# CHAPTER 1: WHOLE NUMBERS

We will begin our study of Arithmetic by learning about the number system we use today. The Base-10 Number System or Hindu-Arabic Numeral System began its development in India in approximately 50 BC. By the 10th century, the system had made its way west to the Middle East where it was adopted and adapted by Arab mathematicians. This number system moved further west to Europe in the early 13th century when the Italian mathematician Fibonacci recognized its efficiency and promoted its use. In this lesson, we will learn the basics that make this number system so useful and how to perform basic arithmetic operations in our number system.

| Chapter Objectives |
| --- |
| By the end of this chapter, students should be able to:<br>✓ Write numbers in place value, extended form, and word form<br>✓ Identify place values and write place value form for large numbers<br>✓ Round numbers using place value<br>✓ Identify addition and subtraction application problems<br>✓ Use strategies to solve addition and subtraction application problems<br>✓ Identify multiplication and division application problems<br>✓ Use strategies to solve multiplication and division application problems<br>✓ Represent and evaluate addition and subtraction applications symbolically that contain more than one operation<br>✓ Represent and evaluate multiplication and division applications symbolically that contain more than one operation<br>✓ Represent and evaluate +, −, ×, ÷ applications symbolically that contain more than one operation<br>✓ Represent and evaluate applications symbolically that use parentheses as a grouping symbol<br>✓ Represent applications using the notation of exponents<br>✓ Write the language and symbolism of exponents in multiple ways<br>✓ Use PEMDAS to evaluate expression |

## Contents

## SECTION 1.1 PLACE VALUE AND ROUNDING
## A. Definition

***Whole numbers*** are often referred to as ***the counting numbers plus the number 0***. The first few whole numbers are written as

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 …

There are ten *digits* that we can use to represent *any* whole number. They are

0, 1, 2, 3, 4, 5, 6, 7, 8, 9

Since we use ten digits, our number system is a ***base-10 number system***. This means each place value is 10 times as large as the place value to its right. The first few place values are 1's, 10's, 100's, 1000's, etc... The typical way we write a number is called the ***place value form of a number.*** It is based on the idea that the placement of each numeral *determines the value* of the quantity.

Consider the whole numbers 264 and 642. They use the same digits, but the digits are in a different order relative to one another. To see how the ordering of the digits makes a difference, we will represent these numbers in multiple ways as shown below.

| Place Value Form | Place Value Chart | | | Expanded Form | Word Name |
|:---:|:---:|:---:|:---:|:---:|:---:|
| 264 | **Hundreds** 2 | **Tens** 6 | **Ones** 4 | 200 + 60 + 4 | two hundred sixty-four |
| 642 | **Hundreds** 6 | **Tens** 4 | **Ones** 2 | 600 + 40 + 2 | six hundred forty-two |

**Important Notes on the Word Name for a Number:**

1. We do not use the word "and" when writing a word name for a whole number. This word will be used later to connect a whole number with a fraction or decimal.

2. We use a hyphen to connect the ten's and one's place of a whole number if these digits cannot be written as a single word. (i.e. 35 is written as *thirty-five*, 50 is written as *fifty* (one word so no hyphen), and 13 is written as *thirteen* (one word so no hyphen))

## B. Writing the Expanded Form, Word Name, and Place Value Form

| | **Media Lesson:** |
|---|---|
| [QR code] | Writing the Expanded Form, Word Name, and Place Value Form |
| | (Duration 4:23) |

*View the video lesson, take notes and complete the problems below.*

Write the following numbers in the indicated forms.

**a)** 423

Place Value Form in a Table:

| 100's | 10's | 1's |
|---|---|---|
| | | |

Expanded Form: _____

Word Name: _____

**b)** Eight hundred sixteen

Place Value Form in a Table:

| 100's | 10's | 1's |
|---|---|---|
| | | |

Number Form: _____

Expanded Form: _____

**c)** $900 + 40 + 6$

Place Value Form in a Table:

| 100's | 10's | 1's |
|---|---|---|
| | | |

Number Form: _____

Word Name: _____

**YOU TRY:**

Write the number in expanded form, place value form (in a chart) and word name form.

**a)** 736

| 100's | 10's | 1's |
|---|---|---|
|  |  |  |

Place Value Form in a Table:

Expanded Form:  _____

Word Name:  _____

**b)** 506

| 100's | 10's | 1's |
|---|---|---|
|  |  |  |

Place Value Form in a Table:

Expanded Form:  _____

Word Name:  _____

## C. Extending Place Value To Larger Numbers

Our **Place Value System** is partitioned into groups of three all based on hundreds, tens and ones. Each place value is 10 times as large as the place value to the right of it. In this section, we will identify these place values and represent them as words and numbers.

| | **Media Lesson** |
|---|---|
| [QR code] | Identifying the Place Value for Larger Numbers |
| | (Duration 6:30) |

*View the video lesson, take notes and complete the problems below.*

Place the number **261,942,037,524** in the place value chart below and answer the corresponding questions.

| BILLIONS | | | MILLIONS | | | THOUSANDS | | | ONES | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 10 | 1 | 100 | 10 | 1 | 100 | 10 | 1 | 100 | 10 | 1 |
|  |  |  |  |  |  |  |  |  |  |  |  |

**a)** Determine the place value for the digit 9 and write what it represents as a word and a number.

**b)** Determine the digit in the ten thousand's place and write what it represents as a word and a number.

**YOU TRY**

Place the number **72,902,635,524** in the place value chart below and answer the corresponding questions.

| BILLIONS | | | MILLIONS | | | THOUSANDS | | | ONES | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 10 | 1 | 100 | 10 | 1 | 100 | 10 | 1 | 100 | 10 | 1 |
| | | | | | | | | | | | |

a) Determine the place value for the digit 7 and write what it represents as a word and a number.

b) Determine the digit in the hundred thousand's place and write what it represents as a word and a number.

## D. Writing Place Value Forms Of Large Numbers

In this section, we will continue our study of place value by writing the place value forms of large numbers that are given in words.

| | **Media Lesson** |
|---|---|
| [QR code] | Writing Place Value Forms for Large Numbers<br>(Duration 1:53) |

*View the video lesson, take notes and complete the problems below.*

Place the numbers below in the place value chart. Use the chart to assist you in writing the place value form of the number.

| BILLIONS | | | MILLIONS | | | THOUSANDS | | | ONES | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 10 | 1 | 100 | 10 | 1 | 100 | 10 | 1 | 100 | 10 | 1 |
| | | | | | | | | | | | |

a) Twenty-four million

Place Value Form: _____

b) Three hundred sixty-seven thousand

Place Value Form: _____

**YOU TRY**

Place the numbers below in the place value chart. Use the chart to assist you in writing the place value form of the number.

| BILLIONS | | | MILLIONS | | | THOUSANDS | | | ONES | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 10 | 1 | 100 | 10 | 1 | 100 | 10 | 1 | 100 | 10 | 1 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

**a)** Seventeen billion

Place Value Form:_____

**b)** One hundred three million

Place Value Form:_____

## E. Rounding Numbers Using Place Value

To **round** a number means to approximate that number by replacing it with another number that is "close" in value. Rounding is often used when estimating.

