

6-1

Estimating with Fractions (pages 240–243)

Estimating helps you find answers when you only need an approximate solution. Estimating before you do exact calculations helps you check your work.

<p>Estimating with Fractions and Mixed Numbers</p>	<p>To estimate the sum or difference of fractions:</p> <ul style="list-style-type: none"> • Round each fraction to 0, $\frac{1}{2}$, or 1, whichever is closest. • Calculate with your rounded fractions. <p>To estimate the sum, difference, or product of mixed numbers:</p> <ul style="list-style-type: none"> • Round each mixed number to the nearest whole number. • Calculate with these whole numbers.
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EXAMPLES

A Estimate $\frac{4}{7} - \frac{1}{5}$.

Think: Half of 7 is $3\frac{1}{2}$, so $\frac{4}{7}$ is close to $\frac{1}{2}$.

$\frac{1}{5}$ is close to 0.

Calculate with the rounded fractions: $\frac{1}{2} - 0 = \frac{1}{2}$.

$\frac{4}{7} - \frac{1}{5}$ is about $\frac{1}{2}$.

B Estimate $2\frac{7}{8} + 1\frac{1}{6}$.

Think: $2\frac{7}{8}$ is close to 3.

$1\frac{1}{6}$ is close to 1.

Calculate with the rounded numbers: $3 + 1 = 4$.

$2\frac{7}{8} + 1\frac{1}{6}$ is about 4.

Try These Together

1. Round $\frac{2}{9}$ to 0, $\frac{1}{2}$, or 1.

HINT: $4\frac{1}{2}$ ninths equals $\frac{1}{2}$.

2. Round $\frac{11}{12}$ to 0, $\frac{1}{2}$, or 1.

HINT: $\frac{6}{12}$ is equal to $\frac{1}{2}$.

PRACTICE

Round each fraction to 0, $\frac{1}{2}$, or 1.

3. $\frac{1}{8}$

4. $\frac{9}{16}$

5. $\frac{8}{9}$

6. $\frac{3}{7}$

Round to the nearest whole number.

7. $2\frac{3}{4}$

8. $5\frac{1}{6}$

9. $4\frac{2}{5}$

10. $8\frac{7}{8}$

Estimate.

11. $\frac{5}{8} + \frac{1}{6}$

12. $1\frac{10}{11} + \frac{9}{10}$

13. $4\frac{1}{5} - 3\frac{2}{9}$

14. $\frac{1}{11} \times \frac{4}{5}$



15. **Standardized Test Practice** Estimate the difference between $5\frac{4}{5}$ and $2\frac{2}{7}$.

A 3

B 4

C 6

D 5

Answers: 1. 0 2. 1 3. 0 4. $\frac{2}{1}$ 5. 1 6. $\frac{2}{1}$ 7. 3 8. 5 9. 4 10. 9 11. $\frac{2}{1}$ 12. 3 13. 1 14. 0 15. B

6-2

Adding and Subtracting Fractions (pages 244–247)

To add or subtract fractions, the denominators must be the same.

<p>Adding and Subtracting Fractions with Unlike Denominators</p>	<p>To add or subtract fractions:</p> <ul style="list-style-type: none"> • Rename the fractions with a common denominator as necessary. • Add or subtract the numerators and use the common denominator in the sum or difference. • Simplify if necessary.
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EXAMPLES

A Add $\frac{3}{4} + \frac{5}{6}$.

Remember that the least common denominator of 4 and 6 is their least common multiple (12).

Multiply to rename with the LCD:

$$\frac{3 \times 3}{4 \times 3} + \frac{5 \times 2}{6 \times 2}$$

Add $\frac{9}{12} + \frac{10}{12} = \frac{19}{12}$ and simplify: $1\frac{7}{12}$.

B Subtract $\frac{2}{3} - \frac{1}{6}$.

The LCD is 6.

$$\frac{2}{3} - \frac{1}{6} = \frac{2 \times 2}{3 \times 2} - \frac{1}{6} \quad \text{Multiply.}$$

$$= \frac{4}{6} - \frac{1}{6}$$

$$= \frac{3}{6} \quad \text{Subtract.}$$

$$= \frac{1}{2} \quad \text{Simplify.}$$

Try These Together

1. Add $\frac{1}{8} + \frac{5}{8}$.

HINT: These have a common denominator already.

