CHAPTER

1

WHOLE NUMBERS

In this chapter, you will learn to:

- Find multiples and factors
- Evaluate exponents
- Use the order of operations

LESSON 1: MULTIPLES

The Most Multiples

You Will Need:

- 2 players
- 2 different colored pencils
- Numbered cards 3–10 (such as Uno cards or playing cards)

You Will Do:

1. Shuffle the cards. Player One draws a card and colors in all the multiples of that number on the chart below. It is ok for players to skip count if they do not remember all of the multiples.
2. Player Two draws a card and colors in the multiples of that number. If a multiple is already colored in, it is skipped.
3. Play continues until all the numbered cards have been played. The player with the most squares colored in wins.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50

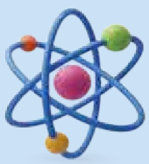
Multiples are the result of multiplying a number. For instance, the multiples of 7 are 7, 14, 21, 28, and on and on. There is no end to the number of multiples.

If a number is the multiple of two or more numbers, we call it a **common multiple**. Below is a list of the multiples of 4 and 5. The common multiples of 4 and 5 are circled.

Multiples of 4: 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, …

Multiples of 5: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, …

Common multiples can help you solve many different kinds of problems. But, they are especially helpful when you try to add and subtract fractions with different denominators. You will learn more about that in Chapter 3.



MULTIPLES: The result of multiplying a number

COMMON MULTIPLE: When a number is a multiple of 2 or more numbers

EXAMPLE 1: List the first 8 multiples of 8.

We can skip count to find these or just do the multiplication in our head.

$8 \times 1 = 8$	$8 \times 5 = 40$
$8 \times 2 = 16$	$8 \times 6 = 48$
$8 \times 3 = 24$	$8 \times 7 = 56$
$8 \times 4 = 32$	$8 \times 8 = 64$

EXAMPLE 2: Find a common multiple of 5 and 8.

First, we will list the multiples of 5. Then, the multiples of 8. We will circle the numbers that are common on both lists.

Multiples of 5: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50,…

Multiples of 8: 8, 16, 24, 32, 40, 48, 56, 64, 72,…

40 is a common multiple of 5 and 8.

1. **List the next 7 multiples for each number.**

   a. 4, _____, _____, _____, _____, _____, _____, _____

   b. 7, _____, _____, _____, _____, _____, _____, _____

   c. 6, _____, _____, _____, _____, _____, _____, _____

   d. 9, _____, _____, _____, _____, _____, _____, _____

   e. 5, _____, _____, _____, _____, _____, _____, _____

2. **Is 33 a multiple of 3?** Yes or no?

3. **Is 42 a multiple of 4?** Yes or no?

4. **List a common multiple of 4 and 7.** _______________________________

5. **Look back at the multiples of 5 above. Circle any multiples of 5 that are also multiples of 3.**

6. **Give an example of a number that is a common multiple of 4 and 6. There is more than one correct answer.**

   ____

7. **At a certain store, hot dogs are only sold in packs of 10, and buns are only sold in bags of 8. What is the least number of hot dogs and buns you can buy so that there is one bun for each hot dog?**

   ____

8. **Mrs. Gong volunteers at the library every 6 days and Mr. Gong volunteers at the local theater every 7 days. How many days will it be before they are both volunteering on the same day?**

   ____

WARM UP

Use your knowledge of multiplication problems to fill in the blanks in each problem. It may take you a few guesses to find the right digit.

a.
```
   3,214
×      □
  19,284
```

b.
```
    4 □
 ×  3 8
    352
+  1320
  1,672
```

When we multiply multi-digit numbers, we multiply the ones first and then continue from there. No matter how large the number is that you are multiplying, make sure you always start with the ones and work your way left.

Let's review several different kinds of multiplication problems.

EXAMPLE 1: **Find the product.**

```
  2,329
×     4
```

We are multiplying a 4-digit number by a 1-digit number. We just need to start with the ones place value.

```
     3
  2329
×    4
     6
```

Multiply the 4 by the 9 ones. This results in 36. We write the 6 ones place value below and the 3 above the tens column.

```
 1  13
  2,329
×     4
  9,316
```

Multiply by the tens, hundreds, and thousands being careful to add on any regroupings.

A quick estimate helps us check to make sure our answer makes sense. Our answer should be close to, but less than, 10,000.

$2500 \times 4 = 10{,}000$

When we multiply a 2-digit by a 2-digit number, we need to pay very careful attention to place value.

EXAMPLE 2: **Find the product.**

$$\begin{array}{r} 35 \\ \underline{\times\ 42} \end{array}$$

$$\begin{array}{r} {}^{1} \\ 35 \\ \underline{\times\ 42} \\ 70 \end{array}$$

When multiplying the 2 by the 5 ones, we must regroup and write a 1 above the tens column. We add this to 6 tens and write a 7 below.

$$\begin{array}{r} {}^{2} \\ 35 \\ \underline{\times\ 42} \\ 70 \\ \underline{00} \end{array}$$

Before multiplying through by the 4 tens, we need to write a zero in the ones column. 4 tens times 5 is 200. We write the 0 and put the 2 above the tens column.

$$\begin{array}{r} {}^{2} \\ 35 \\ \underline{\times\ 42} \\ 70 \\ \underline{+\ 1{,}400} \\ 1{,}470 \end{array}$$

4 multiplied by 3 is 12. Add on the 2 to 12 to get 14. Finally, we add up the total.

