Lesson 4
Percent

Learning Outcomes

By the end of this section you will be better able to:

- demonstrate the meaning of percent
- solve problems involving percent

Take out a newspaper and have a look through it. Do you see any fractions? How about decimals? Can you find any percents? You will probably find all three in the sports section. The batting averages in baseball are decimals, basketball free throw averages are usually in percents, and fractions are found when comparing games won and total games played. You will build on your understanding how percents, decimals and fractions are all related in this lesson. After we review some skills, we'll focus on using those skills to solve problems.

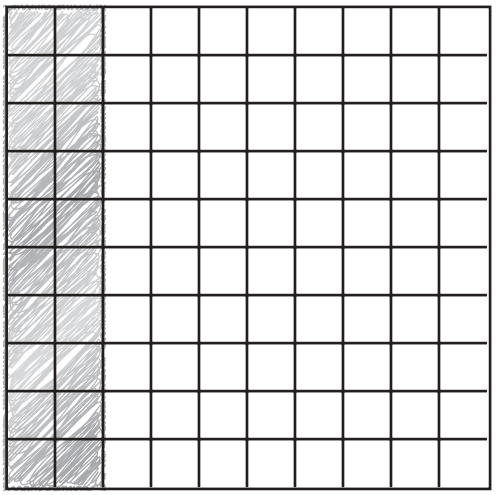
Do you know what percent means?

Let's separate percent into two words: "per" and "cent."

When somebody says that they are driving at 50 kilometres per hour, we can write this as 50 km/h. We can see that "per" is written as a fraction, so whenever you see the word "per" you can think of a fraction.

Now "cent" is French for 100. So whenever you see percent think of "out of 100." This is a fraction with a denominator of 100.

For example, 20% is $= \frac{20}{100}$



We can also write percents as fractions. For instance, 72% is $\frac{72}{100}$.

Remember, we need to simplify fractions.

$$\frac{72}{100} = \frac{72 \div 4}{100 \div 4} = \frac{18}{25}$$

Let's review one more thing. Percents can also be written as decimals. Since a percent can be written as a fraction over 100, we can easily write it as a decimal. Let's take a look at an example.

$25\% = \frac{25}{100} = 0.25$

$33\% = \frac{33}{100} = 0.33$

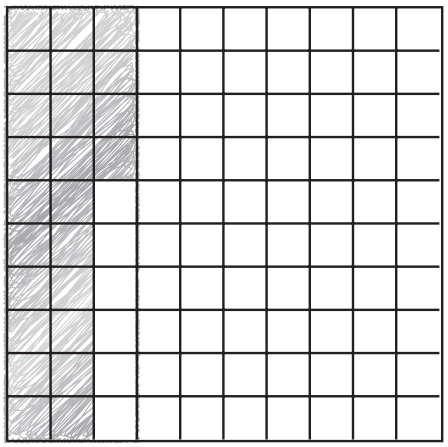
Here are a couple of helpful hints!

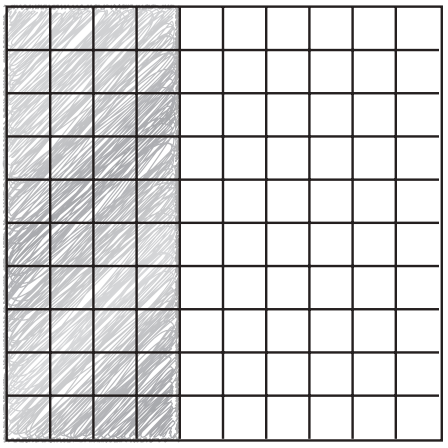
The two 00s in the 100 remind us that there are two decimal points when changing a % to a decimal. For instance 20% = 0.20.

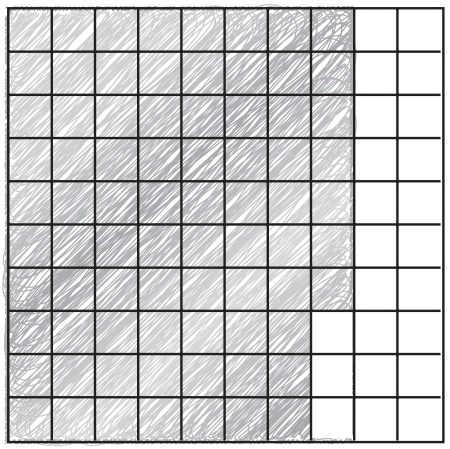
The two 00s in the % symbol also can remind us that % is "**o**ut **o**f" 100. For example, 15% is 15 "out of 100."