2. Subtract $\frac{5}{16} - \frac{1}{4}$.

HINT: The LCD is 16.

PRACTICE

Add or subtract. Write each sum or difference in simplest form.

3. $\frac{5}{7} - \frac{2}{3}$

4. $\frac{1}{6} + \frac{3}{4}$

5. $\frac{7}{18} + \frac{2}{9}$

6. $\frac{15}{27} - \frac{1}{3}$

Solve each equation. Write the solution in simplest form.

7. $\frac{1}{7} + \frac{2}{3} = y$

8. $b = \frac{1}{4} + \frac{7}{10}$

9. $\frac{6}{15} + \frac{1}{2} = g$

10. $h = \frac{5}{9} - \frac{1}{4}$

11. **Cooking** A recipe calls for $\frac{1}{2}$ pound of chocolate chips and $\frac{1}{4}$ pound of butterscotch chips. How many pounds of chips does it call for all together?



12. **Standardized Test Practice** Mr. Jensen is a flight attendant. $\frac{1}{4}$ of his

uniforms are black and $\frac{5}{14}$ of his uniforms are red. What fraction of his uniforms are black or red?

A $\frac{9}{20}$

B $\frac{2}{3}$

C $\frac{6}{18}$

D $\frac{17}{28}$

<p>Answers: 1. $\frac{4}{3}$ 2. $\frac{16}{1}$ 3. $\frac{21}{1}$ 4. $\frac{12}{11}$ 5. $\frac{18}{11}$ 6. $\frac{9}{2}$ 7. $\frac{21}{17}$ 8. $\frac{20}{19}$ 9. $\frac{10}{9}$ 10. $\frac{36}{11}$ 11. $\frac{4}{3}$ 12. D</p>
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6-3**Adding and Subtracting Mixed Numbers**

(pages 248–251)

You can add or subtract mixed numbers with steps similar to those you used for adding or subtracting fractions.

Adding and Subtracting Mixed Numbers

To add or subtract mixed numbers:

- Add or subtract the fraction parts, renaming them if necessary.
- Add or subtract the whole numbers and simplify.

EXAMPLESubtract $3\frac{1}{4} - 2\frac{5}{8}$.

$$3\frac{1}{4} - 2\frac{5}{8} = 3\frac{2}{8} - 2\frac{5}{8}$$

The LCD is 8.

$$= 2\frac{8}{8} + \frac{2}{8} - 2\frac{5}{8}$$

Rename, since you cannot subtract $\frac{5}{8}$ from $\frac{2}{8}$.

$$= 2\frac{10}{8} - 2\frac{5}{8}$$

$$= \frac{5}{8}$$

Subtract. $\frac{10}{8} - \frac{5}{8} = \frac{5}{8}$, $2 - 2 = 0$ **Try These Together**

1. Complete: $2\frac{1}{5} = 1\frac{\square}{5}$.

2. Complete: $4\frac{5}{8} = 3\frac{\square}{8}$.

HINT: $2\frac{1}{5}$ is $1 + 1 + \frac{1}{5}$. How many fifths is 1?

HINT: How many eighths is 1?

PRACTICE**Complete.**

3. $8\frac{1}{6} = 7\frac{\square}{6}$

4. $6\frac{10}{7} = 7\frac{\square}{7}$

5. $5\frac{2}{3} = 4\frac{\square}{3}$

6. $8\frac{7}{5} = \square\frac{2}{5}$

Add or subtract. Write each sum or difference in simplest form.

7. $3\frac{5}{8} + 1\frac{1}{8}$

8. $7\frac{3}{5} - 5\frac{2}{5}$

9. $2\frac{4}{9} + 4\frac{1}{3}$

10. $5\frac{1}{4} - 3\frac{2}{7}$

11. **Standardized Test Practice** Dierdre cut off and discarded $3\frac{1}{8}$ inches

from a $12\frac{1}{2}$ -inch-long piece of wrapping paper to wrap a gift. How long was the piece of wrapping paper she used?

A $16\frac{3}{8}$ inches

B $9\frac{3}{8}$ inches

C $15\frac{5}{8}$ inches

D $10\frac{1}{8}$ inches

Answers: 1. 6 2. 13 3. 7 4. 3 5. 5 6. 9 7. $4\frac{4}{9}$ 8. $2\frac{1}{4}$ 9. $6\frac{6}{7}$ 10. $1\frac{28}{27}$ 11. B

6-4**Multiplying Fractions and Mixed Numbers**

(pages 254–257)

You can multiply fractions and mixed numbers that have the same or different denominators.