A quick estimate helps us check to make sure our answer makes sense.

$40 \times 40 = 1{,}600$

EXAMPLE 3: Find the product.

$$\begin{array}{r} 2{,}049 \\ \underline{\times \quad 27} \end{array}$$

$$\begin{array}{r} {}^{36} \\ 2{,}049 \\ \underline{\times\ 27} \\ 14{,}343 \end{array}$$

Multiply through by the 7 ones, and be careful with the regrouping.

$$\begin{array}{r} {}^{1} \\ 2{,}049 \\ \underline{\times\ 27} \\ 14{,}343 \\ \underline{+\ 40{,}980} \end{array}$$

Before multiplying through by the tens, we need to write a zero in the ones column. Then we multiply the 2 by 9 to get 18. We write the 8 below in the tens column and the one above the hundreds column.

$$\begin{array}{r} 2{,}049 \\ \underline{\times\ 27} \\ 14{,}343 \\ \underline{+\ 40{,}980} \\ 55{,}323 \end{array}$$

Finally, we add up the total.

A quick estimate helps us check to make sure our answer makes sense.

$2{,}000 \times 30 = 60{,}000$

Physicisists are scientists who study mattter, energy, and time. They use multiplication in when finding the force of an object by multiplying the mass by the acceleration. They use this calculation for many things including putting a spacecraft into orbit.

The Dawn spacecraft is the first spacecraft to have orbited two extraterrestrial bodies. Scientists used multiplication to launch it into orbit.

PRACTICE

Find each product. Write the letter in the box below with the same number to solve the riddle.

WHAT DID THE SKELETON ORDER FOR DINNER?

___	___	___	___	___		___	___	___	___
350	3,699	297	900	20,410		900	1,476	1,443	350

P $\begin{array}{r} 1{,}233 \\ \times \quad 3 \\ \hline \end{array}$	**E** $\begin{array}{r} 4{,}082 \\ \times \quad 5 \\ \hline \end{array}$	**B** $\begin{array}{r} 37 \\ \times \ 39 \\ \hline \end{array}$
S $\begin{array}{r} 14 \\ \times \ 25 \\ \hline \end{array}$	**S** $\begin{array}{r} 35 \\ \times \ 10 \\ \hline \end{array}$	**R** $\begin{array}{r} 25 \\ \times \ 36 \\ \hline \end{array}$
A $\begin{array}{r} 27 \\ \times \ 11 \\ \hline \end{array}$	**I** $\begin{array}{r} 82 \\ \times \ 18 \\ \hline \end{array}$	**R** $\begin{array}{r} 18 \\ \times \ 50 \\ \hline \end{array}$

LESSON 3: FACTORS

Fabulous Factors

You Will Need:

- 2 players
- 2 colored pencils

You Will Do:

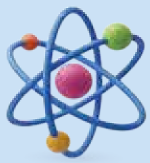
1. Player One chooses any number on the board and circles it with his or her colored pencil.
2. Player Two circles all the factors of Player One's number that are on the board. For instance, if Player One circled 24, then Player Two would circle 1, 2, 3, 4, 6, 8, and 12.
3. Player Two chooses a number on the board and circles it.
4. Player One circles all the factors of Player Two's number that are still available on the board. Players can agree on a certain number of turns until the game is over. Or, they can play until all spaces are circled. The player with the most numbers circled wins.

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

LESSON 3 FACTORS

A **factor** is a number that divides into another number, leaving no remainder. It is often helpful to find a factor of two numbers. The largest factor that two numbers share is called the **greatest common factor**.

Finding the factors of a number is an important skill that will help you solve many kinds of problems in the future. It can help you simplify fractions or start a long division problem.



FACTOR: A factor is a number that is multiplied to get a product. It also divides evenly into that product.

Example: The factors of 30 are 1, 2, 3, 5, 6, 10, 15, and 30. The factors of 25 are 1, 5, and 25.

GREATEST COMMON FACTOR: This is the largest factor that two numbers have in common.
Example: The greatest common factor of 25 and 30 is 5.

EXAMPLE 1: **Find all the factors of 24.**

The easiest way is to make a list of all the ways you can multiply two numbers to get 24. If we go in order, we can make sure we don't miss any.

1×24

2×12

3×8

4×6

$5 \times$???

We cannot multiply 5 to get 24. And then we would be up to 6, which we already listed. We have a complete list.

Factors of 24: 1, 2, 3, 4, 6, 8, 12, 24

EXAMPLE 2: **What is the greatest common factor of 56 and 28?**

Start by listing the factors.

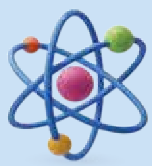
Factors of 28: 1, 2, 4, 7, 14, 28

Factors of 56: 1, 2, 4, 7, 8, 14, 28, 56

The greatest common factor is 28.