For rounding, we will follow the process below.
**1.** *Rounding up* when the place value after the digit we are rounding to is *5 or greater*.
**2.** *Rounding down* when the place value after the digit we are rounding to is *less than 5.*
Write the given numbers in the place value chart and then round to the indicated place value.

| | |
|---|---|
| [QR code] | **Media Lesson**<br>Rounding to the Nearest Ten - Number Line<br>(Duration 6:24) |

*View the video lesson, take notes and complete the problems below.*

**Round whole Numbers**
1.  _____

2.  _____

   • _____

   _____

   _____

   • _____

   _____

   _____

**a)** Round 677 to the nearest ten

```
        |                |                |
_____
      670              675              680
```
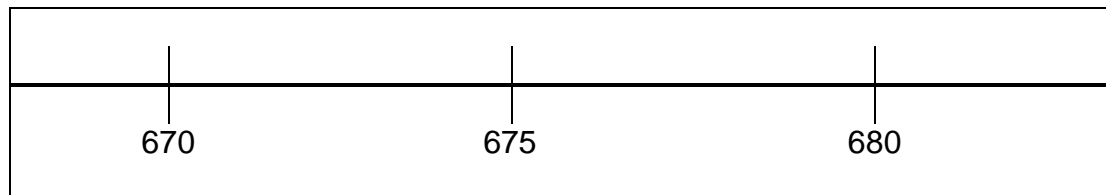
**b)** Round 243 to the nearest ten

```
        |                |                |
_____
      240              245              250
```

**c)** Round 755 to the nearest ten

```
        |                |                |
_____
      750              755              760
```
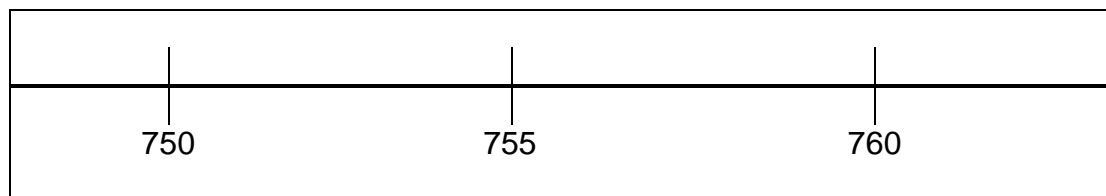
**d)** Round 498 to the nearest ten

```
        |                |                |
_____
      490              495              500
```

| | **Media Lesson** |
|---|---|
| [QR code] | Rounding to the Nearest Hundred - Number Line |
| | (Duration 6:24) |

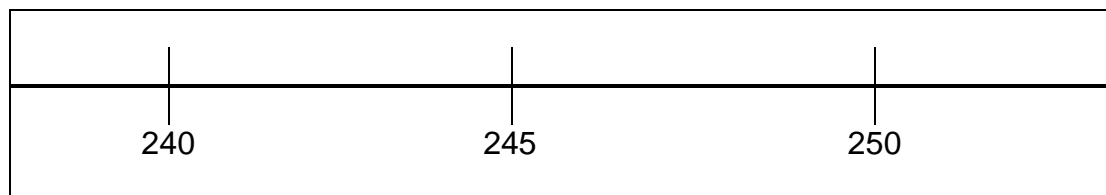*View the video lesson, take notes and complete the problems below.*

**e)** Round 1,938 to the nearest hundred

```
|-----------|-----------|-----------|
          1900        1950        2000
```

**f)** Round 5,268 to the nearest hundred

```
|-----------|-----------|-----------|
          5200        5250        5300
```

**g)** Round 42 to the nearest hundred

```
|-----------|-----------|-----------|
           0           50         100
```

**h)** Round 8,050 to the nearest hundred

```
|-----------|-----------|-----------|
          8000        8050        8100
```

**i)** Round 3,975 to the nearest hundred

```
|-----------|-----------|-----------|
          3900        3950        4000
```

| | **Media Lesson** |
|---|---|
| [QR code] | Rounding Numbers Using Place Value <br> (Duration 9:46) |

*View the video lesson, take notes and complete the problems below.*

**a)** NASA states that the moon is an average of 238,855 miles away from earth.

| BILLIONS | | | MILLIONS | | | THOUSANDS | | | ONES | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 10 | 1 | 100 | 10 | 1 | 100 | 10 | 1 | 100 | 10 | 1 |
| | | | | | | | | | | | |

Round 238,855 to the following place values:

thousand: _____

ten thousand: _____

hundred thousand: _____

**b)** According to the 2010 US Census, Chicago was the 3rd largest US city with a population of 2,695,598 people.

| BILLIONS | | | MILLIONS | | | THOUSANDS | | | ONES | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 10 | 1 | 100 | 10 | 1 | 100 | 10 | 1 | 100 | 10 | 1 |
| | | | | | | | | | | | |

Round 2,695,598 to the following place values:

thousand: _____

ten thousand: _____

hundred thousand: _____

## YOU TRY

According to the 2010 US Census, Phoenix was the 6th largest US city with a population of 1,445,632 people.

| BILLIONS | | | MILLIONS | | | THOUSANDS | | | ONES | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 10 | 1 | 100 | 10 | 1 | 100 | 10 | 1 | 100 | 10 | 1 |
| | | | | | | | | | | | |

Round 1,445,632 to the following place values.

thousand: _____

ten thousand: _____

hundred thousand: _____

## F. EXERCISES

**1)** What are whole numbers?

_____

**Write the following numbers in expanded form, place value form (in a chart) and word name form.**

**2)** 513

|  100's | 10's | 1's |
|---|---|---|
|  |  |  |

Place Value Form in a Table:

Expanded Form: _____

Word Name: _____

**3)** 27

|  100's | 10's | 1's |
|---|---|---|
|  |  |  |

Place Value Form in a Table:

Expanded Form: _____

Word Name: _____

**4)** 801

|  100's | 10's | 1's |
|---|---|---|
|  |  |  |

Place Value Form in a Table:

Expanded Form: _____

Word Name: _____

**Write the following numbers in numerical form, expanded form and place value form (in a chart).**

**5)** One hundred eighty-three

Number: _____

Expanded Form: _____

|  100's | 10's | 1's |
|---|---|---|
|  |  |  |

Place Value Form:

**6)** Four hundred thirty-two

Number: _____

Expanded Form: _____

Place Value Form:

| 100's | 10's | 1's |
|-------|------|-----|
|       |      |     |

**7)** Nine hundred one

Number: _____

Expanded Form: _____

Place Value Form:

| 100's | 10's | 1's |
|-------|------|-----|
|       |      |     |

**Write the following numbers in place value form, numerical form, and word name form.**

**8)** $600 + 30 + 5$

Place Value Form:

| 100's | 10's | 1's |
|-------|------|-----|
|       |      |     |

Number: _____

Word Name: _____

**9)** $700 + 40 + 0$

Place Value Form:

| 100's | 10's | 1's |
|-------|------|-----|
|       |      |     |

Number: _____

Word Name: _____

**10)** $100 + 20 + 5$

Place Value Form:

| 100's | 10's | 1's |
|---|---|---|
|  |  |  |

Number: _____

Word Name: _____

**11)** Round using the place value method.

**a)** Round 283 to the nearest hundred

**b)** Round 352 to the nearest hundred

**c)** Round 106 to the nearest ten

**d)** Round 349 to the nearest hundred

**e)** Round 52 to the nearest ten

**f)** Round 819 to the nearest ten

**g)** Round 437 to the nearest hundred

**h)** Round 86 to the nearest hundred

**i)** Round 182 to the nearest hundred

**j)** Round 23 to the nearest hundred

**k)** Round 409 to the nearest ten

**l)** Round 409 to the nearest hundred

12) The population of the United States is constantly changing. According the website www.worldometers.info when I last checked, the population of the U.S. was listed as 323,352,941. Round this number to the nearest thousand.

13) The national debt is also constantly changing. The website www.usdebtclock.org shows real time estimates of the national debt. At one point, the estimate of the debt was $17,882,815,724,883. Round this number to the nearest billion dollars.

14) Scientists don't know exactly how many cells are in the human body, but they estimate that there are about 37,200,000,000,000 cells. What place value are they rounding to?

15) NASA is currently working on the Orion spacecraft is built to take humans back to the moon and possibly to Mars. The closest distance from Earth to Mars is 35,500,000 miles. Round the distance to the nearest million.