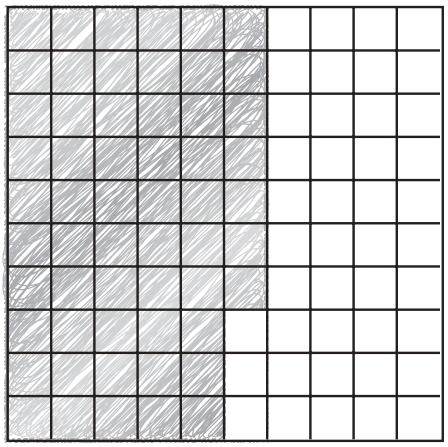
Exercises 4.1

1. Here are some 10 by 10 grids. Find the percent that is shaded in each.

a.  = ____ %

b.  = ____ %

c.  = ____ %

d.  = ____ %

2. Write the following percents as reduced fractions.

   a. 30% =

   b. 85% =

   c. 46% =

   d. 55% =

   e. 28% =

3. Now change these percents to decimals.
   a. 15%

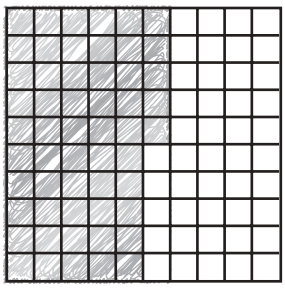
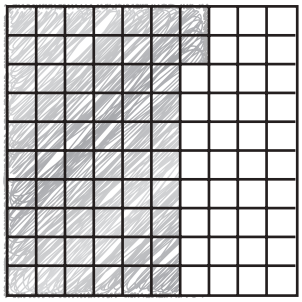
   b. 65%

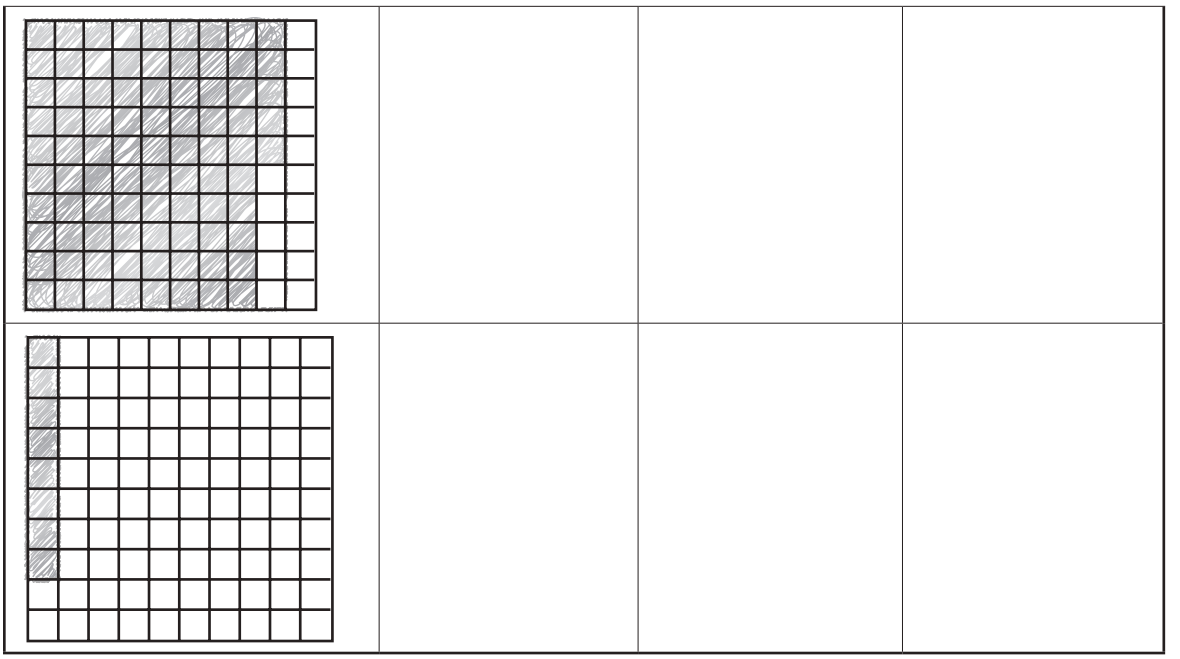
   c. 87%

   d. 59%

   e. 49%

4. Write the amount shaded in the 10 by 10 grid as a fraction (in lowest terms), percent, and decimal.

10 by 10 grid Tenths and hundredths	Fraction (in lowest terms)	Percent	Decimal
			
			



5. Samuel received 75% on his last test. What fraction of the test did he get right?

6. Norio received a quiz back. He received a mark of 3/5. What percent did he get on the quiz?

7. Jessica chose a page out of the newspaper and saw that ads took up one quarter of the page. What percent of the page is covered in ads?

8. Pierre chose a page out of the newspaper and saw that ads took up two thirds of the page. How can this be written as a decimal?

9. Fill in the chart below. The first one is done for you.

Fraction (in lowest terms)	Decimal	Percent
$\frac{1}{4}$	0.25	25%
a. $\frac{19}{20}$		
b. $\frac{43}{50}$		
c.	0.32	
d.	0.74	
e.		92%
f.		8%

Turn to the Answer Key at the end of the module to check your work.

Problem Solving with Percent

All of the word problems we are going to work with use the following equation:

(percent)	×	(original number)	=	(amount)
P	×	**O**	=	A

Here's what you need to know to use this equation:

Percent (P) = the percent in DECIMAL form

Original number (O) = the number after the word "of"

Amount (A) = percent of a number

50% of 20 is 10, so let's see what this will look like in the equation:

(percent)	×	(original number)	=	(amount)
(0.5)	×	(20)	=	(10)

We will be looking at problems where the percent, original number (of number), or the amount is missing.

Let's take a closer look at the equation: **P × O = A**

This equation is solved for A. But what if we want to find P?