Multiplying Fractions	To multiply fractions, multiply the numerators and then multiply the denominators. $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$ (b and d are not equal to 0.)
Multiplying Mixed Numbers	To multiply mixed numbers, rename each mixed number as an improper fraction. Then multiply the fractions.

EXAMPLES

A $\frac{3}{4} \times \frac{2}{9}$

$$\frac{3}{4} \times \frac{2}{9} = \frac{\overset{1}{\cancel{3}}}{2\cancel{4}} \times \frac{\overset{2}{\cancel{9}}}{\underset{3}{\cancel{9}}} \quad \begin{array}{l} \text{The GCF of 3 and 9 is 3.} \\ \text{The GCF of 2 and 4 is 2.} \end{array}$$

$$= \frac{1}{6}$$

B $1\frac{1}{4} \times 3\frac{2}{5}$

$$1\frac{1}{4} \times 3\frac{2}{5} = \frac{5}{4} \times \frac{17}{5} \quad \begin{array}{l} \text{Rename the mixed numbers} \\ \text{as improper fractions.} \end{array}$$

$$= \frac{1}{4} \times \frac{17}{1} \quad \text{The GCF of 5 and 5 is 5.}$$

$$= \frac{17}{4} \text{ or } 4\frac{1}{4}$$

Try These Together

1. $\frac{1}{4} \times \frac{3}{5}$

HINT: Multiply numerators and then multiply denominators.

2. $\frac{5}{8} \times \frac{4}{5}$

HINT: Divide numerators and denominators by any GCFs to simplify before you multiply.

PRACTICE

Multiply. Write each product in simplest form.

3. $\frac{3}{7} \times \frac{1}{3}$

4. $\frac{5}{9} \times \frac{1}{10}$

5. $\frac{2}{11} \times \frac{1}{5}$

6. $2\frac{1}{2} \times 1\frac{3}{4}$

7. $\frac{9}{10} \times \frac{6}{7}$

8. $\frac{6}{13} \times \frac{1}{2}$

9. $\frac{5}{8} \times \frac{2}{5}$

10. $3\frac{2}{3} \times 2\frac{1}{3}$

Solve each equation. Write the solution in simplest form.

11. $1\frac{2}{5} \times 2 = r$

12. $2\frac{1}{4} \times \frac{4}{9} = s$

13. $4\frac{1}{2} \times \frac{1}{12} = t$

14. Standardized Test Practice For a science experiment, Evan needs

3 pieces of string that are each $5\frac{1}{2}$ inches long. How many inches of string does he need total?

A $66\frac{1}{4}$

B $33\frac{1}{4}$

C $15\frac{1}{2}$

D $16\frac{1}{2}$

Answers: 1. $\frac{3}{20}$ 2. $\frac{2}{1}$ 3. $\frac{7}{1}$ 4. $\frac{18}{1}$ 5. $\frac{55}{2}$ 6. $4\frac{8}{3}$ 7. $\frac{35}{27}$ 8. $\frac{13}{3}$ 9. $\frac{4}{1}$ 10. $8\frac{9}{5}$ 11. $2\frac{4}{5}$ 12. 1 13. $\frac{8}{3}$ 14. D

6-5**Solving Equations** (pages 258–261)

Addition and multiplication of fractions have the same properties as addition and multiplication of whole numbers. Two numbers whose product is 1 are **multiplicative inverses**, or **reciprocals**.

Multiplicative Inverse Property	For all fractions $\frac{a}{b}$, where $a, b \neq 0$, $\frac{a}{b} \times \frac{b}{a} = 1$.
Multiplication Property of Equality	If $a = b$, then $ac = bc$.

EXAMPLES

A Find the multiplicative inverse of $\frac{2}{3}$.

$$\frac{2}{3} \times \blacksquare = 1 \quad \text{What number can you multiply by } \frac{2}{3} \text{ to get 1?}$$

Since $\frac{2}{3} \times \frac{3}{2} = 1$, the multiplicative inverse of

$$\frac{2}{3} \text{ is } \frac{3}{2}.$$

B Solve $\frac{q}{7} = 6$.

