Comparing Fractions

Visual Models

\[
\begin{align*}
\frac{1}{4} & \quad \frac{1}{4} \\
\frac{3}{4} & \quad \frac{3}{8} \\
\frac{1}{8} & \quad \frac{1}{8} \\
\frac{1}{8} & \quad \frac{1}{8} \\
\frac{1}{8} & \quad \frac{1}{8} \\
\frac{1}{8} & \quad \frac{1}{8} \\
\frac{1}{8} & \quad \frac{1}{8} \\
\frac{1}{3} & \quad \frac{1}{3} \\
\frac{2}{8} & \quad \frac{2}{3}
\end{align*}
\]

So, \( \frac{5}{8} > \frac{2}{8} \)

Same Denominator

\[
\begin{align*}
0 & \quad 1 \\
\frac{2}{8} & \quad \frac{5}{8} \\
\frac{8}{8} & \quad \frac{8}{8}
\end{align*}
\]

Same Numerator

\[
\begin{align*}
\frac{1}{8} & \quad \frac{1}{6} \\
\frac{1}{6} & \quad \frac{1}{6} \\
\frac{1}{6} & \quad \frac{1}{6} \\
\frac{1}{6} & \quad \frac{1}{6} \\
\frac{1}{6} & \quad \frac{1}{6} \\
\frac{1}{3} & \quad \frac{1}{3} \\
\frac{1}{3} & \quad \frac{1}{3} \\
\frac{2}{6} & \quad \frac{2}{3}
\end{align*}
\]

So, \( \frac{7}{8} > \frac{2}{3} \)

Missing Pieces

\[
\begin{align*}
\frac{7}{8} & \quad \frac{2}{3} \\
\frac{1}{8} & \quad \frac{1}{3}
\end{align*}
\]

So, \( \frac{7}{8} > \frac{2}{3} \)

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**Multiplication and Division Strategies**

**Think Multiply to Divide**

15 ÷ 5 = [ ]
5 × 3 = 15
15 ÷ 5 = 3

**Related Facts**

4 × 3 = 12
3 × 4 = 12
12 ÷ 4 = 3
12 ÷ 3 = 4

**Doubles**

6 × 8 = [ ]
4 × 4 = 24
24 doubled is 48
6 × 8 = 48

**Distributive Property**

3 × 7 = [ ]
3 × 4 = 12
3 × 3 = 9
12 + 9 = 21
3 × 7 = 21

**Count Equal Groups on a Number Line**

4 × 2 = 8
8 ÷ 2 = 4

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Relate Fractions and Decimals

Tenths

![Fraction representation]

\[ \frac{5}{10} = 1.5 \]

Compare Decimals

![Decimal representation]

\[ 0.68 < 0.9 \]

Hundredths

![Fraction representation]

\[ \frac{37}{100} = 0.37 \]

Fractions, Decimals, and Money

![Money representation]

\[ \frac{75}{100} = 1.75 = 51.75 = 175\,\text{c} \]

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### Multiplication with Fractions

#### Represent Equal Shares
What is \( \frac{3}{4} \) of 8?

\[
\begin{array}{cccc}
\frac{3}{4} & \frac{3}{4} & \frac{3}{4} & \frac{3}{4} \\
\mathbf{\text{of 8}} & \mathbf{\text{is 6.}} & & \\
\end{array}
\]

#### Multiply Unit Fractions

\[
\frac{1}{3} \times \frac{1}{2} = \frac{1}{6}
\]
Divide the number line from 0 to 1 into halves, and divide each half into thirds.

#### Multiply Fractions Using an Area Model

\[
\frac{3}{4} \times \frac{2}{5} = \frac{6}{20}
\]

#### Scaling

\[
\begin{align*}
\frac{3}{4} & < \frac{2}{3} \quad \text{because} \quad \frac{3}{4} < 1. \\
\frac{5}{3} & = \frac{5}{3} \quad \text{because} \quad \frac{5}{3} = 1. \\
\frac{2}{3} & > \frac{2}{3} \quad \text{because} \quad \frac{2}{3} > 1.
\end{align*}
\]

#### Multiply Whole Numbers by Fractions

\[
\frac{3}{4} \times 20 = \frac{60}{4} = 60 \div 4 = 15
\]
Customary and Metric Measurement

<table>
<thead>
<tr>
<th>Metric Conversions</th>
<th>Customary Conversions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 meter = 100 centimeters</td>
<td>1 foot (ft) = 12 inches (in.)</td>
</tr>
<tr>
<td>1 meter = 1,000 millimeters</td>
<td>1 yard (yd) = 3 feet</td>
</tr>
<tr>
<td>1 kilometer = 1,000 meters</td>
<td>1 mile (mi) = 5,280 feet</td>
</tr>
<tr>
<td>1 liter = 1,000 milliliters</td>
<td>1 mile = 1,760 yards</td>
</tr>
<tr>
<td>1 kilogram = 1,000 grams</td>
<td>1 cup (c) = 8 fluid ounces (fl oz)</td>
</tr>
<tr>
<td></td>
<td>1 pint (pt) = 2 cups</td>
</tr>
<tr>
<td></td>
<td>1 quart (qt) = 2 pints</td>
</tr>
<tr>
<td></td>
<td>1 gallon (gal) = 4 quarts</td>
</tr>
<tr>
<td></td>
<td>1 pound (lb) = 16 ounces (oz)</td>
</tr>
<tr>
<td></td>
<td>1 ton (T) = 2,000 pounds</td>
</tr>
</tbody>
</table>