**Check your work with the answer key!**

↗ **Online Quiz**

Log on to Canvas to take the section quiz

**Directions**: It is very useful to save your math exercise work and use it as a chapter test review when you study for your chapter test and final.

1) Write each question on the screen down to for your record

2) Solve the problem step by step below each question

3) Double check your work to see whether your answer make sense

4) Enter your answer in the answer box in Canvas. Make sure you click on the **"Preview"** button to make sure you enter the right format before you submit your answer. If you are not sure how to enter your answer with the correct format, ask your instructor.

5) If you did not answer the question correctly, solve the question again from the beginning below your 1st attempt. Sometimes, it is better to start a problem again from the beginning and compare your steps with your 1st attempt to figure out your mistake.

6) Insert your work at the end of each section in your workbook so that you can use it to study for your chapter test later.

## SECTION 1.2: ADDING AND SUBTRACTING WHOLE NUMBERS

In this section, we will look at some simple applications of addition and subtraction. Our goal is to recognize the structure of these operations in context so we can recognize and apply this knowledge to many different problem types.

First let's introduce some general terminology.

### A. Language and Notation

- **Language and Notation of Addition**

We call the numbers we are adding, **addends** and the result is called the **sum.** The symbol "**+**" is the **plus sign** and indicates that we should use the operation of addition.

$$5 + 3 = 8$$

addends    sum

In words, we may say any of the following.

       5 plus 3       the sum of 5 and 3       3 added to 5     3 more than 5

- **Language and Notation of Subtraction**

We call the first number on the left the **minuend**, the second number the **subtrahend,** and the result is called the **difference.** The symbol "**−**" is the **minus sign** and indicates that we should use the operation of subtraction.

$$8 - 3 = 5$$

minuend    subtrahend    difference

In words, we may say any of the following:

8 minus 3;   the difference of 8 and 3;   8 decreased by 3; 3 less than 8; or 3 subtracted from 8.

**Note:** Notice we have different names for the two numbers in the subtraction problem, but use the same name (addends) for the numbers in the addition problem. This is because changing the order in the subtraction problem changes the difference. This is not the case for addition. In practice, we rarely use the words "minuend" and "subtrahend". However, it is important for you to know they play different roles in subtraction.

| | Media Lesson |
|---|---|
| | Language of Addition |
| | (Duration 1:42) |

*View the video lesson, take notes and complete the problems below.*

### Word Phrases for Addition

Write the expression for each statement.

| Statement | Expression |
|---|---|
| 3 **plus** 5 | |
| The **sum** of 9 and 12 | |
| 2 **increased** by 7 | |
| 6 **more than** 3 | |
| The **total** of 4 and 11 | |
| 8 **added** to 15 | |

| | Media Lesson |
|---|---|
| | Language of Subtraction? |
| | (Duration 1:32) |

*View the video lesson, take notes and complete the problems below.*

### Word Phrases for Subtraction

Write the expression for each statement.

| Statement | Expression |
|---|---|
| 6 minus 2 | |
| The difference of 15 and 8 | |
| 7 decreased by 3 | |
| 6 less than 14 | |
| 5 subtracted from 9 | |

## B. Operations with Addition and Subtractions

### 1. Addition without regrouping

| | Media Lesson |
|---|---|
| | Adding without carrying |
| | (Duration 3:03) |

*View the video lesson, take notes and complete the problems below.*

$$+\begin{array}{r} 3\ 2\ 1 \\ 1\ 2\ 3 \\ \hline \end{array} \qquad +\begin{array}{r} 4\ 5\ 6 \\ 1\ 4\ 3 \\ \hline \end{array} \qquad +\begin{array}{r} 4\ 5\ 7 \\ 3\ 3\ 2 \\ \hline \end{array}$$

## 2. Addition with regrouping

| | |
|---|---|
| **Media Lesson** | |
| Adding with carrying | |
| (Duration 3:32) | |

*View the video lesson, take notes and complete the problems below.*

$$+\ \frac{9\ 8\ 7}{1\ 1\ 3}$$

$$+\ \frac{9\ 8\ 7}{7\ 9\ 9}$$

## 3. Subtraction without regrouping

| | |
|---|---|
| **Media Lesson** | |
| Subtracting without borrowing | |
| (Duration 2:53) | |

*View the video lesson, take notes and complete the problems below.*

$$-\ \frac{6\ 8}{4\ 2}$$

## 4. Subtraction with regrouping

| | |
|---|---|
| **Media Lesson** | |
| Subtracting with borrowing | |
| (Duration 2:46) | |

*View the video lesson, take notes and complete the problems below.*

$$-\ \frac{9\ 7\ 1}{6\ 5\ 9}$$

| | |
|---|---|
| **Media Lesson** | |
| Subtracting with borrowing twice | |
| (Duration 3:47) | |

*View the video lesson, take notes and complete the problems below.*

$$-\ \frac{9\ 1\ 3}{2\ 8\ 6}$$

**YOU TRY**

---

Add or Subtract

**a)** 3005 + 5217

**b)** 3005 + 5217

**c)** 2974 − 2374

**d)** 881 − 606

---

## C. Addition and Subtraction Strategies

**Media Lesson**
What are Addition and Subtraction?
(Duration 14:49)

*View the video lesson, take notes and complete the problems below.*

Draw a diagram or picture to represent the addition or subtraction problem. Then write the problem symbolically and find the sum or difference.

**1: Action or Change**

**a)** Glenn has $3. He earns $4 mowing his neighbor's lawn. How many dollars does Glenn have now?

**b)** Grant has $7. He spent $4 on a snack and a drink. How many dollars does Grant have now?

**2: Part/Part/Whole**

**a)** There are 3 boys and 4 girls on the swim team. How many children are on the swim team?

**b)** There are 7 children on the swim team. Three of the children are boys. How many girls are on the swim team?

**3: Comparison**

**a)** Lara has 4 more goldfish than Owen. Owen has 3 goldfish. How many goldfish does Lara have?

**b)** Lisa has 7 goldfish and Oscar has 3 goldfish. How many more goldfish does Lisa have?

**Summary:** The addition and subtraction problems we performed fall into three basic categories. We will expand on these further in the next example.

| Problem Type | Addition | Subtraction |
|---|---|---|
| **a)** Action/Change | One amount is ***added on*** to another | One amount is ***taken away*** from another |
| **b)** Part/Part/Whole | Part A + Part B = Whole | Whole – Part A = Part B |
| **c)** Comparison | Amount A + Difference = Amount B | Amount B – Difference = Amount A<br>Amount B – Amount A = Difference |
| **d)** Fact Family Example | $3+4=7$<br>$4+3=7$ | $7-3=4$<br>$7-4=3$ |

| | **Media Lesson** |
|---|---|
| | Adding and Subtracting Application Strategies (a) |
| | (Duration 9:44) |

*View the video lesson, take notes and complete the problems below.*

Underline or highlight the *Givens* and circle the *Goal* for each problem. Determine the structure of the problem by finding whether it is Action, Part/Part/Whole, or Comparison. Set up an appropriate expression to find the *Goal* using words and symbols. Then add or subtract using place value to find the solution. Write your final answer as a complete sentence.

**a)** Sara and John were selling candy to benefit the Theatre Club. Sara sold 84 candy bars more than John. Sara sold 279 candy bars. How many candy bars did John sell?

| | **Media Lesson** |
|---|---|
| | Adding and Subtracting Application Strategies (b) |
| | (Duration 5:37) |

*View the video lesson, take notes and complete the problems below.*

**b)** Jessica has been saving for a tablet for college. After six months, she saved enough money and spent $1300 on the tablet. Jessica has $127 leftover after the purchase. How much money had Jessica originally saved?

| | **Media Lesson** |
|---|---|
| | Adding and Subtracting Application Strategies (cd) |
| | (Duration 9:50) |

*View the video lesson, take notes and complete the problems below.*

**c)** Brianna took the SAT exam twice. The first time, she earned 520 on the math portion. The second time, she prepared for the exam and earned 680 on the math portion. How many more points did she earn on her second try after studying?