You can undo dividing by 7 by multiplying each side of the equation by 7.

$$\begin{aligned} \frac{q}{7} \times 7 &= 6 \times 7 \\ q &= 42 \end{aligned}$$

Try These Together

Solve each equation.

1. $7 = \frac{y}{2}$

2. $\frac{3}{4}x = -6$

HINT: Multiply to undo dividing.

HINT: What is the multiplicative inverse of $\frac{3}{4}$?

PRACTICE

Solve each equation. Write the solution in simplest form.

3. $\frac{b}{6} = 2$

4. $-2 = \frac{3}{5}t$

5. $\frac{d}{3} = 9$

6. $\frac{1}{8}z = \frac{2}{7}$



7. Standardized Test Practice What is the reciprocal of $4\frac{1}{3}$?

A $4\frac{3}{1}$

B $\frac{13}{3}$

C $\frac{1}{12}$

D $\frac{3}{13}$

Answers: 1. 14 2. -8 3. 12 4. -3 $\frac{3}{4}$ 5. 27 6. 2 $\frac{7}{8}$ 7. D

6-6

Dividing Fractions and Mixed Numbers

(pages 264–266)

To divide by a fraction, multiply by its multiplicative inverse or reciprocal.

Dividing by a Fraction	You can rewrite $\frac{a}{b} \div \frac{c}{d}$ as $\frac{a}{b} \times \frac{d}{c}$, where $b, c,$ and $d \neq 0$.
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EXAMPLES

A Find $\frac{2}{7} \div \frac{3}{5}$.

$$\frac{2}{7} \div \frac{3}{5} = \frac{2}{7} \times \frac{5}{3} \quad \frac{5}{3} \text{ is the multiplicative inverse of } \frac{3}{5}.$$

$$= \frac{10}{21} \quad \text{Multiply.}$$

B Find $3\frac{1}{2} \div 5\frac{4}{9}$.

$$3\frac{1}{2} \div 5\frac{4}{9} = \frac{7}{2} \div \frac{49}{9} \quad \text{Rewrite the improper fractions as mixed numbers.}$$

$$= \frac{7}{2} \times \frac{9}{49} \quad \text{The GCF of 7 and 49 is 7.}$$

$$= \frac{9}{14} \quad \text{Multiply.}$$

Try These Together

1. Find $\frac{3}{8} \div 3$.

HINT: Rewrite $\div 3$ as $\times \frac{1}{3}$.

2. Find $\frac{2}{5} \div \frac{2}{3}$.

HINT: Rewrite $\div \frac{2}{3}$ as $\times \frac{3}{2}$.

PRACTICE

Divide. Write each quotient in simplest form.

3. $\frac{5}{7} \div \frac{4}{7}$

4. $\frac{8}{11} \div \frac{3}{4}$

5. $\frac{4}{5} \div 2\frac{2}{3}$

6. $4\frac{4}{7} \div \frac{4}{5}$

Solve each equation.

7. $r = \frac{4}{7} \div 2$

8. $\frac{8}{9} \div 3\frac{1}{4} = s$

9. $t = \frac{5}{6} \div \frac{2}{3}$

10. $w = \frac{1}{3} \div \frac{1}{2}$



11. Standardized Test Practice Taina has $3\frac{1}{9}$ yards of material that she wants to split into 4 pieces of equal length for a project. How long will each piece be?

A $\frac{7}{9}$ yd

B $1\frac{2}{7}$ yd

C $3\frac{1}{36}$ yd

D $\frac{3}{4}$ yd

Answers: 1. $\frac{1}{8}$ 2. $\frac{5}{3}$ 3. $1\frac{1}{4}$ 4. $\frac{33}{32}$ 5. $\frac{10}{3}$ 6. $5\frac{7}{5}$ 7. $\frac{7}{2}$ 8. $\frac{117}{32}$ 9. $1\frac{1}{4}$ 10. $\frac{5}{2}$ 11. A
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6-7**Changing Customary Units** (pages 267–269)

Customary units of weight are the **ounce, pound, and ton.**

1 pound (lb) = 16 ounces (oz)
1 ton (T) = 2,000 pounds

Customary units of liquid capacity are the **cup, pint, quart, and gallon.**

1 cup (c) = 8 fluid ounces (fl oz)
1 pint (pt) = 2 cups
1 quart (qt) = 2 pints
1 gallon (gal) = 4 quarts

Converting Units

- When you change from a larger unit to a smaller unit, multiply. There will be a greater number of smaller units than larger units.
- When you change from a smaller unit to a larger unit, divide. There will be fewer larger units than smaller units.