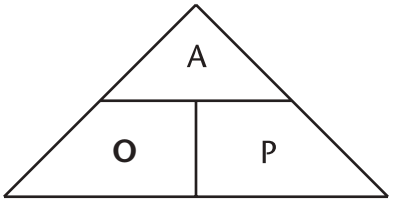
You will learn more about ways to solve equations like this in a future Math course. For now, here is a short explanation.

To have P on its own, we need to move the **O**. Since the P and **O** are being multiplied we need to "un-multiply" them. Un-multiplying is the same dividing. We "un-multiply" by dividing both sides by **O.**

$$\frac{P \times \mathbf{O}}{\mathbf{O}} = \frac{A}{\mathbf{O}} \rightarrow P = \frac{A}{\mathbf{O}}$$

We can use the same "un-multiply" method to solve for **O**. We can isolate **O** by dividing both sides by P. $O = \frac{A}{P}$.

It is important to understand how to isolate variables. But in case you have trouble understanding this right away, you can use a handy trick. Rewrite the equation in a triangle.



A = amount

O = original number (of number)

P = percent in decimal form

Now we will see how to use this triangle by going through examples.

Example 1

20% of 40 is what number?

We know:

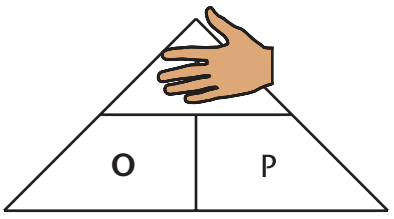
The percent is 20% = 0.20 and the number after "of" is 40 so this is our original number (of number).

P = 0.20

O = 40

A = ?

To find the amount, we cover the A in the triangle and see what we have:



Since the **O** and the P are next to each other, we multiply them.

This is the same as our original equation:

(percent) × (original number) = (amount)

A = O × P

A = 0.20 × 40 = 8

So we know the amount is 8.

Example 2

What percent of 45 is 27?

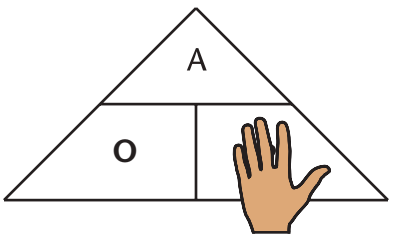
We do not know the percent. The number after "of" is 45, so this is our original number (of number) and our amount is 27.

P = ?

O = 45

A = 27

We do not know P, so let's cover the P in our triangle to see what we need to do:



Since the A is over the O, we know $P=\frac{A}{O}$. This is the same equation we found earlier.

$$P=\frac{A}{O}$$

$$P=\frac{27}{45}=0.6=60\%$$

Example 3

80% of what number is 29.6?

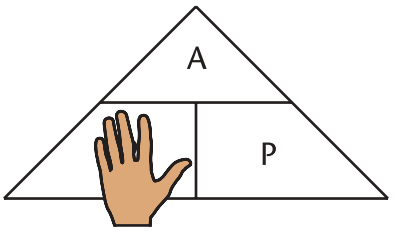
The percent is 80% = 0.80, we do not know the original number (of number), and our amount is 29.6.

P = 0.80

O = ?

A = 29.6

We do not know *O*, so let's cover the *O* in our triangle to see what we need to do:



A is over the P so we need to divide.

$$O = \frac{A}{P}$$

$$O = \frac{29.6}{0.80} = 37$$

Our original number is 37.

Some simple steps can make problem solving easier. In this lesson we'll focus on the following:

1. What is the question asking for?	Read through the problem and identify what you are trying to find. Knowing what sort of answer you're looking for can help you solve the problem.
2. Estimate an answer.	If you have an estimate, then you'll know if your answer is reasonable.
3. Find an answer.	Do the appropriate calculations, and come up with an answer.
4. Make sure the answer is reasonable.	This is a good way to check your work and can help you identify if you've made an error. Compare your answer with your estimate. Is it close? Why or why not? Remember that just because your answer isn't the same as your estimate, doesn't make it wrong. Look carefully at how you rounded the numbers to make your estimate. Stop to think about how your answer compares to your estimate, and decide if your solution is reasonable.

Here's an example problem. We'll use the steps outlined above to solve it.

Scott just ate dinner at a restaurant. His bill came to $23.54. He wants to leave his waiter a 15% tip. How much money should Scott leave for the tip?

Let's follow the four steps:

1. Write what this question is asking (e.g., find 15% of $23.54).
2. Estimate an answer.
3. Find an answer.
4. Make sure the answer is reasonable.

1. What is the question asking for?	What is 15% of $23.54?
2. Estimate an answer.	The bill is about $24. 10% of $24 is $2.40. 15% is 1½ times as much as a 10%. So, $2.40 + $1.20 = $3.60.
3. Find an answer.	The percent is 15% = 0.15, the original number (of number) is 23.54, and we want to find the amount. P = 0.15 **O** = 23.54 A = ? A = **O** × P A = 23.54 × 0.15 = 3.531 = $3.53 The tip should be $3.53.
4. Make sure the answer is reasonable. If not then check over your work.	$3.53 is very close to our estimate, so our answer is reasonable.

Don't forget to answer the question in a sentence.

Scott should leave $3.53 for a tip.

Here are some definitions you may need to review:

Discount = how much money is taken off the original price?

Example: A jacket is originally $100. It is on sale at 25% off.

The discount = 100 × 0.25 = $25

Sales Price = original price – discount.