**d)** In 2017, there were 28 member countries in the North Atlantic Treaty Organization (NATO). All 28 of these countries are also members of the United Nations (UN). If there are 193 member countries in the UN, how many of the countries in the UN are not members of NATO?

## YOU TRY

Underline or highlight the ***Givens*** and circle the ***Goal*** for each problem. Determine the structure of the problem by finding whether it is Action, Part/Part/Whole, or Comparison. Set up an appropriate expression to find the ***Goal*** using words and symbols. Then add or subtract using place value to find the solution. Write your final answer as a complete sentence.

**a)** The water level in Don's pool was low. He added 180 gallons of water to bring it to the proper level of 900 gallons. How much water was in the pool before Don added the water?

**b)** Joan and Sandy were counting their Halloween candy. Joan had 32 more pieces than Sandy. Sandy had 173 pieces of candy. How much candy did Joan have?

## D. EXERCISES

**Add or subtract**

**1)** 8583 + 592

**2)** 563 + 298 + 611 + 828

**3)** 5738 − 280 − 4280

**4)** 1870 + 5021

**5)** 2157 − 1224

**6)** 3950 − 1530 − 2363

**7)** 899 + 528 + 116

**8)** 2974 − 2374

**9)** 9626 − 8363 − 1052

**10)** **Water Subsidies.** Since the drought began in 2007, California farms have received $79 million in water subsidies. California cotton and rice farmers received an additional $439 million. How much total water subsidies have farmers received? *Associated Press Times-Standard 4/15/09*

**11)** **War Budget.** The 2010 Federal budget allocates $534 billion for the Department of Defense base programs and an additional $130 billion for the nation's two wars. How much will the Department of Defense receive altogether? *Associated Press Times-Standard 5/8/09*

12) **Shuttle Orbit.** The space shuttle usually orbits at 250 miles above the surface of the earth. To service the Hubble Space Telescope, the shuttle had to go to 350 miles above the surface. How much higher did the shuttle have to orbit? 109. Earth's Orbit. Earth orbits the sun in an ellipse. When earth is at its closest to the sun, called perihelion, earth is about 147 million kilometers. When earth is at its furthest point from the sun, called aphelion, earth is about 152 million kilometers from the sun. What's the difference in millions of kilometers between aphelion and perihelion?

13) **Pluto's Orbit.** Pluto's orbit is highly eccentric. Find the difference between Pluto's closest approach to the sun and Pluto's furthest distance from the sun if Pluto's perihelion (closest point on its orbit about the sun) is about 7 billion kilometers and its aphelion (furthest point on its orbit about the sun) is about 30 billion kilometers

14) **Sunspot Temperature**. The surface of the sun is about 10,000 degrees Fahrenheit. Sunspots are darker regions on the surface of the sun that have a relatively cooler temperature of 6,300 degrees Fahrenheit. How many degrees cooler are sunspots?

15) **Wild tigers.** The chart shows the estimated wild tiger population, by region. According to this chart, what is the total wild tiger population worldwide? *Associated Press-Times-Standard 01/24/10 Pressure mounts to save the tiger.*

| Region | Tiger population |
| --- | --- |
| India, Nepal and Bhutan | 1,650 |
| China and Russia | 450 |
| Bangladesh | 250 |
| Sumatra (Indonesia) | 400 |
| Malaysia | 500 |
| other SE Asia | 350 |

## Check your work with the answer key!

### ⬈ **Online Quiz**

Log on to Canvas to take the section quiz

**Directions**: It is very useful to save your math exercise work and use it as a chapter test review when you study for your chapter test and final.

7) Write each question on the screen down to for your record

8) Solve the problem step by step below each question

9) Double check your work to see whether your answer make sense

10) Enter your answer in the answer box in Canvas. Make sure you click on the **"Preview"** button to make sure you enter the right format before you submit your answer. If you are not sure how to enter your answer with the correct format, ask your instructor.

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## SECTION 1.3: MULTIPLYING AND DIVIDING WHOLE NUMBERS

We will begin our investigation of multiplication and division by looking at word problems that use these operations in different ways. First let's introduce some general terminology.

### A. Language and Notation
- **Language and Notation of Multiplication**

We call the numbers we are multiplying **factors**, and the result is called the **product.**

$$\boxed{4} \times \boxed{3} = \boxed{12}$$

factors          product
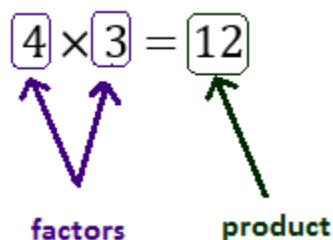
In words, we may say any of the following.

4 times 3

the product of 4 and 3

4 copies of 3

4 multiplied by 3

4 groups of 3

We may use any of the notations below to request this product.

$$4 \times 3 \qquad 4 \cdot 3 \qquad 4(3) \qquad (4)(3) \qquad 4*3$$

- **Language and Notation of Division**

We call the number we are dividing the **dividend**, the number we are dividing by the **divisor,** and the result is called the **quotient**.

$$\boxed{12} \div \boxed{4} = \boxed{3}$$

dividend          divisor          quotient
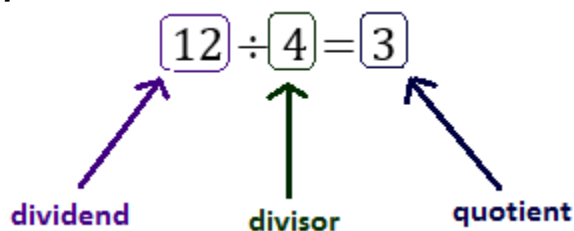
In words, we may say any of the following.

12 divided by 4

4 into 12

12 over 4 (fraction form)

26

the quotient of 12 and 4

How many groups of size 4 are in 12?

If 12 is broken into 4 equal groups, what is the size of each group?

We may use any of the notations below to request this quotient.

$$12 \div 4 \qquad (12) \div (4) \qquad (12) \div 4 \qquad 12 \div (4) \qquad \frac{12}{4}$$

| | **Media Lesson** |
|---|---|
| ▦ | Language of Multiplication<br>(Duration 2:15) |

*View the video lesson, take notes and complete the problems below.*

### Word Phrases for Multiplication

Write the expression for each statement.

| Statement | Expression |
|---|---|
| 8 **times** 4 | |
| The **product** of 5 and 9 | |
| 7 **multiplied** by 3 | |
| **Twice** 8 | |
| **Triple** 12 | |

| | **Media Lesson** |
|---|---|
| ▦ | Language of Division<br>(Duration 1:34) |

*View the video lesson, take notes and complete the problems below.*

### Word Phrases for Subtraction

Write the expression for each statement.

| Statement | Expression |
|---|---|
| 15 **divided by** 3 | |
| The **quotient** of 30 and 6 | |
| 7 **divided into** 56 | |

## B. Meaning of Multiplication and Division

| | **Media Lesson** |
|---|---|
| ▣ | [What are Multiplication and Division? - Equal grouping/ Fair sharing (ab)](#) |
| | (Duration 7:28) |

*View the video lesson, take notes and complete the problems below.*

Draw a diagram or picture to represent the multiplication or division problem. Then write the problem symbolically and find the product or quotient.

### 1. Equal Grouping or Fair Sharing

.

**a)** Bernadette is having a party. She invites 4 friends over and is going to make 3 cupcakes per friend. How many cupcakes does she need for her friends?