A **prime** number is a number with only one pair of factors. That pair of factors will always be 1 and the number itself. The prime numbers less than 10 are 2, 3, 5, and 7. It must be a pair of numbers, 1 and the number. This is why 1 is not prime, it only has one factor; itself!

If a number is greater than 1 and has more than one pair of factors, we say it is **composite**. The number 15 is a composite number.



PRIME: Any whole number greater than 1 is prime if its only factors are 1 and itself.

COMPOSITE: Any whole number greater than 1 that is not prime.

EXAMPLE 3: **List the factors of 23. Is 23 prime or composite?**

We will make a list.

1 × 23	6 × ?????
2 × ????	7 × ?????
3 × ???	8 × ????
4 × ????	9 × ????
5 × ????	10 × ????

We cannot multiply 2, 3, 4, 5, 6, 7, 8, 9 or 10 to get 23. At that point, we know we haven't skipped any factors.

Factors of 23: 1, 23

23 is prime.

PRACTICE

1. List the factors of each number.

50 6 22 35

2. Find the greatest common factor of each pair of numbers.

a. 77 49	b. 99 88
c. 56 42	d. 64 48

3. Find the factors of each number. Then, circle whether it is prime or composite.

12
prime/composite

27
prime/composite

31
prime/composite

39
prime/composite

WARM UP

Prepare for today's lesson by making a list of all the prime numbers under 30. Use the list of numbers below to help you eliminate numbers that have more than two factors.

1. One is not prime. You can cross it out.
2. Any number other than 2 that has 2 as a factor is not prime. You can cross out all of these numbers on the list. This will mean that you are crossing out all of the even numbers except 2.
3. Any number other than 3 that has 3 as a factor is not prime. You can skip count by 3's to eliminate all of these numbers.
4. Any number other than 5 that has 5 as a factor is not prime. You can cross out all of these numbers on the list. They will all have a zero or a 5 as their ones digit.
5. Look at the remaining numbers. Do any of them have more than 2 factors? If so, cross them out.
6. The remaining numbers are a list of primes. Check your list against the one in the answer key.

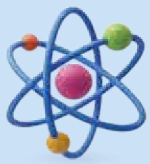
1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30

Prime numbers under 30: ______________________________

In the last lesson, you found pairs of factors for a number. In this lesson, you will find the **prime factorization** of a number. The prime factorization of a number is when we write a number only as the product of prime numbers. Below are examples of two prime factorizations.

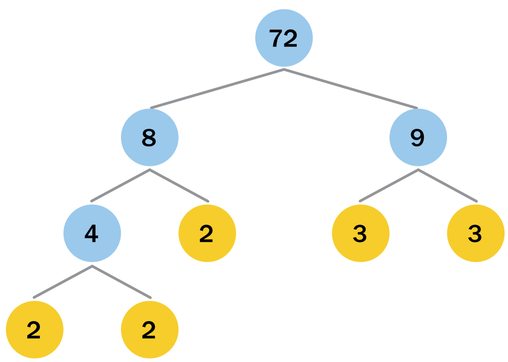
$$30 = 2 \times 3 \times 5$$

$$36 = 2 \times 2 \times 3 \times 3$$



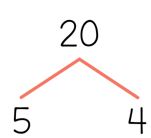
PRIME FACTORIZATION:
Rewriting the number as a product of prime numbers.

A tree diagram is a helpful way to find the prime factorization of a number.

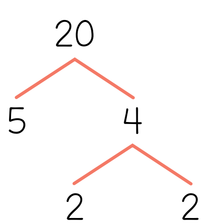


72 = __2__ × __2__ × __2__ × __3__ × __3__

EXAMPLE 1: **Find the prime factorization of 20.**

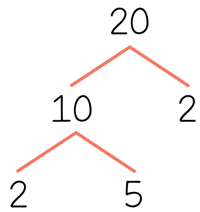


Begin by rewriting 20 as the product of 2 numbers. These two numbers will be the first branches of our tree.



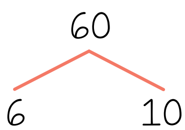
The factor 5 is prime, so that branch of the tree is done. But, 4 is not prime. We will split it into two factors.

We know that 2 is prime. All of the branches of the tree are prime, so the tree is finished. Let's write out the product. When we do this, we always write the factors in order from least to greatest. 20 = 2 × 2 × 5

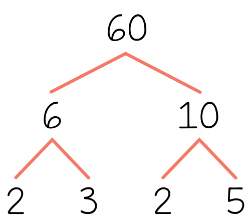


Note that if we had started with two different factors, we would still have arrived at the same answer. The order is different, but when we write the factors in order from least to greatest, we will see that it is the same answer.
20 = 2 × 2 × 5

EXAMPLE 2: Find the prime factorization of 60.



This is a larger number. But remember, you can start with any factor pair. Choose the factor pair that is the easiest for you.



Neither of the branches ends in a prime number. We will need to split both branches again into factor pairs.