Example: A jacket is originally $100 and the discount is $25.

The sale price = $100 – $25 = $75

Exercises 4.2

Answer the following questions by following four steps.

1. Write what this question is asking.
2. Estimate an answer. (To estimate, round off the numbers. Then use these rounded numbers to find an estimated answer.)
3. Find an answer.
4. Make sure the answer is reasonable. (Make sure your answer in step 3 is close to your estimate in step 2.)

A chart is provided to guide you for the first few questions. Remember to round to 2 decimal places when working with money.

1. A shirt is regularly priced at $37.49. It is discounted at 30% off. How much is the discount?

What is the question asking for?	
Estimate an answer.	
Find an answer.	
Make sure the answer is reasonable. If not then check over your work.	

2. Christopher just received a mark of 59 out of 70 on his math test. What percent score did he get on the test?

What is the question asking for?	
Estimate an answer.	
Find an answer.	
Make sure the answer is reasonable. If not then check over your work.	

3. Jamie bought a shirt 30% off. It was discounted at $11.27 less than the original price. What was the original price?

What is the question asking for?	
Estimate an answer.	
Find an answer.	
Make sure the answer is reasonable. If not then check over your work.	

4. Two years ago Ben was 120 cm tall. He has grown 20% since then. What is Ben's current height?

Turn to the Answer Key at the end of the module to check your work.

Lesson 5
Ratios and Proportion

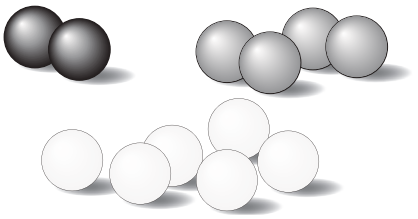
Learning Outcomes

By the end of this section you will be better able to:

- identify and create part-to-part and part-to-whole ratios
- identify and create a proportional statement using ratios

Ratios

Look at the picture below.



We can see from this picture that:

- There are 2 black marbles.
- There are 4 grey marbles.
- There are 6 white marbles.
- There are 12 marbles all together.

Using this information, we can make some comparisons. For example, we can compare:

- the number of grey marbles to the number of white marbles
- the number of black marbles to the number of grey marbles to the number of white marbles
- the number of white marbles to the total number of marbles

In math, we can describe these comparisons using ratios. A **ratio** is a comparison of two or more numbers. We can write each comparison listed above as a ratio by separating the numbers with a colon.

the number of grey marbles to the number of white marbles	4:6
the number of black marbles to the number of grey marbles to the number of white marbles	2:4:6
the number of white marbles to the total number of marbles	6:12

Notice that the order in which the numbers appear is very important. Write the numbers in the ratio in the same order that they are listed in the words.

grey to white

4 : 6

Each number in a ratio is called a *term*. The ratio 4:6 is a *two-term* ratio because it contains two terms, 4 and 6. The ratio 2:4:6 is a *three-term* ratio because it contains three terms, 2, 4, and 6.

Part-to-Part Ratios

A *part-to-part* ratio describes certain parts of a group, or certain parts of a whole. In the marble example above, the ratio of grey marbles to white marbles (4:6) is a part-to-part ratio. It compares different parts of a collection of marbles. The three-term ratio 2:4:6 is also a part-to-part ratio. It describes three parts of the collection.

Part-to-Whole Ratios

A *part-to-whole* ratio describes a part of a group in comparison to the whole group. In the marble example above the ratio of white marbles to the total number of marbles is a part-to-whole ratio. It compares a specific part of the group to the whole group.

Part-to-whole ratios can also be written as fractions. For example, we could write the ratio of white marbles to the total number of marbles as 6:12 or $\frac{6}{12}$.

Ratios can be easier to understand if they are in lowest terms.

Both 6 and 12 are divisible by 6.

$6 \div 6 = 1$

$12 \div 6 = 2$

So $\frac{6}{12}$ and $\frac{1}{2}$.

We could say that $\frac{6}{12}$ and $\frac{1}{2}$ are equivalent fractions.

We could also say that $\frac{6}{12}$ in lowest terms is $\frac{1}{2}$, because the fraction $\frac{1}{2}$ cannot be reduced.

Six of the twelve marbles are white. One out of every two marbles is white. Both of these sentences express the same relationship.

6:12 = 1:2

Proportions

Think about a different pile of marbles. This one is bigger - there are 50 marbles al together.

10 of them are black

15 are grey

25 are white.

How does this pile compare the the smaller collection of marbles we were looking at before?

To answer that question, we will describe some of the relationships using ratios and then write those ratios in lowest terms.

Ratios are easier to understand and compare if they are in lowest terms.

First, we'll look at the ratio of while marbles to the total number of marbles.

Small pile of marbles	Large pile of marbles
white : total	white : total
= 6:12	= 25:50
= 1:2	= 1:2

When we write these ratios in lowest terms, we can see that they are equal.

$$6:12 = 25:50$$

A pair of equivalent ratios is called a **proportion**. We say that these two ratios are proportional to each other.

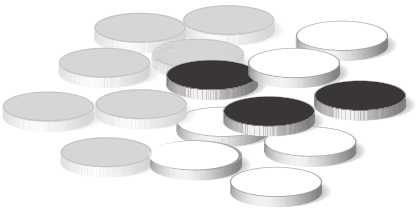
Let's look at another comparison. Are the ratios of black to grey marbles proportional?