**b)** Chester is making apple pies. He wants to make 3 pies and he needs 4 apples per pie. How many apples does he need altogether?

| | **Media Lesson** |
|---|---|
| | [What are Multiplication and Division?- Equal grouping/ Fair sharing (cd)](#) |
| | (Duration 7:02) |

*View the video lesson, take notes and complete the problems below.*

**c)** Penny is having a party. She invites 4 friends over and has 12 cupcakes for them. How many cupcakes does each friend receive if they share the cupcakes equally?

**d)** Charlie is making apple pies. He has 12 apples and he needs 4 apples per pie. How many pies can Charlie make?

| | **Media Lesson** |
|---|---|
| | [What are Multiplication and Division?- Area/ Distance, rate, time/Multiplicative comparison](#) |
| | (Duration 15:05) |

*View the video lesson, take notes and complete the problems below.*

## 2. Area

**a)** Dan is carpeting a utility room in his house that is 4 feet by 3 feet. How many square feet of carpet does he need?

**b)** Dave is carpeting a utility room in his house that is 12 square feet. The length of the rectangular room is 4 feet. If the carpet fits perfectly, what is width of the room?

### 3. Distance, rate, and time

**a)** Fannie is walking at a rate of 4 miles per hour for 3 hours. How many miles did she walk?

**b)** Dani walked 12 miles at a rate of 4 miles per hour. How many hours was she walking?

### 4. Multiplicative Comparison

**a)** Chuck has three times as much money as Tony. If Tony has $4, how much does Chuck have?

**b)** Chip has 3 times as much money as Timmy. If Chip has $12, how much does Timmy have?

## C. Operations with Multiplications and Divisions

| | **Media Lesson** |
|---|---|
| [QR code] | Multiplying whole numbers |
| | (Duration 7:39) |

View the video lesson, take notes and complete the problems below.

- **Multiplying whole numbers**

$$3 \times 2 = 3 \cdot 2 = 3(2) = (3)(2) = 6$$

3 times 2 means we have **3 groups of 2** or **3 copies of 2.**
You can thing of multiplication as scaling.

The numbers being multiplied together are **factors**. _____

The product is the result of the multiplication. _____

- **Some properties of Multiplications:**
  - Multiplication is _____. $3 \times 2 = 2 \times 3$
  - Multiplying by zero: $0 \times 7 = 7 \times 0 = 0$
- **Examples:**

**a)** $43 \times 6$

**b)** $21 \times 32$

**c)** $27 \times 3{,}425$

**d)** You notice that your favorite restaurant is offering lunch for $4 per person tax included instead of the regular $6 person. As a result, you decided to buy lunch for your 5 friends. If you have $30, how much money will you have left after lunch? Of course, you are going to eat also.

| | **Media Lesson** |
|---|---|
| | [Dividing whole numbers](#) |
| | (Duration 11:01) |

View the video lesson, take notes and complete the problems below.

- **Divide whole numbers**

$$6 \div 2 = 6/2 = \frac{6}{2} = 3 \qquad 2\overline{)6}^{\,3}$$

Division of whole numbers means we will take a certain number of items and

_____.

The number being divided is the _____.

The number we are dividing by is the _____.

The answer is the _____.

Examples:

**a)** $515 \div 5$

**b)** $231 \div 4$

**c)** $1104 \div 46$

**d)** $12{,}092 \div 28$

**YOU TRY**

Multiply or divide

**a)**  $152 \cdot 8$

**b)**  $346 \cdot 27$

**c)**  $2896 \div 8$

**d)**  $8305 \div 23$

## D.  Multiplication and Division Application Strategies

**Media Lesson**
What are Multiplication and Division?- Area/ Distance, rate, time/Multiplicative comparison
(Duration 15:05)

*View the video lesson, take notes and complete the problems below.*

**Summary:**  The multiplication and division problems we performed fall into three basic categories. We will expand on these further in the next example.

| Problem Type | Multiplication | Division |
|---|---|---|
| **a)** Fair Sharing<br>or<br>Equal Grouping | number of groups × size of group = total<br><br>size of group × number of groups = total | **Fair Sharing**<br>total ÷ number of groups = size of group<br><br>**Equal Grouping**<br>total ÷ size of group = number of groups |
| **b)** Area of a Rectangle | Area = length × width | Area ÷ length = width<br>Area ÷ width = length |

| c) | Distance, rate, and time | distance = rate × time | distance ÷ rate = time <br> distance ÷ time = rate |
|---|---|---|---|
| d) | Multiplicative Comparison | multiplier × quantity A = quantity B | quantity B ÷ quantity A = multiplier <br> quantity B ÷ multiplier = quantity A |
| e) | Fact Family Example | $3 \cdot 4 = 12$ <br> $4 \cdot 3 = 12$ | $12 \div 3 = 4$ <br> $12 \div 4 = 3$ |

**Media Lesson**
Multiplication and Division Application Strategies( ab)
(Duration 8:37)

*View the video lesson, take notes and complete the problems below.*

Underline or highlight the **Givens** and circle the **Goal** for each problem. Determine the structure of the problem by finding whether it is Fair Sharing, Equal Grouping, Area, Distance/rate/time or Multiplicative Comparison. Set up an appropriate expression to find the **Goal** using words and symbols. Then multiple or divide using place value to find the solution. Write your final answer as a complete sentence.

a) Last month, Larry worked out 4 times as many hours as he did this month. Last month, he worked out 20 hours. How many hours did he work out this month?

b) Sky drove from Scottsdale to Las Vegas. Her average speed was 65 miles per hour. The trip took 5 hours. How far did Sky drive?

**c)** A high school soccer field is approximately 110 yards long and 70 yards wide. How many square yards is the soccer field?

**d)** Michael's parents give him $180 to go out with his friends on his birthday. If he wants to spend $20 per person, how many people can attend (including Michael)?

## YOU TRY

Underline or highlight the **Givens** and circle the **Goal** for each problem. Determine the structure of the problem by finding whether it is Fair Sharing, Equal Grouping, Area, Distance/rate/time or Multiplicative Comparison. Set up an appropriate expression to find the **Goal** using words and symbols. Then multiple or divide using place value to find the solution. Write your final answer as a complete sentence.

**a)** Daisy drove from Scottsdale to San Diego. She traveled a total distance of 378 miles and the trip took 6 hours. How fast did Daisy drive on average?

**b)** A student worker makes $680/month from her job at school. How much does she makes a year?

## E. Language of Operations

| | **Media Lesson** |
|---|---|
| [QR code] | [Language of Operations](#)<br>(Duration 2:03) |

*View the video lesson, take notes and complete the problems below.*

- Addition: We call the result of adding two numbers the _____

  Example: $5 + 3 = 8$ _____

- Subtraction: We call the result of subtracting two numbers the _____

  Example: $8 - 5 = 3$ _____

- Multiplication: We call the result of multiplying two numbers the _____

  Example: $3 \cdot 5 = 15$ _____

- Division: We call the result of dividing two numbers the _____

  Example: $15 \div 3 = 5$ _____

## F. Applications: Perimeter And Area

### 1. Perimeter

A **polygon** is a many-sided closed figure with sides that are straight line segments. Triangles, rectangles, and pentagons (five-sided figures) are polygons, but a circle or semicircle is not. The **perimeter** of a polygon is the **distance around** the polygon. To find the perimeter of a polygon, **add the lengths** of its sides, as in the example below.

| | **Media Lesson** |
|---|---|
| **G.** [QR code] | [Finding the perimeter of square and rectangle shapes](#)<br>(Duration 1:12) |

*View the video lesson, take notes and complete the problems below.*

Find the perimeter for each of the shapes below.

