. 4 to 3

6. \( \frac{5}{20} \)

7. \( \frac{49}{42} \)

8. 3:14

9. 22:4

Find each ratio. Simplify, if possible.

10. There are 4 mollies and 6 guppies in a fish tank. What is the ratio of guppies to mollies in the tank?

11. Josephine makes an olive salad using green olives and black olives. She adds 5 green olives for every 3 black olives. What is the ratio of all olives to green olives in the olive salad?
Find each unit rate.

12. A sign at a store reads, “3 notebooks for $6.” What is the price per notebook?

______________________

13. Aiden paid $1.50 for 5 pounds of watermelon. What is the unit price for the watermelon?

______________________

14. Yvette earns $3 for every \( \frac{1}{4} \) hour she works. What is her hourly rate of pay?

______________________

15. Sarah uses \( \frac{5}{2} \) cups of flour for every 2 loaves of bread she bakes. What is the unit rate per loaf?

______________________

16. A sloth walks \( \frac{2}{5} \) mile in each \( \frac{1}{3} \) hour. Write a complex fraction to represent the sloth’s unit rate of speed. Then determine the unit rate of speed in miles per hour.

______________________

Solve each problem.

17. There are 9 red gumdrops, 10 yellow gumdrops, and 15 orange gumdrops in a bag. What is the ratio of orange gumdrops to red gumdrops in the bag?

______________________

18. At a blood drive, 5 donors had type AB blood. The other 95 donors had other blood types. What was the ratio of donors with type AB blood to all donors?

______________________

19. Julia has a total of 12 T-shirts in her dresser. If 3 of the T-shirts are blue, what is the ratio of blue T-shirts to nonblue T-shirts in her dresser?

______________________
Module 3

Geometry

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Similar figures have the same shape but not necessarily the same size. Similar figures have the following properties:

- Their corresponding angles are congruent.
- Their corresponding sides have proportional lengths.

Triangle $ABC$ is similar to $\triangle DEF$. Use this art for both examples.

**Example 1**

What is the measure of $\angle D$?

Angle $D$ corresponds to $\angle A$.

Since angle $A$ measures $21^\circ$, so does $\angle D$.

Angle $D$ measures $21^\circ$.

**Example 2**

What is the length of $\overline{DE}$?

The lengths of corresponding sides $BC$ and $EF$ are given.

The length of side $AB$ is given, and you need to find the length of its corresponding side, $DE$.

Set up and solve a proportion.

\[
\frac{AB}{DE} = \frac{BC}{EF}
\]

\[
\frac{4}{x} = \frac{5}{2.5}
\]

\[
4 \cdot 2.5 = x \cdot 5
\]

\[
10 = 5x
\]

\[
2 = x
\]

The length of $\overline{DE}$ is 2 meters.

**KEY WORDS**

- congruent
- corresponding angles
- corresponding sides
- similar figures

**Example**

**Example 2**

What is the length of $\overline{DE}$?

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\[
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\]

The length of $\overline{DE}$ is 2 meters.
**Guided Practice**

Is \( \triangle KLM \) similar to \( \triangle XYZ \)?

![Diagrams of triangles KLM and XYZ]

**Step 1** Are corresponding angles congruent?

Angle \( K \) corresponds to \( \angle X \). The symbols show that each is a right angle, so each measures ______ degrees.

Angle \( L \) corresponds to angle ______.

Angle \( M \) corresponds to angle ______.

The angle marks show that both of those pairs of angles have ______ measures.

So, all pairs of corresponding angles ______ congruent.

**Step 2** Do corresponding sides have proportional lengths?

\[
\frac{KL}{XY} = \frac{5}{10} = \frac{5}{10} = ______
\]

\[
\frac{LM}{YZ} = \frac{13}{26} = \frac{13}{26} = \frac{13}{26} = \frac{13}{26}
\]

\[
\frac{KM}{XZ} = \frac{12}{24} = \frac{12}{24} = \frac{12}{24} = \frac{12}{24}
\]

All pairs of corresponding sides have lengths in the ratio ______.

Triangle \( KLM \) and triangle \( XYZ \) ________ similar.

**Remember**

If two angles have the same angle marks, their measures are the same.

**Think**

If all pairs of corresponding sides have lengths in the same ratio, then corresponding sides have proportional lengths.
Lesson 1: Similar Figures

Independent Practice

1. What must be true of the corresponding angles in two similar figures?

________________________________________________________________________

________________________________________________________________________

2. If two figures have the same shape and the same size, are they similar? Explain.

________________________________________________________________________

________________________________________________________________________

Identify each pair of figures as similar or not similar. Explain why or why not.

3. 

Ask Yourself
What do you notice about corresponding angle measures? Are corresponding side lengths in the same ratio?

________________________________________________________________________

________________________________________________________________________

4. 

________________________________________________________________________

________________________________________________________________________

5. 

________________________________________________________________________

________________________________________________________________________
For each of the following, find the indicated measure.