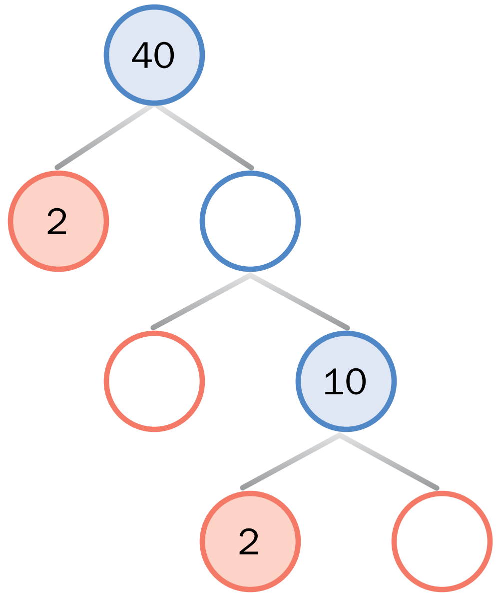
Every branch ends in a prime number. We do not need to factor again. Now we need to write out the factors from least to greatest. 60 = 2 × 2 × 3 × 5

Prime numbers are very important in math and in life. They are used for many things including generating strong passwords for cyber security.

PRACTICE

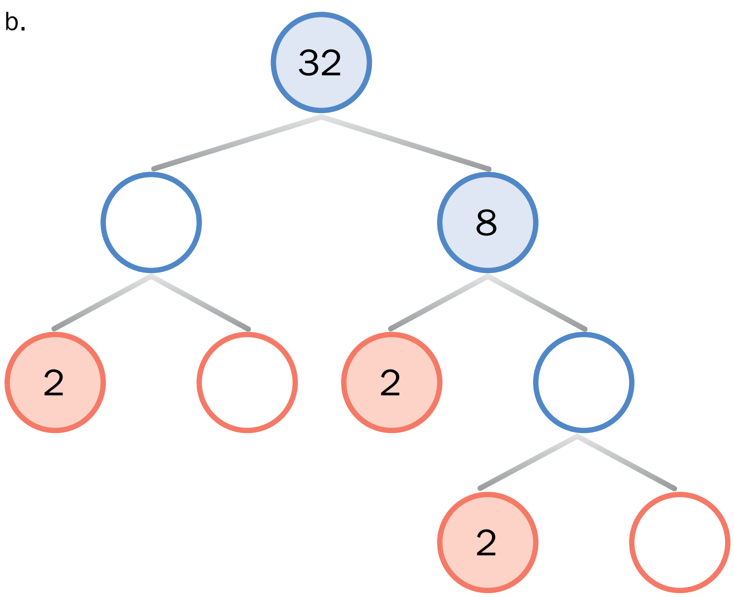
1. Fill in the missing numbers on each tree diagram. Then write out the prime factorization.

a.



40 = ______ × ______ × ______ × ______

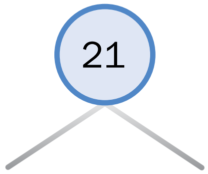
b.



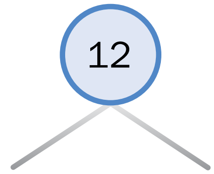
32 = ______ × ______ × ______ × ______ × ______

2. Use tree diagrams to find the prime factorization of each number.

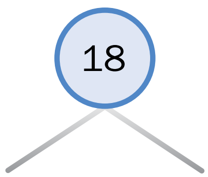
a.



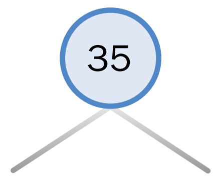
b.



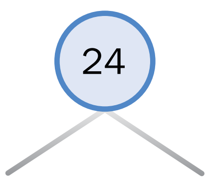
c.



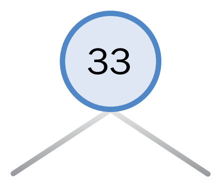
d.



e.



f.



ACTIVITY

LESSON 5: LONG DIVISION (DAY ONE)

Long Division Scramble

You Will Need:

- Lesson 5: Activity Sheet
- Scissors

You Will Do:

1. Carefully tear out the activity sheet from the back of the answer key. Cut the strips apart along the dashed lines.
2. Rearrange the strips to correctly show each long division problem. Have your parent check your answers.

In this lesson and the next, we will be reviewing long division. We use long division to systematically divide large numbers. Begin by reviewing the steps shown in the box to the right.

Because the problems are longer, some students have trouble remembering which step to do next. Remember that you continue to Divide, Multiply, Subtract, and Bring Down until you get to the end of the dividend.

STEPS FOR LONG DIVISION		
D	÷	Divide
M	×	Multiply
S	–	Subtract
B	↓	Bring down

EXAMPLE 1: **Find the quotient.**

D

$$\begin{array}{r} 5 \\ 9\overline{)504} \end{array}$$

Divide. We cannot divide 9 into 5. However, 9 goes into 50 five times. Write the 5 above the zero.

M S

$$\begin{array}{r} 5 \\ 9\overline{)504} \\ -\,45 \\ \hline 5 \end{array}$$

Multiply 9 by 5. The product is 45. Write that directly below and then subtract. There are 5 remaining.