**a)** Add the lengths of each side
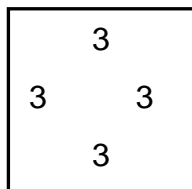


**b)** Sometimes you have to make assumptions if lengths are not labeled
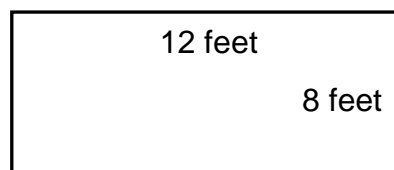
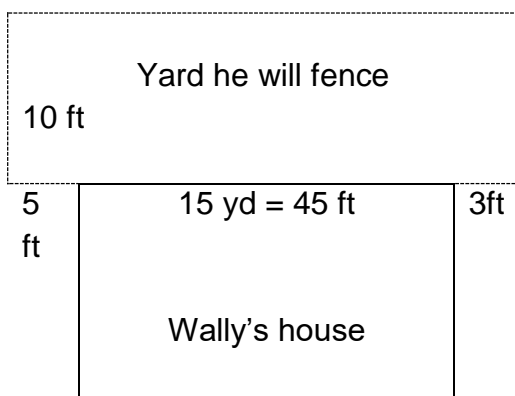| | **Media Lesson** |
|---|---|
| **H.** | Finding the perimeter of a polygon |
| | (Duration 0:42) |

*View the video lesson, take notes and complete the problems below.*

Example: How do we find the perimeter of this more complicated shape? Just keep adding those side lengths?
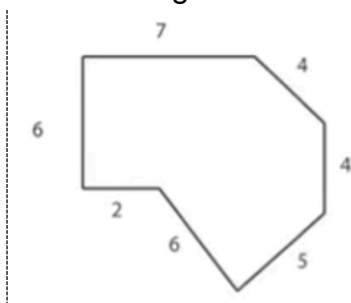


| | **Media Lesson** |
|---|---|
| **I.** | Applications of Perimeter |
| | (Duration 2:42) |

*View the video lesson, take notes and complete the problems below.*

Example: Wally wants to add a fence to the back of his house to make some room for his children to play safely (see diagram below). He began measuring his yard but got distracted and forgot to finish measuring before he went to the store. If he remembers that the back wall of his house is 15 yards long, does he have enough information to buy the fencing he needs? If so, how many feet should he buy?

## 2. Area
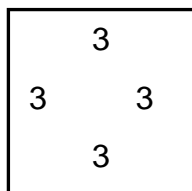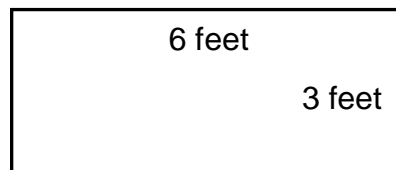
*View the video lesson, take notes and complete the problems below.*

Example: Find the area for each of the shapes below.

**c)** Remember to count the unit squares inside the shape.



3

3        3

3

**Area of a square:** $A = side \times side$

**d)** Is there a pattern here that would make your work easier?



6 feet

3 feet

**Area of a rectangle:** $A = length \times width$

*View the video lesson, take notes and complete the problems below.*

**Example:** Wally is still fixing up his house and has a flooring project to complete. He wants to buy enough bamboo flooring to cover the floor space in rooms A, C and hallway B and enough bamboo edging for baseboards in all the spaces as well. How many square feet of flooring and how many feet of baseboards should he buy?



3ft    15ft

A

10 ft

B

8ft

C

4ft

8ft

Doorways
2ft wide
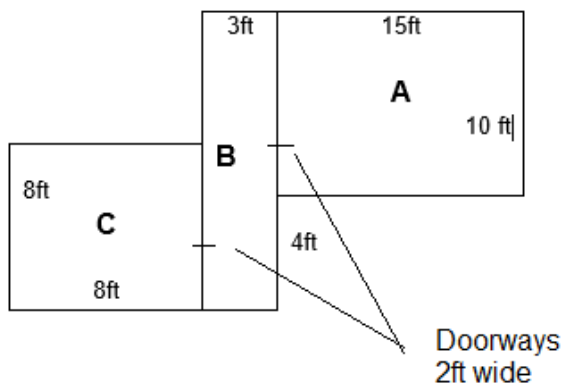
## G. EXERCISES

Multiply or divide the given numbers.

**1)** $78 \cdot 3$

**2)** $907\,(\,6\,)$

**3)** $237 \times 54$

**4)** $(955)\,(89)$

**5)** $2{,}816 \div 44$

**6)** $\dfrac{8{,}075}{85}$

**7)** $22{,}304 \div 41$

**8)** $\dfrac{18{,}652}{46}$

9) Eli writes an average of 4 articles a day, five days a week, to support product sales. How many articles does Eli write in one week?

10) A 0.50-caliber antiaircraft machine gun can fire 800 rounds each minute. How many rounds could fire in three minutes? Associated Press Times-Standard 4/15/09

11) The swimming pool at CalCourts is 25 yards long. If one lap is up and back again, how many yards has Wendell swam doing 27 laps?

12) Refrigerator wattage. A conventional refrigerator will run about 12 hours each day can use 150 Watts of power each hour. How many Watts of power will a refrigerator use over the day?

13) A full-grown horse should eat a minimum of 12 pounds of hay each day and may eat much more depending on their weight. How many pounds minimum would a horse eat over a year?

14) California residents who want to attend the University of California as a full-time undergraduate should expect to pay $15,621 tuition per year. If the cost were to remain the same for the next several years, how much should a student expect to pay for a four-year degree program at a UC school?

15) Nonresident undergraduates who want to attend a University of California college should expect to pay about $45,375 for the upcoming academic year. Assuming costs remain the same, what can a four-year degree cost?

**16)** One boat to the island can take 5 people. How many trips will the boat have to take in order to ferry 38 people to the island? (Round up your answer.)

**17)** If street lights are placed at most 105 feet apart, how many street lights will be needed for a street that is 2 miles long, assuming that there are lights at each end of the street? (Note: 1 mile = 5280 feet.)

**18)** Find the perimeter of the trapezoid in feet

```
        300
       _____
      /      \
  500/        \500
    /          \
   /_____\
       900
```
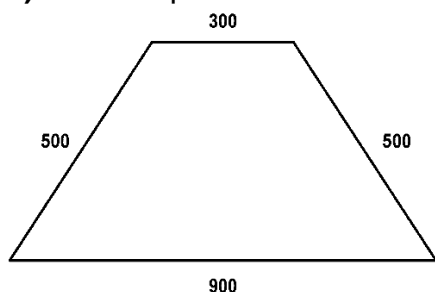
**19)** A rectangle has a length of 8 centimeters and a width of 3 centimeters. Find the area.

```
 _____
|                     |
|  8 cm               |
|            3 cm     |
|_____|
```
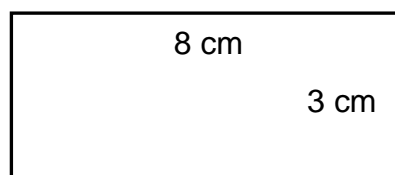
**20)** A company is planning to construct a building. Below is a diagram illustrating the shape of the building's floor plan. The length of each side is given in the diagram. Measurements for each side are in feet. Find the perimeter of the building.
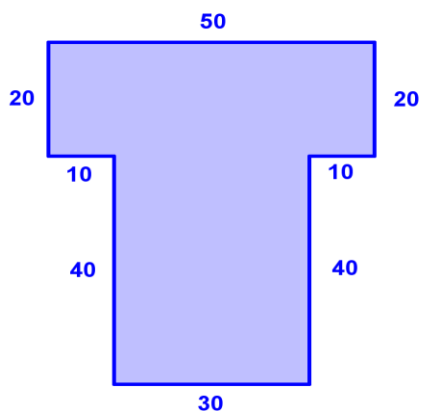
**21)** Write the following in symbolic form, then evaluate.