Small pile of marbles	Large pile of marbles
black : grey	black : grey
= 2:4	= 10:15
= 1:2	= 2:3

When we write these ratios in lowest terms, we can see that they are NOT proportional.

Exercises 5.1

1. Look at the counters below. The ratios below describe how the coloured counters relate to each other. Explain the relation for each ratio. The first one has been done for you.



   a. 3:7 Number of black counters to the number of grey counters

   b. 3:6 _____

   _____

   c. 7:16 _____

   _____

   d. 3:6:7 _____

   _____

   e. 3:8 _____

   _____

2. Classify each ratio in question 1 as either a part-to-part ratio or a part-to-whole ratio.

   a.

   b.

   c.

   d.

   e.

3. Write a part-to-part ratio for each of the comparisons below.

   a. There are 12 boys and 15 girls in a Grade 8 math class.

   b. To prepare pancakes from a packaged mix, you need 1 cup of water and 2 cups of pancake mix.

   c. This week, the forecast calls for three days of sunshine and four days of rain.

   d. In your dresser drawer you have one pair of pants, three pairs of shorts, and four T-shirts.

4. For each of the comparisons in question 3, write a part-to-whole ratio.

   a.

   b.

   c.

   d.

5. Which of the following pairs of ratios are proportional? How do you know?

   a. 2:4 and 6:12

   b. 1:3 and 4:15

   c. 16:30 and 8:15

Turn to the Answer Key at the end of the module to check your work.

Answer Key

Lesson 1: Fractions

Exercises 1.1

1. (a) $\frac{3}{12}$ $\frac{1}{4}$

   (b) $\frac{2}{12}$ $\frac{1}{6}$

2. (a) $\frac{6}{12}$ $\frac{3}{6}$ $\frac{1}{2}$ (any two)

   (b) $\frac{2}{12}$ $\frac{1}{6}$

3. (a) $\frac{1}{2}$

   (b) $\frac{1}{4}$

   (c) $\frac{3}{4}$

   (d) $\frac{1}{2}$

4. (a) $\frac{1}{3}$ $\frac{2}{6}$

   (b) $\frac{3}{6}$ $\frac{1}{2}$

   (c) $\frac{2}{6}$ $\frac{1}{3}$

   (d) $\frac{4}{8}$ $\frac{1}{2}$ or $\frac{2}{4}$ (any two)

Exercises 1.2

1. (a) 1, 2, 4, 8
   (b) 1, 2, 3, 4, 6, 12
   (c) No, because 2 or 4 can divide into the top and bottom (numerator and denominator).

2. (a) 1, 3, 5, 15
   (b) 1, 2, 4, 7, 14, 28
   (c) Yes, because 1 is the only common factor.

3. (a) Because 2 will divide into the numerator and denominator.
   (b) Because 5 will divide into the numerator and denominator.

4. (a) $\frac{1}{4}$ $\frac{2}{8}$ $\frac{3}{12}$ $\frac{4}{16}$ $\frac{5}{20}$

   (b) $\frac{5}{8}$ $\frac{10}{16}$ $\frac{15}{24}$ $\frac{20}{32}$ $\frac{25}{40}$

Exercises 1.3

1. (a) $\frac{3}{4}$ $\frac{6}{8}$

   (b) $\frac{1}{4}$ $\frac{2}{8}$

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

3. one (1)

4. (a) $\frac{3 \times 4}{3 \times 5}$ (b) $\frac{5 \times 4}{5 \times 5}$ (c) $\frac{16}{20}$ (d) $\frac{24}{30}$

5. (a) $\frac{20}{24}, \frac{25}{30}, \frac{30}{36}, \ldots$

   (b) $\frac{9}{30}, \frac{15}{50}, \frac{18}{60}, \ldots$

   (c) $\frac{20}{32}, \frac{25}{40}, \frac{35}{56}, \ldots$

   (d) $\frac{3}{24}, \frac{4}{32}, \frac{6}{48}, \ldots$

5. (a) $\frac{3}{5}$ (b) $\frac{1}{3}$ (c) $\frac{9}{10}$

(d) $\frac{1}{7}$ (e) $\frac{2}{7}$ (f) $\frac{3}{4}$

(g) $\frac{3}{7}$ (h) $\frac{3}{14}$ (i) $\frac{1}{2}$

(j) $\frac{2}{3}$ (k) $\frac{4}{5}$ (l) $\frac{8}{15}$

(m) $\frac{5}{12}$ (n) $\frac{5}{8}$ (o) $\frac{3}{26}$

Lesson 2: Adding and Subtracting Fractions

Exercises 2.1

1. (a) $\frac{6}{7}$

(b) $\frac{5}{10} = \frac{1}{2}$

(c) $\frac{9}{9} = 1$

(d) $\frac{4}{6} = \frac{2}{3}$

(e)
$$\begin{array}{r} \frac{2}{3} = \frac{4}{6} \\ +\ \frac{1}{6} = \frac{1}{6} \\ \hline \frac{5}{6} \end{array}$$

(f)
$$\begin{array}{r} \frac{1}{4} = \frac{2}{8} \\ +\ \frac{3}{8} = \frac{3}{8} \\ \hline \frac{5}{8} \end{array}$$