B	5 9)504 – 45 54	Bring down the 4.
	56 9)504 – 45 54 – 54 0	Divide 9 into 54. Nine goes into 54 six times. Write the 6 above the 4 in the ones column. Multiply and subtract. There is no remainder.

EXAMPLE 2: Find the quotient.

D	1 5)86	Divide 5 into 8. It goes into 8 one time. Write the one above the 8.
M S	1 5)86 – 5 3	Multiply 5 by 1. Write the product below and subtract. There are 3 remaining.
B	1 5)86 – 5 36	Bring down the 6.
	17 r. 1 5)86 – 5 36 – 35 1	Divide 5 into 36. Five goes into 36 seven times. Multiply and subtract. There is a remainder of 1.

We can write the remainder using the letter "r" for remainder. Or, we can write the remainder as a fraction.

86 ÷ 5 = 17 r. 1

$86 \div 5 = 17\frac{1}{5}$

When we write a remainder as a fraction, the remainder is the numerator and the divisor is the denominator.

Find each quotient. For answers with remainders, write the answer with the "r." notation and again as a fraction so you can practice both methods.

a. $6\overline{)126}$

b. $5\overline{)650}$

c. $8\overline{)91}$

d. $6\overline{)27}$

e. $4\overline{)123}$

f. $7\overline{)145}$

g. $9\overline{)108}$

h. $4\overline{)323}$

WARM UP

Today we will be using estimation to help us divide. Get ready for today's lesson by circling the number that is closest to each quotient below.

a. $21\overline{)38}$

1 3 5

b. $16\overline{)33}$

1 2 3

c. $24\overline{)52}$

1 2 3

d. $15\overline{)85}$

3 5 7

We will be practicing long division again in this lesson. The only difference is we will now solve problems with a two-digit divisor. We will follow the same four steps to do this: divide, multiply, subtract, and bring down.

When we divide in the first step, we will use estimation to help us decide how many times the divisor goes into the first part of our dividend. You also may need to do some multiplication on scratch paper on the side to check your estimate.

EXAMPLE 1: **Find the quotient.**

$21\overline{)382}$

D

$$\begin{array}{r} 1 \\ 21\overline{)382} \end{array}$$

Divide. We cannot divide 21 into 3. We need to estimate how many times it will divide into 38. We know that 21 x 2 = 42, which is too large. We will estimate that it goes into 38 one time.

M
S

$$\begin{array}{r} 1 \\ 21\overline{)382} \\ -21 \\ \hline 17 \end{array}$$

Multiply 1 x 21 and write the product below. Subtract. The difference is less than 21, so we now know that we divided correctly in the first step.

B

18 21)382 – 21 172	Bring down the 2. We now need to divide 21 into 172. Again, we will use estimation. We know 160 ÷ 20 = 8. We will estimate that 21 goes into 172 eight times.
18 r. 4 21)382 – 21 172 – 168 4	Multiply. The product of 8 x 21 is 168. Write this below. Subtract. There are 4 remaining. We can write the remainder with the "r." notation. We can also write the answer with a fraction. $18 \frac{4}{21}$

Another strategy is to use multiples to help you divide. You'll want to make a list of the multiples of the divisor on the side or on a separate sheet of scratch paper. One advantage of this method is that you can use the same list many times for the same problem. Let's work through an example to see how this can help you.

Common Mistake

If you do not divide correctly on the first step, you will have a difference that is larger than your divisor.

			1	
3	3	6	7	1
	–	3	3	
		3	4	

33 can still go 1 more time into 34. We did not divide correctly on the first step.

Since we used 1 to start, we need to go back and increase that number to a 2.

EXAMPLE 2: **Find the quotient.**

$$33\overline{)671}$$

Before we start the long division steps, we will make a list of the multiples of 33.

$33 \times 1 = 33$

$33 \times 2 = 66$

$33 \times 3 = 99$

$33 \times 4 = 132$

D

$$\begin{array}{r} 2 \\ 33\overline{)671} \end{array}$$

Divide. We cannot divide 33 into 6. We need to divide it into 67. Looking at our list of multiples, we can see that it will divide into 67 two times.

M

S

$$\begin{array}{r} 2 \\ 33\overline{)671} \\ \underline{-\ 66} \\ 1 \end{array}$$

Multiply 2×33 and write the product below. Subtract. The difference is less than 33, so we now know that we divided correctly in the first step.

B

$$\begin{array}{r} 20 \\ 33\overline{)671} \\ \underline{-\ 66} \\ 11 \end{array}$$

Bring down the 1. We now need to divide 33 into 11. It is larger than 11, so we know it goes in zero times. Write the zero above.

$$\begin{array}{r} 20 \text{ r. } 11 \\ 33\overline{)671} \\ \underline{-\ 66} \\ 11 \\ \underline{-\ \ 0} \\ 11 \end{array}$$

Multiply. The product will be zero. Write this below. Subtract. There are 11 remaining.

We can also write the answer using a fraction.