**a)** The sum of twelve and six

**b)** The product of twelve and six

**c)** The quotient of twelve and six

**d)** Twelve minus six.

**e)** Twelve divided by 6

**f)** Six times twelve

**g)** Six less than twelve

**h)** he difference between six and twelve

## Check your work with the answer key!

# $\nwarrow$ **Online Quiz**

Log on to [Canvas](#) to take the section quiz

**Directions**: It is very useful to save your math exercise work and use it as a chapter test review when you study for your chapter test and final.

13) Write each question on the screen down to for your record

14) Solve the problem step by step below each question

15) Double check your work to see whether your answer make sense

16) Enter your answer in the answer box in Canvas. Make sure you click on the **"Preview"** button to make sure you enter the right format before you submit your answer. If you are not sure how to enter your answer with the correct format, ask your instructor.

17) If you did not answer the question correctly, solve the question again from the beginning below your 1st attempt. Sometimes, it is better to start a problem again from the beginning and compare your steps with your 1st attempt to figure out your mistake.

18) Insert your work at the end of each section in your workbook so that you can use it to study for your chapter test later.

## SECTION 1.4: EXPONENTS AND THE ORDER OF OPERATIONS
### A. Introduction to Exponents

| | **Media Lesson** |
|---|---|
| [QR code] | Introduction to Exponents |
| | (Duration 5:03) |

*View the video lesson, take notes and complete the problems below.*

Solve the problem below. Use the rectangle below to represent the problem visually.

**a)** Don makes a rectangular 20 square foot cake for the state fair. After he wins his award, he wants to share it with the crowd. First he cuts the cake into 2 pieces. Then he cuts the 2 pieces into 2 pieces each. Then he cuts all of these pieces into two pieces. He continues to do this a total of 5 times. How many pieces of cake does he have to share?
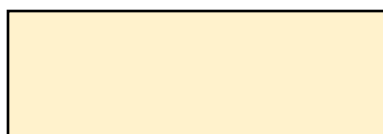
**b)** Write a mathematical expression that represents the total number of pieces in which Don cut the cake.

### Terminology

We will use *exponential expressions* to represent problems such as the last one. Exponents represent repeated multiplication just like multiplication represents repeated addition as shown below.

$$\text{Multiplication: } 5 \cdot 2 = 2 + 2 + 2 + 2 + 2 = 10$$
$$\text{Exponents: } 2^5 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32$$

In the exponential expression, $2^5$

2 is called the *base*
5 is called the *exponent*

$2^5$ ← 5 Exponent, 2 Base

We will say $2^5$ as "2 raised to the fifth power" or "2 to the fifth"

Since exponents represent repeated multiplication, and we call the numbers we multiply factors, we will also use this more meaningful language when discussing exponents.

$2^5$ means 5 factors of 2

We also have special names for bases raised to the second or third power.
**a)** For $3^2$, we say 3 squared or 3 to the second power
**b)** For $4^3$, we say 4 cubed or 4 to the third power

| | |
|---|---|
| ▣▨▣ (QR code) | **Media Lesson**<br>Language and Notation of  Exponents<br>(Duration 4:07) |

*View the video lesson, take notes and complete the problems below.*

Represent the given exponential expressions in the four ways indicated.

**a)**  $6^2$                                                            **b)**      $2^6$

| | | | |
|---|---|---|---|
| Expanded Form | | Expanded Form | |
| Word Name | | Word Name | |
| Factor Language | | Factor Language | |
| Math Equation | | Math Equation | |

### YOU TRY

Represent the given exponential expressions in the four ways indicated.
**a)**  $7^2$

| | |
|---|---|
| Expanded Form | |
| Word Name | |
| Factor Language | |
| Math Equation | |

**b)** $4^3$

| | |
|---|---|
| Expanded Form | |
| Word Name | |
| Factor Language | |
| Math Equation | |

Thus far, we have only performed one operation at a time. In the remaining section, we will learn about the order we will use when there is more than one operation to perform in an expression.

## B. Addition, Subtraction and the Order of Operations

**Media Lesson**
Addition, Subtraction and the Order of Operations
(Duration 4:11)
*View the video lesson, take notes and complete the problems below.*

Solve the problem below. Be sure to indicate every step in the process of your solution.

   **a)** Suppose on the first day of the month you start with $150 in your bank account. You make a debit transaction on the second day for $60 and then make a deposit on the third day for $20. What is the balance in your account on the third day?

   **b)** What string of operations (written horizontally) can be used to determine the amount in your account?

✦ **Rule 1:** When we need to add or subtract 2 or more times in one problem, we will perform the operations from left to right

| | **Media Lesson** |
|---|---|
| | [Addition, Subtraction and the Order of Operations (cont.)](#) |
| | (Duration 3:14) |

*View the video lesson, take notes and complete the problems below.*

Use a highlighter to highlight the operations in the problem. Determine the number of operations to be performed in the problem. Then compute the results by using the convention of performing the operations from left to right.

# of operations____          # of operations____

**a)**   $4 + 8 - 3 + 6$

**b)**  $12 - 5 + 6 - 2 - 1 + 4$

## YOU TRY

Use a highlighter to highlight the operations in the problem. Determine the number of operations to be performed in the problem. Then compute the results by using the convention of performing the operations from left to right.

# operations____          # operations____

**a)**   $4 + 7 - 3 - 2$

**b)**  $8 - 5 - 1 + 12 + 7 - 3$

## C. Multiplication, Division And The Order Of Operations

| | **Media Lesson** |
|---|---|
| [QR code] | Multiplication, Division and the Order of Operations |
| | (Duration 4:10) |

*View the video lesson, take notes and complete the problems below.*

Solve the problem below. Be sure to indicate every step in the process of your solution.

a) Suppose you and your three siblings inherit $40,000. You divide it amongst yourselves equally. You then invest your portion and make 5 times the amount of your portion. How much money do you have? Be sure to indicate every step in your process.

b) What string of operations (written horizontally) can be used to determine the result?

✦ **Rule 2:** When we need to multiply or divide 2 or more times in one problem, we will perform the operations from <u>left to right</u>.

| | **Media Lesson** |
|---|---|
| [QR code] | Multiplication, Division and the Order of Operations (cont.) |
| | (Duration 3:18) |

*View the video lesson, take notes and complete the problems below.*

Use a highlighter to highlight the operations in the problem. Determine the number of operations to be performed in the problem. Then compute the results by using the convention of performing the operations from left to right.

# of operations_____

**a)** $6 \cdot 4 \div 2 \cdot 3$

# of operations_____

**b)** $24 \div 4 \div 2(3)$

**YOU TRY**

---

Use a highlighter to highlight the operations in the problem. Determine the number of operations to be performed in the problem. Then compute the results by using the convention of performing the operations from left to right.

|  |  |
|---|---|
| # of operations____ | # operations____ |
| **a)**  $16(2) \div 4 \div 2$ | **b)**  $36 \div 9(4)(2)$ |

---

## D.  The Order Of Operations For $+, \ -, \ \times, \ \div$

| | **Media Lesson**<br>The Order of Operations for $+, \ -, \ \times, \ \div$<br>(Duration 7:30) |
|---|---|

*View the video lesson, take notes and complete the problems below.*

Solve the two problems below. Be sure to indicate every step in your process

a)  Bill went to the store and bought 3 six-packs of soda and an additional 2 cans. How many cans did he buy in total?

What string of operations (written horizontally) can be used to represent this problem?

b)  Amber went to the store and bought 3 six-packs of cola and an additional 2 six-packs of diet cola. How many cans did she buy in total?

What string of operations (written horizontally) can be used to represent this problem?

✦ **Rule 3:**  Unless otherwise indicated by parentheses, we perform multiplication and division **_before_** addition and subtraction. We continue to perform the operations from left to right.

| | **Media Lesson** |
|---|---|
| | The Order of Operations for $\div, \times, -, +$ (cont.) |
| | (Duration 5:35) |

*View the video lesson, take notes and complete the problems below.*

Use a highlighter to highlight the operations in the problem. Determine the number of operations to be performed in the problem. Perform the operations in the appropriate order. Show all intermediary steps.