(g) $\frac{1}{5} = \frac{2}{10}$
$+\frac{3}{10} = \frac{3}{10}$
$\frac{5}{10} = \frac{1}{2}$

(h) $\frac{1}{6} = \frac{1}{6}$
$+\frac{1}{2} = \frac{3}{6}$
$\frac{4}{6} = \frac{2}{3}$

(i) $\frac{2}{5} = \frac{4}{10}$
$+\frac{1}{10} = \frac{1}{10}$
$\frac{5}{10} = \frac{1}{2}$

2. (a) $\frac{5}{9}$

(b) $\frac{5}{10} = \frac{1}{2}$

(c) $\frac{4}{12} = \frac{1}{3}$

(d) $\frac{0}{6} = 0$

(e) $\frac{2}{6} = \frac{1}{3}$

(f) $\frac{7}{9} = \frac{7}{9}$
$-\frac{1}{3} = \frac{3}{9}$
$\frac{4}{9}$

(g) $\frac{8}{12} = \frac{8}{12}$
$-\frac{1}{4} = \frac{3}{12}$
$\frac{5}{12}$

(h) $\frac{5}{10} = \frac{5}{10}$
$-\frac{1}{2} = \frac{5}{10}$
$\frac{0}{10} = 0$

(i) $\frac{9}{10} = \frac{9}{10}$
$-\frac{2}{5} = \frac{4}{10}$
$\frac{5}{10} = \frac{1}{2}$

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

Lesson 3: Decimals

Exercises 3.1

1. $\frac{3}{5}$ 2. $\frac{1}{2}$
3. $\frac{9}{10}$ 4. $\frac{1}{8}$
5. $\frac{5}{10}$ 6. $\frac{1}{5}$
7. $\frac{2}{3}$ 8. $\frac{2}{6}$
9. $\frac{70}{100}$ 10. $\frac{7}{8}$

Exercises 3.2

A. 1. $\frac{7}{10}$, 0.7 2. $\frac{8}{10}$, 0.8
3. $\frac{7}{10}$, 0.7 4. $\frac{3}{10}$, 0.3
5. $\frac{6}{10}$, 0.6 6. $\frac{9}{10}$, 0.9

B. 1. $\frac{1}{10}$ 2. $\frac{1}{10}$
3. $\frac{7}{10}$ 4. $\frac{5}{10}$
5. $\frac{9}{10}$ 6. $\frac{8}{10}$

C. 1. 0.8
2. 0.2
3. 0.3
4. 0.9
5. 0.6
6. 0.5

Exercises 3.3

1. 0.3 cm
2. 0.5 cm
3. 0.8 cm
4. 0.9 cm
5. 1.0 cm or $\frac{10}{10}$ cm

Exercises 3.4

A.
1. 7605
2. 40 200
3. 923
4. 8001
5. 68 000

B.
1. forty-two hundred or four thousand two hundred
2. sixty-nine thousand
3. five hundred seven
4. thirty thousand
5. four hundred six thousand

Exercises 3.5

A.
1. 0.47
2. 1.03
3. 0.304
4. 0.006

B.
1. **tenths**—The number of parts is written on the ***first*** place to the right of the decimal point.
2. **hundredths**—The number of parts is written on the ***second*** place to the right of the decimal point.
3. **thousandths**—The number of parts is written on the ***third*** place to the right of the decimal point.

C. 1. 0.8
2. 600.09
3. 0.002
4. 7.51
5. 0.044
6. 500.007

D. 1. eight tenths
2. three hundredths
3. four thousandths
4. five and thirty-six hundredths
5. two thousands and one hundred and fifty thousandths or fifteen hundredths

Exercises 3.6

1. 30
2. 70 000
3. 90 000
4. 8000
5. 61 000
6. 20 000
7. 191 000
8. 39 100

Exercises 3.7

A. 1. 0.3
2. 0.2
3. 5.6
4. 0.9
5. 3498.0
6. 679.0

B. 1. 0.30
2. 0.90
3. 0.89
4. 67.80
5. 19.20
6. 3891.00

C. 1. 0.030
2. 0.900
3. 0.070
4. 43.100
5. 391.000
6. 4.200

Exercises 3.8

A. 1. 0.46
2. 4.02
3. 0.72
4. 2.70
5. 0.22
6. 7.60

B. No – appropriate picture to show they are the same.

Exercises 3.9

1. 30
2. 300
3. 4000
4. 7000
5. 100 000
6. 50 000
7. 0
8. 2 000 000

Exercises 3.10

A. 1. 4.7
2. 11.42
3. 0.07
4. 0.9

B. 1. 0.06 and $\frac{6}{100}$
2. 0.2 and $\frac{2}{10}$
3. 0.05 and $\frac{5}{100}$
4. 0

C. 1.

Tens	Ones		Tenths	Hundredths
	8	.	4	5

2.