$20\frac{11}{33}$

Simplified the answer will be:

$20\frac{1}{3}$

PRACTICE

1. Find each quotient. Use estimation to help you divide correctly.

a. $16\overline{)339}$

b. $15\overline{)852}$

c. $22\overline{)375}$

2. Find each quotient. A list of multiples is provided to help you divide correctly.

a. $24\overline{)679}$

$24 \times 1 = 24$
$24 \times 2 = 48$
$24 \times 3 = 72$
$24 \times 4 = 96$

b. $13\overline{)5614}$

$13 \times 1 = 13$
$13 \times 2 = 26$
$13 \times 3 = 39$
$13 \times 4 = 52$
$13 \times 5 = 65$
$13 \times 6 = 78$
$13 \times 7 = 91$

3. Find each quotient. First, write out a list of the multiples on a separate sheet of paper and then divide.

a. $15\overline{)467}$

b. $22\overline{)875}$

EXPONENTS

Exponent Exploration

You Will Need:

- Beans (or another small counter to act out the problem)
- Calculator

You Will Do:

1. Brandon's grandmother offers him two options for his Christmas present. In option 1, he can choose to receive \$30. In option 2, he can receive \$2 on the first day, \$4 on the second day, and \$8 on the third day, with the amount doubling each day for 10 days. Which option would you choose?
2. Act out the problem with your beans or another counter. Let each bean represent \$1. Write in the amount of money that Brandon would receive each day if he chooses option 2.

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
\$2	\$4	\$8							

3. Use your calculator to add up the total amount.

Total for Option 1: \$30

Total for Option 2: _______________

You have already learned that you can use multiplication instead of doing repeated addition.

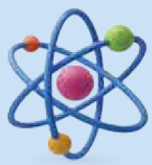
$$3 + 3 + 3 + 3 + 3 = 15 \quad \text{or} \quad 3 \times 5 = 15$$

But what about repeated multiplication? In the opening activity, the amount of money was multiplied by 2 each day. You could find the amount for the tenth day by multiplying by 2 ten times.

$$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$$

We can write repeated multiplication like this using a base and exponent. A base is the number we are multiplying, and the exponent shows us the number of times we will multiply the base by itself. We write the exponent up and to the right of the base and in a smaller size.

BASE → 2^{10} ← **EXPONENT**



BASE: The number we are multiplying by itself.

EXPONENT: The number that shows us how many times we need to multiply the base by itself.

We can also use exponents for an expression that has two different bases.

EXAMPLE 1: **Write the expression using exponents. $4 \times 4 \times 4 =$**

The base is 4 and the exponent is 3.

4^3

EXAMPLE 2: **Write the expression using exponents. $3 \times 3 \times 6 \times 6 \times 6 =$**

We will use 2 different bases and 2 different exponents to write this expression.

$3^2 \times 6^3$

EXAMPLE 3: **Use your calculator to find the correct exponent. $5^{\square} = 125$**

We could make a list and use a calculator to check.

$5^1 = 5$

$5^2 = 5 \times 5 = 25$

$5^3 = 5 \times 5 \times 5 = 125$

The exponent is 3.

1. Write the expression using exponents.

a. $3 \times 3 \times 3 =$ ___________

b. $6 \times 6 \times 6 \times 6 =$ ___________

c. $8 \times 8 \times 8 \times 8 \times 8 =$ ___________

d. $10 \times 10 =$ ___________

e. $5 \times 5 \times 5 \times 6 \times 6 =$ ___________

2. Write out the expression using repeated multiplication.

a. 7^3 ____

b. 2^3 ____

c. 5^6 ____

d. $4^3 \times 2^5$ ____

3. Use your calculator to find the missing exponent for each equation.

a. $2^{\square} = 32$

b. $6^{\square} = 1{,}296$

c. $3^{\square} = 243$

d. $4^{\square} = 256$

LESSON 8: SQUARES AND SQUARE ROOTS

Square Number Bingo

You Will Need:

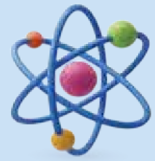
- A pair of dice
- 2 players
- 2 colored pencils

You Will Do:

1. Player One rolls the dice and adds the numbers to get a result between 2 and 12. They then multiply the number by itself. For instance, if a 1 and 4 is rolled, then multiply 5 × 5 to get 25. Player One shades in any space with that product on the board below.
2. Player Two rolls and shades as well. If there is no available space to shade, then the turn is skipped.
3. The first player to get five spaces in a row vertically, horizontally, or diagonally wins. If no one gets 5 proper spaces, the one with the most colored spaces wins.

64	4	36	64	49
36	121	9	25	36
25	16	49	36	25
121	100	81	64	49
100	144	16	9	36

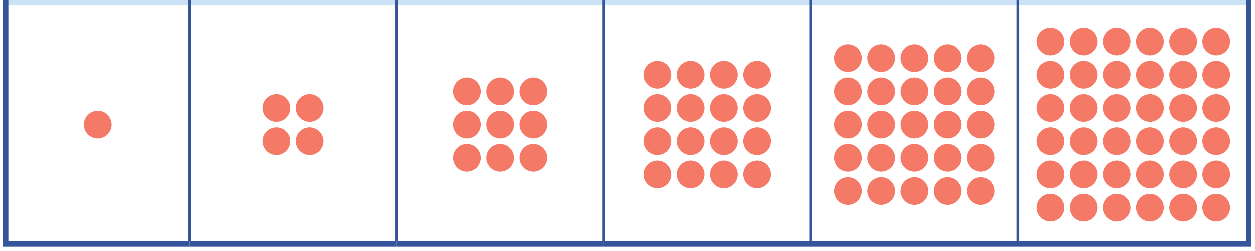
If you multiply a number by itself, the product is called a **square number**. The products are all amounts that can be formed into a square. These numbers can also be called **perfect squares**.