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# Area of Triangles and Special Quadrilaterals

## Area of Parallelograms

The area $A$ of a parallelogram is the product of its base $b$ and its height $h$.

$$A = bh$$

- $b = 6\text{ cm}$
- $h = 3\text{ cm}$

$$A = 6 \cdot 3 = 18\text{ cm}^2$$

## Area of Triangles

The area $A$ of a triangle is half the product of its base $b$ and its height $h$.

$$A = \frac{1}{2}bh$$

- $b = 20\text{ m}$
- $h = 8\text{ m}$

$$A = \frac{1}{2} \cdot 20 \cdot 8 = 80\text{ square meters}$$

## Area of Trapezoids

The area of a trapezoid is half its height multiplied by the sum of the lengths of its two bases.

$$A = \frac{1}{2}h(b_1 + b_2)$$

- $b_1 = 17\text{ ft}$
- $b_2 = 16\text{ ft}$
- $h = 39\text{ ft}$

$$A = \frac{1}{2} \cdot 39 \cdot (17 + 34) = 448\text{ square feet}$$

## Area of Composite Figures

You can find the areas of composite figures by breaking the figures into rectangles, triangles, or other familiar shapes. Then you can apply the area formulas.

- Small rectangle: $6 \cdot 4 = 24\text{ square meters}$
- Triangle: $\frac{1}{2} \cdot 8 \cdot 4 = 16\text{ square meters}$
- Large rectangle: $14 \cdot 6 = 84\text{ square meters}$

Total area: $24 + 16 + 84 = 124\text{ square meters}$

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Real-World Relationships Between Variables

Representing Equations

The equation \( y = x + 2 \) can be represented in a table or as a graph.

<table>
<thead>
<tr>
<th>( x )</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

Write Equations from Verbal Descriptions

A freight train moves at a constant speed of 50 miles per hour.

Use the information to make a model.

\[
\begin{align*}
\text{Distance traveled (miles)} &= \text{Distance traveled per hour} \cdot \text{Time (hours)} \\
y &= 50x
\end{align*}
\]

Write Equations from Tables

Write an equation to represent the relationship between \( x \) and \( y \) in the table below.

<table>
<thead>
<tr>
<th>( x )</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>6</td>
<td>16</td>
<td>26</td>
<td>36</td>
</tr>
</tbody>
</table>

A. Look for a pattern.
   Each \( y \)-value is 4 less than the corresponding \( x \)-value.

B. Use the pattern to write an equation.
   \( y = x - 4 \)

Write Equations from Graphs

A. Read the ordered pairs from the graph.

<table>
<thead>
<tr>
<th>( x )</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>40</td>
</tr>
</tbody>
</table>

B. Look for a pattern.
   Each \( y \)-value is 20 more than the corresponding \( x \)-value.

C. Use the pattern to write an equation.
   \( y = x + 20 \)

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**Types of Probability**

**Theoretical Probability**
Based on possible outcomes when all outcomes are equally likely

Formula:

\[ P(\text{event}) = \frac{\text{number of outcomes in the event}}{\text{total number of equally likely outcomes}} \]

**Experimental Probability**
Based on the outcomes of an experiment

Formula:

\[ P(\text{event}) = \frac{\text{number of times the event occurs}}{\text{total number of trials}} \]

---

**Types of Events**

**Simple**
Outcomes resulting from a single event

*Example:*

- A cube with faces numbered 1, 2, and 3.

**Compound**
Outcomes resulting from more than one simple event happening together

*Example:*

- Three dice rolled simultaneously.

---

**Vocabulary**

- The set of all possible outcomes from a probability experiment is known as a **sample space**.
- A **simulation** is the process of using a model to recreate a situation to find probability.

---

**Three ways to express probability ratios:**

1. fraction
2. decimal
3. percent

**Three ways to list the sample space:**

1. table
2. tree diagram
3. organized list

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### The Pythagorean Theorem

**Pythagorean Theorem**

If \(a\) and \(b\) are legs and \(c\) is the hypotenuse, \(a^2 + b^2 = c^2\).

**Converse of the Pythagorean Theorem**

If the sum of the squares of the two shorter legs of a triangle is equal to the square of the longest side, then the triangle is a right triangle.

If \(a^2 + b^2 = c^2\), then the triangle is a right triangle.

**Apply the Pythagorean Theorem**

A 32-inch baseball bat fits diagonally inside this box. What is the diagonal of the base of the box? Round to the nearest whole number.

\[25^2 + x^2 = 32^2\]
\[625 + x^2 = 1024\]
\[x^2 = 399\]
\[x \approx 20\text{ inches}\]

**Apply the Pythagorean Theorem in the Coordinate Plane**

Brady walks directly from his location at point B to see his friend Phil at point P. How far does Brady walk, rounded to the nearest tenth of a foot?

\[d = \sqrt{30^2 + 15^2}\]
\[d = \sqrt{1125}\]
\[d \approx 33.5\text{ feet}\]

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