EXAMPLES

A Change 5 cups to pints.

Cup is a smaller unit than pint. Divide.

$$5 \div 2 = 2\frac{1}{2}$$

$$5 \text{ cups} = 2\frac{1}{2} \text{ pints}$$

B Change 32 pounds to ounces.

Pound is larger than ounce. Multiply.

$$32 \times 16 = 512$$

$$32 \text{ pounds} = 512 \text{ ounces}$$

Try These Together

1. $8 \text{ qt} = \underline{\quad} \text{ gal}$

HINT: Quart is smaller than gallon.

2. $2\frac{1}{2} \text{ c} = \underline{\quad} \text{ fl oz}$

HINT: Cup is larger than fluid ounce.

PRACTICE**Complete.**

3. $3\frac{2}{5} \text{ T} = \underline{\quad} \text{ lb}$

4. $5 \text{ qt} = \underline{\quad} \text{ pt}$

5. $8 \text{ lb} = \underline{\quad} \text{ oz}$

6. $8,000 \text{ lb} = \underline{\quad} \text{ T}$

7. $5\frac{1}{4} \text{ gal} = \underline{\quad} \text{ qt}$

8. $6 \text{ pt} = \underline{\quad} \text{ qt}$

9. $5\frac{3}{4} \text{ pt} = \underline{\quad} \text{ c}$

10. $12 \text{ qt} = \underline{\quad} \text{ gal}$

11. $16 \text{ fl oz} = \underline{\quad} \text{ c}$

12. Space Exploration During liftoff, the space shuttle's three main engines each use 1,000 lbs of fuel every second. How many tons of fuel do the three engines use together in one second?

13. Food A fast food restaurant sells 16-ounce drinks. How many cups are in a 16-ounce drink?



14. Standardized Test Practice Mauri's little sister weighed exactly 7 pounds when she was born. How many ounces did she weigh?

A 70

B 56

C 112

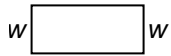
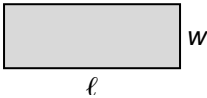
D 23

Answers: 1. 2 2. 20 3. 6,800 4. 10 5. 128 6. 4 7. 21 8. 3 9. $11\frac{1}{4}$ 10. 3 11. 2 12. 1.5 T 13. 2 cups 14. C

6-8

Perimeter and Area (pages 270–273)

The distance around a geometric figure is called its **perimeter**. The **area** (A) of a closed figure is the number of square units needed to cover its surface.

<p>Finding the Perimeter of a Rectangle</p>	<p>The perimeter of a rectangle is the sum of the measures of the sides. It can also be expressed as 2 times the length (ℓ) plus 2 times the width (w). $P = \ell + w + \ell + w$ or $P = 2\ell + 2w$</p>	
<p>Area of Rectangles</p>	<p>The area (A) of a rectangle equals the product of its length (ℓ) and width (w). $A = \ell w$</p>	

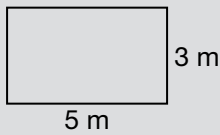
EXAMPLES

A Find the perimeter of a rectangle with a length of 4 yards and a width of 3 yards.
 $P = 2\ell + 2w$
 $P = 2(4) + 2(3)$ Replace ℓ with 4 and w with 3.
 $P = 14$ yd

B Find the area of a rectangle with a length of 20 cm and a width of 4 cm.
 $A = \ell w$ Write the formula for area.
 $A = 20 \times 4$ Replace ℓ with 20 and w with 4.
 $A = 80$ Multiply.
 The area is 80 cm^2 .

Try These Together

1. Find the perimeter of the figure.



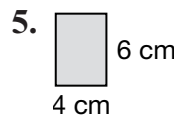
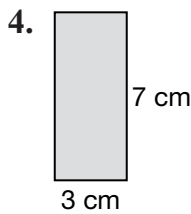
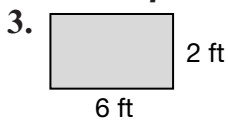
HINT: Use the formula for the perimeter of a rectangle.

2. Find the area of a rectangle with a length of 15 in. and a width of 12 in.

HINT: The area of a rectangle is length times width.

PRACTICE


Find the perimeter and area of each rectangle.