SQUARE NUMBER:
The result of multiplying a number by itself. Another name for these numbers is **PERFECT SQUARES**.

Square Numbers

1 × 1 = 1	2 × 2 = 4	3 × 3 = 9	4 × 4 = 16	5 × 5 = 25	6 × 6 = 36



We can also use exponents when we square numbers. The expression 3^2 is read as *3 squared* or *3 to the 2nd power* and the expression 4^3 is read as *4 cubed* or *4 to the 3rd power*.

$3 \times 3 = 3^2 = 9$

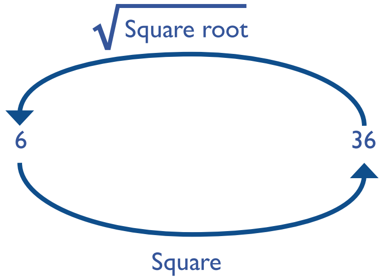
EXAMPLE 1: Find each square number.

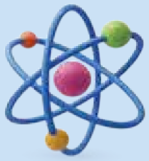
$4^2 =$ $10^2 =$ $7^2 =$

Write out each expression as repeated multiplication. Then, find the product.

$4^2 = 4 \times 4 = 16$ $10^2 = 10 \times 10 = 100$ $7^2 = 7 \times 7 = 49$

The opposite of squaring a number is finding the **square root**. When we find a square root, we ask ourselves, "What number could I square to get this product?" The symbol for square root is unique. It looks a bit like the long division symbol, but has a small check mark at the bottom.





SQUARE ROOT: the number that can be multiplied by itself to give the original number. For example, the square root of 36 is 6, because 6 x 6 = 36. The symbol for square root is $\sqrt{\ }$.

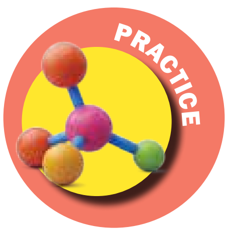
The square root of 81 is 9, because if we square 9 (multiplying 9 by itself) we will get 81.

EXAMPLE 2: **Find the square root of each number.**

$\sqrt{4} =$ $\sqrt{49} =$ $\sqrt{64} =$

We need to think of what number we can square to get each of the results that are under the square root sign.

$\sqrt{4} = 2$ $\sqrt{49} = 7$ $\sqrt{64} = 8$



1. Square each of the numbers below.

a. 8^2 __________ b. 11^2 __________

c. 6^2 __________ d. 13^2 __________

2. Find each square root.

a. $\sqrt{9} =$ _______ b. $\sqrt{1} =$ __________

c. $\sqrt{81} =$ ______ d. $\sqrt{25} =$ __________

e. $\sqrt{100} =$ _____ f. $\sqrt{169} =$ __________

g. $\sqrt{4} =$ ________ h. $\sqrt{16} =$ __________

3. **A square tile has a side length of 9 inches. What is the area of the tile in square inches?**

4. **The area of a square garden is 25 square feet. What is the length of one side of the garden?**

5. **A square blanket has an area of 36 square feet. What is the length of one side of the blanket?**

CHALLENGE!

Two square numbers have a sum of 25. What are the two numbers?

ACTIVITY

LESSON 9: THE ORDER OF OPERATIONS (DAY ONE)

Order of Operations Foldable

You Will Need:

- Lesson 9: Activity Sheet
- Scissors
- Colored pencils

You Will Do:

1. Carefully tear the activity sheet out of the back of the answer key and cut along the dashed lines. Cut slits on the smaller dashed lines and fold along the solid lines so that the images show on the outside and the large letters are on top of the step descriptions.
2. Color in the arrows above the "multiplication and division" and "addition and subtraction" steps. This is to remind you to always work from left to right.
3. Draw in parentheses and brackets on the top right flap.
4. Write two more examples of exponents on the exponents flap.
5. Look at the large letters on the top of your foldable. They spell *PEMDAS*. This acronym is one way students remember the order of operations.
6. You will fill in the inside of the foldable after reading today's lesson.

The **order of operations** is an agreed upon order mathematicians use when working on problems. They created the order to make sure all mathematicians arrive at the same answer every time. You have worked with 3 steps of the order of operations before, but now you will learn the entire order.

The Order of Operations

1. Perform operations that are in grouping symbols.
2. Evaluate exponents.
3. Multiply and Divide (from left to right).
4. Add and Subtract (from left to right).

THE ORDER OF OPERATIONS:
This is an agreed upon order for doing math problems.