**a)** $10 \div 2 \cdot 5 - 3$

**b)** $28 \div 4 - 2(3)$

**c)** $\dfrac{5(2) + 4}{5 - 3}$

## YOU TRY

Use a highlighter to highlight the operations in the problem. Determine the number of operations to be performed in the problem. Perform the operations in the appropriate order. Show all intermediary steps.

**a)** $36 \div 9 + 2(3)$

**b)** $26 \div 2 \cdot 5 - (3)(4)$

**c)** $\dfrac{6 + 3(3)}{7 - 2}$

### E. Parentheses As A Tool For Changing Order

There are cases when we want to perform addition and subtraction before multiplication and division in the order of operations. So we need a method of indicating we want to make such a modification. In the next media problem, we will discuss how to show this change.

| | **Media Lesson** |
|---|---|
| [QR code] | [Parentheses as a Tool for Changing Order](#)<br>(Duration 3:13) |

*View the video lesson, take notes and complete the problems below.*

Solve the problems below.

a) Howard bought a $25 comic book and a $35 belt buckle. He paid with a $100 bill. How much change will Howard receive? Be sure to indicate every step in your process.

b) What string of operations (written horizontally) can be used to determine the amount in your account?

✦ **Rule 4:** If we want to change the order in which we perform operations in an arithmetic expression, we can use parentheses to indicate that we will perform the operation(s) <u>inside the parentheses first.</u>

| | **Media Lesson** |
|---|---|
| [QR code] | [Parentheses as a Tool for Changing Order (cont.)](#)<br>(Duration 3:01) |

*View the video lesson, take notes and complete the problems below.*

Use a highlighter to highlight the operations in the problem. Determine the number of operations to be performed in the problem. Perform the operations in the appropriate order. Show all intermediary steps.

**a)** $8 \div (4 - 2)$ 　　　　 # of operations____ 　　 **b)** $53 - [6(5 + 2)]$ 　　 # of operations____

**YOU TRY**

Use a highlighter to highlight the operations in the problem. Determine the number of operations to be performed in the problem. Then compute the results by using the convention of performing the operations from left to right.

**a)** $6 \div [7-4]$      # of operations____

**b)** $13-[9-(6-2)]$      # operations____

## F. PEMDAS and The Order Of Operations

Finally, we will consider problems that may contain any combination of parentheses, exponents, multiplication, division, addition and subtraction.

| | **Media Lesson** |
|---|---|
| [QR code] | PEMDAS and the Order of Operations |
| | (Duration 6:49) |

*View the video lesson, take notes and complete the problems below.*

✦ **Rule 5:** Exponents are performed before the operations of addition, subtraction, multiplication and division.

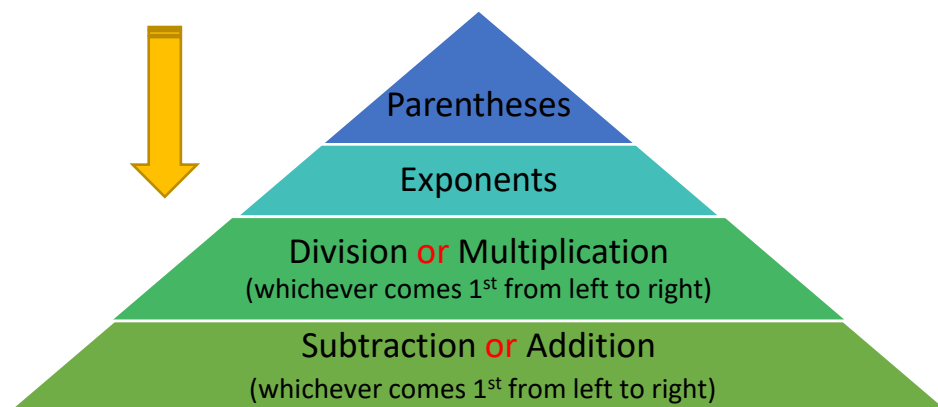| | |
|---|---|
| **P** | Simplify items inside Parentheses **( )**, brackets **[ ]** or other grouping symbols first. |
| **E** | Simplify items that are raised to powers (Exponents) |
| **M** **D** | Perform Multiplication and Division next (as they appear from **Left to Right**) |
| **A** **S** | Perform Addition and Subtraction on what is left. (as they appear from **Left to Right)** |

Use a highlighter to highlight the operations in the problem. Determine the number of operations to be performed in the problem. Then compute the results by using the correct order of operations. Check your results on your calculator.

**a)** $(8-3)^2 - 4$

**b)** $2 \cdot 4^2 + 3$

**c)** $(5)^2 - 4(5) + 2$

The pyramid below is an alternative graphic to help you to remember the order of operations. Starting with the parentheses on the top, you perform the order top down. Since the multiplication and division are on the same level, you calculate whichever operation comes first from left to right. Similarly, the addition and subtraction are on the same level, you calculate whichever operation comes first from left to right



Parentheses

Exponents

Division or Multiplication
(whichever comes 1st from left to right)

Subtraction or Addition
(whichever comes 1st from left to right)

**YOU TRY**

Use a highlighter to highlight the operations in the problem. Determine the number of operations to be performed in the problem. Then compute the results by using the correct order of operations. Check your results on your calculator.

**a)** $7 - (2-3)^2$    # of operations____

**b)** $(-4)^2 + 5(-4) - 6$  # operations____

Mathematics and Writing

When faced with a mathematical problem, you really have two goals:

1. to work the problem correctly
2. to present a complete solution that can be read and understood by yourself and by others

Just because you know how to do a problem today does not mean that you will quickly remember how to do it when you look back on it in the future. Strive to present complete solutions following the examples and presentations that you see in the media links.

**Mathematics is really learned through writing. The better your solutions the more you will learn and retain.**

As you move forward in mathematics, learning to write a good solution may help you solve problems you would not have been able to otherwise.

## G. EXERCISES

**Write each of the following in the expanded form (factored form) and then compute the final result.**

**1)** $2^3$

**2)** $3^5$

**3)** $4^2$

**4)** $5^4$

**5)** $6^3$

**6)** $9^5$

**Evaluate each of the following using correct order of operations. Show all possible steps**

**7)** $25 - 6 + 15$

**8)** $15 \div 3 \times 15$

**9)** $7 + 2(5 - 3)$

**10)** $4 + 12 \div 3 + 2 \cdot 4^2$

**11)** $3^2 + 6 - 5$

**12)** $51 - (47 - 2) \div 5 \cdot 3$

**13)** $15 + [3(8 - 2^2) - 6]$

**14)** $4 + 2 \times 6^3 + 8 - 2$

**15)** $12(5 - 2(5 - 4) + 5(6))$

**Check your work with the answer key!**

$$\nearrow \text{ } \textbf{Online Quiz}$$

Log on to Canvas to take the section quiz

**Directions**: It is very useful to save your math exercise work and use it as a chapter test review when you study for your chapter test and final.

**19)** Write each question on the screen down to for your record

**20)** Solve the problem step by step below each question

**21)** Double check your work to see whether your answer make sense

**22)** Enter your answer in the answer box in Canvas. Make sure you click on the **"Preview"** button to make sure you enter the right format before you submit your answer. If you are not sure how to enter your answer with the correct format, ask your instructor.

**23)** If you did not answer the question correctly, solve the question again from the beginning below your 1st attempt. Sometimes, it is better to start a problem again from the beginning and compare your steps with your 1st attempt to figure out your mistake.

**24)** Insert your work at the end of each section in your workbook so that you can use it to study for your chapter test later.