6. Rectangle $ABCD$ is similar to rectangle $PQRS$.

$$\begin{align*}
PQ &= \underline{\phantom{0000}} \\
m\angle T &= \underline{\phantom{0000}}
\end{align*}$$

7. Triangle $WUX$ is similar to $\triangle TUV$.

$$\begin{align*}
11 \text{ in.} & \quad 6 \text{ in.} \\
m\angle T &= \underline{\phantom{0000}}
\end{align*}$$

8. Triangle $FGH$ is similar to $\triangle KJH$.

$$\begin{align*}
m\angle J &= \underline{\phantom{0000}}
\end{align*}$$

9. Triangle $LMN$ is similar to $\triangle PMQ$.

$$\begin{align*}
LM &= \underline{\phantom{0000}}
\end{align*}$$

10. Cara is 5 feet tall and casts a shadow 8 feet long. At the same time, a building casts a shadow 32 feet long. What is the height of the building?

$$\underline{\phantom{0000}}$$

11. The distance, $d$, across a lake cannot be directly measured, so a land surveyor used known distances to draw the diagram at the right. What is the value of $d$? Explain how you found your answer.

$$\underline{\phantom{0000}}$$

$$\underline{\phantom{0000}}$$
# Geometry

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**Glossary** .................................................. 40

**Math Tools** .................................................. 43
**Similar figures** have the same shape but not necessarily the same size. Similar figures have the following properties:

- Their **corresponding angles** are **congruent**.
- Their **corresponding sides** have proportional lengths.

Triangle $ABC$ is similar to $\triangle DEF$. Use this art for both examples.

**Example 1**

What is the measure of $\angle D$?

Angle $D$ corresponds to $\angle A$.

Since angle $A$ measures $21^\circ$, so does $\angle D$.

Angle $D$ measures $21^\circ$.

**Example 2**

What is the length of $\overline{DE}$?

The lengths of corresponding sides $BC$ and $EF$ are given.

The length of side $AB$ is given, and you need to find the length of its corresponding side, $\overline{DE}$.

Set up and solve a proportion.

$$\frac{AB}{DE} = \frac{BC}{EF}$$

$$\frac{4}{x} = \frac{5}{2.5}$$

$$4 \cdot 2.5 = x \cdot 5$$

$$10 = 5x$$

$$2 = x$$

The length of $\overline{DE}$ is 2 meters.
Guided Practice

Is \( \triangle KLM \) similar to \( \triangle XYZ \)?

**Step 1** Are corresponding angles congruent?

Angle \( K \) corresponds to \( \angle X \). The symbols show that each is a right angle, so each measures _____ degrees.

Angle \( L \) corresponds to angle ______.

Angle \( M \) corresponds to angle ______.

The angle marks show that both of those pairs of angles have _______ measures.

So, all pairs of corresponding angles ______ congruent.

**Step 2** Do corresponding sides have proportional lengths?

\[
\frac{KL}{XY} = \frac{5}{10} = \frac{5 \div 5}{10 \div 5} = _____
\]

\[
\frac{LM}{YZ} = \frac{13}{26} = \frac{13 \div 13}{26 \div 13} = ________________
\]

\[
\frac{KM}{XZ} = \frac{10}{24} = \frac{10 \div 2}{24 \div 2} = ________________
\]

All pairs of corresponding sides have lengths in the ratio ______.

Triangle \( KLM \) and triangle \( XYZ \) _______ similar.
Lesson 1: Similar Figures

Independent Practice

1. What must be true of the corresponding angles in two similar figures?

2. If two figures have the same shape and the same size, are they similar? Explain.

Identify each pair of figures as similar or not similar. Explain why or why not.

3. 

4. 

5. 

Ask Yourself
What do you notice about corresponding angle measures? Are corresponding side lengths in the same ratio?
For each of the following, find the indicated measure.

6. Rectangle $ABCD$ is similar to rectangle $PQRS$.

![Diagram of rectangles]

$PQ = \underline{\hspace{2cm}}$

7. Triangle $WUX$ is similar to $\triangle TUV$.

![Diagram of triangles]

$m\angle T = \underline{\hspace{2cm}}$

8. Triangle $FGH$ is similar to $\triangle KJH$.

![Diagram of triangles]

$m\angle J = \underline{\hspace{2cm}}$

9. Triangle $LMN$ is similar to $\triangle PMQ$.

![Diagram of triangles]

$LM = \underline{\hspace{2cm}}$

Solve each problem.

10. Cara is 5 feet tall and casts a shadow 8 feet long. At the same time, a building casts a shadow 32 feet long. What is the height of the building?

$\underline{\hspace{2cm}}$

11. The distance, $d$, across a lake cannot be directly measured, so a land surveyor used known distances to draw the diagram at the right. What is the value of $d$? Explain how you found your answer.

$\underline{\hspace{2cm}}$

$\underline{\hspace{2cm}}$
COMMON CORE CLINICS
Grade 7
Mathematics
Statistics and Probability
## Module 4

### Statistics and Probability

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Probability is a number from 0 to 1 that shows the likelihood that an event will occur. A probability close to 0 means an event is unlikely, and a probability close to 1 means it is very likely. A probability close to $\frac{1}{2}$ means an event is neither likely nor unlikely.