EXAMPLE 1: **Evaluate the expression. 20 – 10 ÷ 2**

20 – 10 ÷ 2	There are no parentheses or exponents. We can skip the first step. We now need to multiply or divide from left to right. There is no multiplication. We need to divide. 10 ÷ 2 = 5
20 – 5	Now we do addition and subtraction from left to right. There is no addition. We need to subtract.
15	We have arrived at an answer that all mathematicians would agree to. Do you see how this is different from 20 – 10 = 10 then 10 ÷ 2 = 5. Mathematicians must agree on the order to always arrive at the same answer!

EXAMPLE 2: **Evaluate the expression. $3 \times 5^2 + 4 \times (2 + 4)$**

$3 \times 5^2 + 4 \times 6$	Our first step is to do whatever is inside of grouping symbols. In this example we have parentheses. 2 + 4 = 6
3 × 25 + 4 × 6	Next, we need to evaluate the exponent. $5^2 = 5 \times 5 = 25$
75 + 24	Now, we multiply (or divide) working from left to right. 3 × 25 = 75 and 4 × 6 = 24
99	Finally, we add (or subtract) working from left to right. 75 + 24 = 99

EXAMPLE 3: **Evaluate the expression. $3 + (4^2 – 10)$**

3 + (16 – 10)	Our first step is to do whatever is inside of the parentheses. There are two operations. When this happens you start again at the beginning of the order of operations. There are no more grouping symbols so we will evaluate the exponent first. Now, we subtract within the parentheses. 16 – 10 = 6
3 + 6	Finally, we evaluate this problem and see we need to add to get the final answer. 3 + 6 = 9

Fill in the inside of your foldable following the order of operations shown in the above examples.

PRACTICE

Evaluate each expression. Remember to use PEMDAS through each stage of solving. Look at your foldable if you need help remembering the steps.

a. $5 + 21 \div 3 \times 2$

b. $9 + (62 - 12)$

c. $33 \div (15 - 4\ ) + 3$

d. $(7 + 42) - 2 \times 3$

e. $16 + 12 \div 4 - 2^2$

f. $81 \div 3^2$

g. $10^2 - 60 \div 6$

h. $4 \times 5^2 + (3 + 2)$

WARM UP

The first letter of each step in the order of operations is written below. Do your best to write in the name of each step. Then, use your foldable from the last lesson to fill in any steps you forgot.

P____________________

E____________________

M/D____________________/____________________

A/S____________________/____________________

1. Evaluate each expression. Use your foldable to help you remember the steps.

a. $5 \times (5 + 1) - 7$

b. $(8 + 2^2) \div 3 + 9$

c. $4 \times 3 + (9 - 9) + 3^2$

d. $20 + 10 \div 2 - 3^2$

e. $21 \div (15 - 8) + 10$

f. $64 \div (2^2 + 4)$

WARM UP

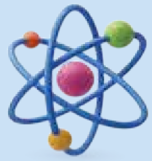
Evaluate each expression.

a. $10^2 + (12 \div 4)$

b. $64 \div 4^2$

The **Distributive Property** states that multiplying a number by a group of numbers added together is the same as doing each multiplication separately. It can help us do many math problems mentally. It will also be essential in helping you do more complicated math in the future. Master breaking down simple problems now and becoming comfortable with it so that eventually it becomes second nature to you. Let's see why the property works.

$10 \times (3 + 2) = 10 \times 5 = 50$ $10 \times 3 + 10 \times 2 = 30 + 20 = 50$



THE DISTRIBUTIVE PROPERTY:

Multiplying a number by a group of numbers added together is the same as doing each multiplication separately.

EXAMPLE 1: Find the product of 7 × 56 mentally.

Start by breaking the number 56 apart. We can do this by putting the addition inside parentheses.

7×56

$7 \times (50 + 6)$

$7 \times 50 + 7 \text{ x } 6$

To multiply 7 times 50, think of 7 × 5, and then add a zero on the end.

$350 + 42 = 392$

PRACTICE

Rewrite each multiplication problem by breaking the second factor apart. Then multiply mentally by using the Distributive Property.

a. 5 × 46

5 × (_____ + _____)

b. 6 × 34

6 × (_____ + _____)

c. 3 × 23

3 × (_____ + _____)

d. 8 × 41

8 × (_____ + _____)

e. 7 × 31

7 × (_____ + _____)

f. 9 × 33

9 × (_____ + _____)

g. 10 × 45

10 × (_____ + _____)

h. 7 × 52

7 × (_____ + _____)

SKILLS CHECK

You have been working with multiples and factors as part of the Unit 1 skills practice. Here are a few more for you to try.

1. List the next 5 multiples of each number.

a. 4, 8, _____, _____, _____, _____, _____

b. 7, 14, _____, _____, _____, _____, _____

2. Find all the factors of the given number.

a. 24 ____

b. 35 ____

3. Find each product or quotient.

a. $\begin{array}{r} 4{,}516 \\ \times \quad 3 \\ \hline \end{array}$

b. $4\overline{)23}$

c. $\begin{array}{r} 34 \\ \times \ 27 \\ \hline \end{array}$

d. $24\overline{)491}$

4. Evaluate each expression.

a. $9 \div 3 + 2 =$

b. $4^2 - 9 + 6 =$

5. Use mental math to find the product.

4×83