Tens	Ones		Tenths	Hundredths
1	2	.	0	7

D. 1. 7

2. $\frac{7}{10}$ or 0.7

3. $\frac{9}{100}$ or 0.09

4. 4

5. 0

6. 40

E. 1. $0.21 > 0.12$

2. $3.16 < 4.99$

3. $17.21 > 7.89$

4. $13.01 > 13.00$

5. $619.444 < 691.444$

6. $99.002 > 98.763$

7. $11.310 > 11.301$

8. $5.005 < 5.050$

9. $783.90 < 784.90$

10. $20.016 < 20.106$

Exercises 3.11

A. 1. 7.7 2. 3.40

3. 17.80 4. 2.30

5. 19.9 6. 25.6

B. 1. 0.034 0.039 0.043 0.304 0.344

2. 390.99 391.02 391.22 392.01 392.21

C. 1. 178.41 79.41 79.14 79.07 77.04

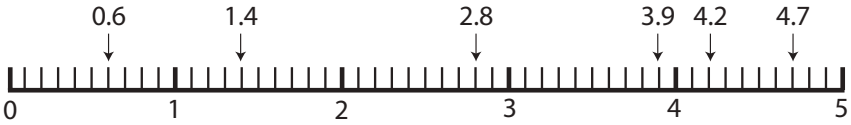
2. 0.200 0.120 0.012 0.002 0.001

Exercises 3.12

	Number	Common Fraction	Decimal Fraction
1.	$\frac{12}{10}$	$1\frac{2}{10}$	1.2
2.	$\frac{23}{10}$	$2\frac{3}{10}$	2.3
3.	$\frac{38}{10}$	$3\frac{8}{10}$	3.8
4.	$\frac{26}{10}$	$2\frac{6}{10}$	2.6
5.	$\frac{17}{10}$	$1\frac{7}{10}$	1.7
6.	$\frac{10}{10}$	1	1.0

Exercises 3.13

A.



B. 1. 0.4, 2.1, 4.2
2. 7.1, 7.9, 8.2
3. 5.3, 5.5, 6, 6.1
4. 6.8, 7, 7.1, 7.3
5. 0.7, 1, 1.6, 1.9, 2.3
6. 3, 3.9, 4, 4.1

Exercises 3.14

1. 0.7, 2.7, 7.1, 7.2, 7.8
2. 0.9 9.0, 9.1, 9.6, 9.9
3. 10, 10.1, 10.6,10.9, 11.2
4. 0.9, 3.7, 4.8, 5.1, 7.3, 8.3

Exercises 3.15

1.	2.	3.
34.150	481.200	14.900
600.000	13.000	6.840
0.051	691.510	0.050
6.180	0.002	182.130
9.136	1732.000	72.000

Exercises 3.16

A. 1. 0.6 2. 1.0

3. 1.1 4. 1.7

B. 1. $0.2 + 0.7 = \mathbf{0.9}$ 2. $2.9 + 3.5 = \mathbf{6.4}$ 3. $27.2 + 47.9 = \mathbf{75.1}$ 4. $21.6 + 75.2 + 49.2 = \mathbf{146.0}$

C. 1. $14.5 + 5.3 = 19.8$ 2. $\$12.38 + 1.89 + 43.98 = \$58.25$ 3. $6.2 + 14.6 = 20.8$

4. $8.403 + 12.000 + 3.980 = 24.383$ 5. $33.9 + 41.2 = 75.1$

D. 1. $6.2 + 4.8 = 11.0$

Jenny jogged 11.0 km.

2. $1.3 + 1.6 + 1.7 + 1.6 = 6.2$

Laurie's combined score was 6.2 m.

Exercises 3.17

1. 37.995
2. 100.84
3. 191.713
4. 115.427

$$\begin{array}{r} 13.512 \\ +\,9.7 \\ \hline 23.212 \text{ kg} \end{array}$$

Exercises 3.18

1. $\begin{array}{r} {\scriptstyle 3\,1} \\ 4\not{5}9 \\ -389 \\ \hline 70 \end{array}$
2. $\begin{array}{r} {\scriptstyle 8\,1} \\ 3\not{9}64 \\ -1892 \\ \hline 2072 \end{array}$
3. $\begin{array}{r} {\scriptstyle 8\,1\,2\,1} \\ \not{9}7\not{3}3 \\ -4819 \\ \hline 4914 \end{array}$
4. $\begin{array}{r} {\scriptstyle 5\,1\,4\,1} \\ 6\not{0}5\not{1} \\ -3944 \\ \hline 2107 \end{array}$
5. $\begin{array}{r} {\scriptstyle 8\,1\,9\,1} \\ \not{9}2\not{0}5 \\ -3856 \\ \hline 5349 \end{array}$

Exercises 3.19

A.
1. 0.3
2. 0.2
3. 0.7
4. 0.5
5. 0.5
6. 0.1

B.
1. $\begin{array}{r} \$284.16 \\ -\$103.79 \\ \hline \$180.37 \end{array}$
2. $\begin{array}{r} 423.1 \\ -16.5 \\ \hline 406.6 \end{array}$
3. $\begin{array}{r} 18.00 \\ -9.37 \\ \hline 8.63 \end{array}$

C.
1. $\begin{array}{rr} 34.5 & 35 \\ -23.6 & -24 \\ \hline 10.9 & 11 \end{array}$
2. $\begin{array}{rr} 17.4 & 17 \\ -10.7 & -11 \\ \hline 6.7 & 6 \end{array}$
3. $\begin{array}{rr} 23.50 & 24 \\ -19.78 & -20 \\ \hline 3.72 & 4 \end{array}$
4. $\begin{array}{rr} 431.25 & 431 \\ -330.55 & -331 \\ \hline 100.70 & 100 \end{array}$

Exercises 3.20

A. 1. 2.402
2. 0.086
3. $822.44
4. 98.246

B. 1.
$$\begin{array}{r} 45.61 \\ -\,43.19 \\ \hline 2.42 \end{array}$$
Chris won the race by 2.42 minutes.

2.
$$\begin{array}{rr} \$37.89 & \$31.11 \\ -\,6.78 & +\,1.87 \\ \hline \$31.11 & \$32.98 \end{array}$$
She paid $32.98.