The theoretical probability of an event $A$ occurring is found as follows:

$$P(A) = \frac{\text{favorable outcomes}}{\text{total possible outcomes}}$$

A theoretical probability allows us to predict how many times an event would likely occur in a certain number of trials. Just multiply the theoretical probability by the number of trials.

Since we do not live in a perfect world, your prediction may be close to, but not exactly equal to, your results. The actual outcomes can be used to determine the experimental probability that event $A$ will occur, as follows:

$$P_e(A) = \frac{\text{times event occurs}}{\text{total trials}}$$

The more times you perform an experiment, the closer the experimental probability should get to the theoretical probability.

**Example**

A CD has only 1 pop song and 12 classic rock songs on it. What is the probability that a song selected at random will be a pop song? Determine if the event is likely, unlikely, or neither.

There is 1 pop song.

There are a total of $1 + 12$, or 13, songs on the CD.

So, $P(\text{pop}) = \frac{\text{favorable outcomes}}{\text{total possible outcomes}} = \frac{1}{13}$.

$\frac{1}{13}$ is close to 0.

So, the event is unlikely.

The theoretical probability of choosing a pop song is $\frac{1}{13}$, and the event is unlikely.

**Apply**

Suppose you roll a number cube with faces numbered 1 to 6. What is the probability of the cube landing on a number less than 7?
Guided Practice

1. This spinner is divided into three congruent sections. What is the experimental probability of spinning a 2?

   **Step 1** Place a paper clip over the center of the spinner, hold it in place with the point of a pencil, and flick the paperclip to spin it. Do this 15 times. Record your results in the tally chart.

<table>
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<th>Number</th>
<th>Tallies</th>
<th>Times Spun</th>
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<td>1</td>
<td></td>
<td></td>
</tr>
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<tr>
<td>3</td>
<td></td>
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   **Step 2** Find the experimental probability of spinning a 2.

   How many times did you spin a 2? ______

   \[ P_e(2) = \frac{\text{times event occurs}}{\text{total trials}} = \frac{\square}{15} \]

   My experimental probability of spinning a 2 was ______.

2. Compare your experimental probability to the theoretical probability of spinning a 2.

   **Step 1** Find the theoretical probability of spinning a 2.

   There is 1 favorable outcome (spinning a 2).

   There are ______ possible outcomes: spinning a _____, ____, or ____.

   \[ P(2) = \frac{\text{favorable outcomes}}{\text{total possible outcomes}} = \frac{\square}{\square} \]

   **Step 2** Compare the two probabilities.

   experimental probability: ______
   theoretical probability: ______

   The experimental probability that I found is ____________ the theoretical probability.
Lesson 1: Probability

**Independent Practice**

1. What is theoretical probability?

2. How does experimental probability differ from theoretical probability?

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Gillian places the cards below in a bag, shakes the bag, and draws one card at random. Use this diagram for questions 3 through 5.

```
U N I T E D
S T A T E S
```

3. What is the theoretical probability that Gillian will draw the letter N?

4. What is the theoretical probability that Gillian will draw the letter T?

5. Which best describes the probability that Gillian will draw a vowel (A, E, I, O, or U)—likely, unlikely, or neither? Why?

---

**Solve.**

6. If you flip a fair coin 50 times, how many times would you expect it to land on heads? Show or explain how you found your answer.
Cleo has a bag of marbles. Each marble is either blue, red, or yellow. She reaches into the bag, draws a marble, records its color in the table below, and replaces it in the bag. She does this 80 times. Use this information for questions 7 and 8.

7. What is the experimental probability of choosing each type of marble?

\[
P_e(\text{blue}): \quad P_e(\text{red}): \quad P_e(\text{yellow}): \]

<table>
<thead>
<tr>
<th>Color</th>
<th>Times Picked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>49</td>
</tr>
<tr>
<td>Red</td>
<td>8</td>
</tr>
<tr>
<td>Yellow</td>
<td>23</td>
</tr>
</tbody>
</table>

8. Do the outcomes appear to be equally likely to one another? Explain.

---

Solve each problem.

9. There are 12 girls and 14 boys in Lilly’s class. She is the only girl named Lilly. If each student’s name is placed in a hat and a name is drawn at random, what is the probability that a girl’s name will be chosen? That Lilly’s name will be chosen?

\[
P(\text{girl}): \quad P(\text{Lilly}): \]

10. Jayden tosses a number cube, with faces numbered 1 to 6. If Jayden does this 120 times, how many times would you expect the cube to land on a number less than 3?


11. A spinner is divided into four congruent sections, some shaded and some unshaded. Max spun the spinner 100 times and recorded his results in the table.

<table>
<thead>
<tr>
<th>Section</th>
<th>Times Spun</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaded</td>
<td>73</td>
</tr>
<tr>
<td>Unshaded</td>
<td>27</td>
</tr>
</tbody>
</table>

Based on these results, decide how many of the spinner sections you would expect to be shaded and how many you would expect to be unshaded. Explain your choices.