6. rectangle: $\ell = 12$ inches
 $w = 4$ inches

7. rectangle: $\ell = 3$ cm
 $w = 2$ cm

8. rectangle: $\ell = 8$ feet
 $w = 5$ feet

 **9. Standardized Test Practice** The Angtuaco family is putting sod in their backyard. Their backyard is in the shape of a rectangle with a width of 60 feet and a length of 100 feet. How many square feet of sod will they need to cover their backyard?

A 120 ft^2

B 600 ft^2

C $6,000 \text{ ft}^2$

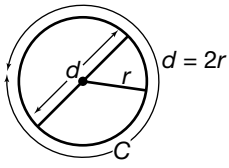
D $1,200 \text{ ft}^2$

Answers: 1. 16 m 2. 180 in^2 3. 16 ft , 12 ft^2 4. 20 cm , 21 cm^2 5. 20 cm , 24 cm^2 6. 32 in , 48 in^2 7. 10 cm , 6 cm^2 8. 26 ft , 40 ft^2 9. C

6-9

Circles and Circumferences (pages 275–277)

A **circle** is the set of all points in a plane that are the same distance from a given point called the **center**. The **diameter** (d) is the distance across the circle through its center. The **radius** (r) is the distance from the center to any point on the circle. The **circumference** (C) is the distance around the circle.

<p>Finding the Circumference of a Circle</p> 	<p>The circumference of a circle is equal to π times its diameter or π times twice the radius.</p> <p>$C = \pi d$ or $C = 2\pi r$</p> <p>You can use 3.14 or $\frac{22}{7}$ as approximate values for π.</p>
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EXAMPLES

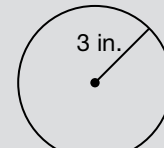
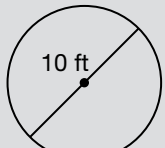
A Find the circumference of a circle with a diameter of 9 inches.

$C = \pi d$
 $C \approx 3.14 \times 9$ *Replace π with 3.14 and d with 9.*
 $C \approx 28.26$ inches

B Find the circumference of a circle with a radius of 5 feet.

$C = 2\pi r$
 $C \approx 2 \times 3.14 \times 5$ *Replace π with 3.14 and r with 5.*
 $C \approx 31.4$ feet

Try These Together
Find the circumference of each circle.

<p>1.  <i>HINT: Replace r with 3.</i></p>	<p>2.  <i>HINT: Replace d with 10.</i></p>
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PRACTICE

Find the circumference of each circle. Use 3.14 or $\frac{22}{7}$ for π . Round to the nearest tenth if necessary.

3. $d = 18$ cm 4. $d = 24$ m 5. $r = 7$ in. 6. $r = 4$ ft

7. **Recreation** A plastic disc for throwing through the air has a diameter of 12 inches. What is its circumference?



8. **Standardized Test Practice** Find the circumference of a circle whose radius is 15 centimeters.

- A** 47.1 cm **B** 94.2 cm **C** 23.6 cm **D** 65.3 cm

Answers: 1. 18.8 in. 2. 31.4 ft 3. 56.5 cm 4. 75.4 m 5. 44 in. 6. 25.1 ft 7. 37.7 in. 8. B

6**Chapter 6 Review****Educated Guess**

Have you ever been to a carnival and seen a booth where the worker guesses people's weight or height? Follow the steps in this activity to see if you can guess the heights of the members of your family.

1. With a parent and a tape measure, find the height of a wall in your home. Make sure the wall has lots of things on it, such as paintings, decorations, a window, and so on. Record the height of your wall in feet.

2. Find objects on your wall that are located at different fractions of the height of the wall. For example, find something, perhaps a light switch, that is located at $\frac{1}{2}$ the height of the wall. Find another object, perhaps the top of a poster, that is located at $\frac{3}{4}$ the height of the wall. If your wall is 8 feet tall, then $\frac{1}{2}$ of 8 feet is 4 feet, and $\frac{3}{4}$ of 8 feet is 6 feet. Record the heights of the different objects on your wall here.

3. Now you are ready to guess someone's height. Have a family member walk by the wall that you measured while you are on the other side of the room. Use the objects that you measured on the wall to estimate your family member's height. Repeat this for other family members and friends. Record the name and height of each person here.

4. Once you have guessed everyone's height, have your parent help you measure everyone's height using the tape measure. How close were your guesses?

Answers are located on page 107.