Lesson 4: Percent

Exercises 4.1

1. a. 24
   b. 40
   c. 77
   d. 57

2. a. $30\% = \frac{30}{100} = \frac{3}{10}$
   b. $85\% = \frac{85}{100} = \frac{17}{20}$
   c. $46\% = \frac{46}{100} = \frac{23}{50}$
   d. $55\% = \frac{55}{100} = \frac{11}{20}$
   e. $28\% = \frac{28}{100} = \frac{7}{25}$

3. a. 0.15
   b. 0.65
   c. 0.87
   d. 0.59
   e. 0.49

4. a. $\frac{55}{100} = \frac{11}{20}$, 55%, 0.55
   b. $\frac{62}{100} = \frac{31}{50}$, 62%, 0.62
   c. $\frac{85}{100} = \frac{17}{20}$, 85%, 0.85
   d. $\frac{8}{100} = \frac{2}{25}$, 8%, 0.08

5. $75\% = \frac{75}{100} = \frac{75 \div 25}{100 \div 25} = \frac{3}{4}$

6. $\frac{3}{5} = \frac{3 \times 20}{5 \times 20} = \frac{60}{100} = 60\%$

7. 25%

8. 0.67

9.

	Fraction (in lowest terms)	Decimal	Percent
	$\frac{1}{4}$	0.25	25%
a.	$\frac{19}{20}$	**0.95**	**95%**
b.	$\frac{43}{50}$	**0.86**	**86%**
c.	$\frac{32}{100} = \frac{8}{25}$	0.32	**32%**
d.	$\frac{74}{100} = \frac{37}{50}$	0.74	**74%**
e.	$\frac{92}{100} = \frac{23}{25}$	**0.92**	92%
f.	$\frac{8}{100} = \frac{2}{25}$	**0.08**	8%

Exercises 4.2

1.

1. What is the question asking for?	What is 30% of $37.49?
2. Estimate an answer.	Estimate 30% of $40.00. 10% of $40.00 is $4.00. So, 30% of $40.00 = $12.00.
3. Find an answer.	P = 0.30 A = **O** × P **O** = $37.49 A = $37.49 × 0.30 A = ? A = $11.25 The discount is $11.25.
4. Make sure the answer is reasonable. If not then check over your work.	$11.25 is close to $12.00. The answer is reasonable.

2.

1. What is the question asking for?	Write $\frac{59}{70}$ as a percent.
2. Estimate an answer.	59 is close to 60. 70 is close to 75. $\frac{60}{75} = \frac{20}{25} = \frac{80}{100} = 80\%$
3. Find an answer.	$\frac{59}{70} = 0.8428.... = 84\%$
4. Make sure the answer is reasonable. If not then check over your work.	The answer is close to estimate.

3.

1. What is the question asking for?	\$11.27 is 30% of what?
2. Estimate an answer.	P = 0.30 **O** = ? A = \$12.00 $O = \frac{A}{P}$ $= \frac{12.00}{0.30}$ $= \frac{120}{3}$ $= 40$
3. Find an answer.	P = 0.30 **O** = ? A = \$11.27 $O = \frac{A}{P}$ $= \frac{11.27}{0.30}$ $= 37.57$ The original price is \$37.57.
4. Make sure the answer is reasonable. If not then check over your work.	The answer is close to estimate.

4. 20% of 120 cm

   $0.20 \times 120 = 24$ cm

   Bert grew 24 cm. His current height is 144 cm

Lesson 5: Ratios and Proportion

Exercises 5.1

1. a. number of black counters to the number of grey counters

   b. number of black counters to the number of white counters

   c. number of grey counters to the total number of counters

   d. number of black counters to the number of white counters to the number of grey counters

   e. number of white counters to the total number of counters (6:16 can also be written as 3:8, an equivalent ratio)

2. a. part-to-part ratio

   b. part-to-part ratio

   c. part-to-whole ratio

   d. part-to-part ratio

   e. part-to-whole ratio

3. a. 12:15 (can also be written 4:5)

   b. 1:2

   c. 3:4

   d. 1:3:4

4. Answers may vary depending on which part you chose to compare.

   a. number of boys to total number of students 12:27
   number of girls to total number of students 15:27

   b. cups of water to total cups of ingredients 1:3
   cups of pancake mix to total cups of ingredients 2:3

   c. days of sunshine to days in the week 3:7
   days of rain to days in the week 4:7

   d. number of pants to total number of clothing articles 1:8
   number of shorts to total number of clothing articles 3:8
   number of T-shirts to total number of clothing articles 4:8

5. a. The ratios are proportional. Multiply both terms in 2:4 by 3 to get 6:12.

   b. The ratios are not proportional. There is no factor that you can multiply or divide either of the ratios by to get the other ratio.

   c. The ratios are proportional. Divide both terms in 16:30 by 2 to get 8:15.