


Grade 8 Mathematics

Number and Number Relations: Lesson 10

Read aloud to the students the material that is printed in **boldface type** inside the boxes. Information in regular type inside the boxes and all information outside the boxes should **not** be read to students. Possible student responses are included in parentheses after the questions.

NOTE: The directions read to students may depend on the available materials. Read only those parts of the lesson that apply to the materials you are using.

Any directions that ask you to do something, such as to turn to a page or to hand out materials to students, will have an arrow symbol () by them.

Purpose of Lesson 10:

- In this lesson, the tutor and the students will
 - ✓ multiply and divide integers, and
 - ✓ solve real-life problems involving integers.

Equipment/Materials Needed:

- Copies of Student Sheets 82, 83
- Paper and pencils
- Chalkboard

Preparations before beginning Lesson 10:


- Run one copy of Student Sheets 82, 83 for each student.
- Have paper and pencils available.

Lesson 10: Number and Number Relations

Integers were first introduced in Lesson 3 of Number and Number Relations. In Lesson 9 of Number Relations, addition and subtraction of integers were covered. This lesson will focus on multiplication and division of integers. Instead of simply giving students the rules for multiplication and division of integers, you need to help them understand the underlying concepts. If you feel that the students already understand these concepts, move to the part of the lesson dealing with word problems.

Say:

In this lesson, you will learn to multiply and divide positive and negative integers and to solve real-life problems involving them. You can think of multiplication as groups of the same amount. For example, 4×5 can be thought of as 4 groups of positive 5 or 20. $4 \times (-5)$ can be thought of as 4 groups of -5 or -20 .

 Write the following number sentences on the board.

3×4	$= 12$	3 groups of 4 = 12
3×3	$= 9$	3 groups of 3 = 9
3×2	$= 6$	
3×1	$= 3$	
3×0	$= 0$	
$3 \times (-1)$	$= -3$	3 groups of $-1 = -3$
$3 \times (-2)$	$= -6$	
$3 \times (-3)$	$= -9$	

Say:

What patterns do you see in the number sentences above. (Answers will vary, but these examples are some of the patterns. All of the numbers in the first column are 3's. The numbers in the 2nd column are decreasing by one. The numbers in the third column are decreasing by 3.) **What would you predict the next number sentence would be?** ($3 \times (-4) = -12$) **What is $3 \times (-5)$?** (-15) **What is the sign of the product of a positive number and a negative number?** (negative) **What is $10 \times (-8)$?** (-80) **What is the sign of the product of a positive number and a positive number?** (positive)

Say:

Is $3 \times (-3)$ the same as $(-3) \times 3$? (Yes.) **What property states that these expressions name the same number?** (commutative or order property)

Write the following problems on the board.

$$(-3) \times 3 = -9$$

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

$$(-3) \times 1 = -3$$

Say:

What patterns do you see in the number sentences above? (Answers will vary, but these examples are some of the patterns. All of the numbers in the first column are -3 's. The numbers in the 2nd column are decreasing by one. The numbers in the third column are increasing by 3.) **If you continue the patterns shown in these number sentences, what are the next four number sentences?** Write them underneath the above sentences.

Write the following problems on the board.

$$(-3) \times 0 = 0$$

$$(-3) \times (-1) = 3$$

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

$$(-3) \times (-3) = 9$$

Say:

What patterns do you see in these four number sentences? (Answers will vary, but these examples are some of the patterns. All of the numbers in the first column are -3 's. The numbers in the 2nd column are decreasing by one. The numbers in the third column are increasing by 3.) **What do you predict will be the next number sentence in the pattern?** [$(-3) \times (-4) = 12$] **What is $(-3) \times (-5)$?** (15) **What is the sign of the product of a negative number and a negative number?** (positive) **What is -10×-8 ?** (80) **What is the sign of the product of a negative number and a positive number?** (negative) **What is -10×8 ?** (-80)

Say:

Another way to think of the signs in multiplication of integers is to think of the motions involved in a video tape of ice skating. Think of skating forward as a positive motion and skating backwards as a negative motion. If you run the video tape forward, the motion is positive and if you run it backward, the motion is negative.

 Draw this chart on the board.

Skating direction	Forward	Backward	Forward	Backward
Video direction	Forward	Forward	Backward	Backward
Apparent direction of skater				

Say:

If the person is skating forward and the video is running forward, what is the apparent direction of the skater? (forward) So a positive direction times a positive direction yields an apparent positive direction.

$$4 \cdot 6 = 24$$

If the person is skating backward and the video is running forward, what is the apparent direction of the skater? (backward) So a negative direction times a positive direction yields an apparent negative direction. $-4 \cdot 6 = -24$


If the person is skating forward and the video is running backward, what is the apparent direction of the skater? (backward) So a positive direction times a negative direction yields an apparent negative direction. $4 \cdot (-6) = -24$

If the person is skating backward and the video is running backward, what is the apparent direction of the skater? (forward) So a negative direction times a negative direction yields an apparent positive direction. $-4 \cdot (-6) = 24$

These ideas may help you understand the reason that a negative number times a negative number yields a positive number.

Say:

Let's review what we have learned about multiplication of integers. If you multiply two positive numbers, what is the sign of the product? (positive) If you multiply two negative numbers, what is the sign of the product? (positive) If you multiply a positive number and a negative number, what is the sign of the product? (negative) If you multiply a negative number and a positive number, what is the sign of the product? (negative) The rules for division are similar. If you divide two positive or two negative numbers, the quotient is positive. If you divide a positive and a negative number, the quotient is negative.


 Give students Student Sheet 82. This sheet will give students practice with the four operations on integers.

Answers:

- | | | | |
|------------|-------------|-------------|------------|
| 1. 1, -2 | 2. -15, 50 | 3. -5, -36 | 4. -1, 0 |
| 5. -4, 4 | 6. 18, 81 | 7. 0, 0 | 8. 5, -20 |
| 9. 12, -60 | 10. 7, -28 | 11. -3, 24 | 12. 5, 45 |
| 13. 6, -2 | 14. -13, -7 | 15. -10, -5 | 16. -2, -6 |
| 17. 1, 8 | 18. 4, -5 | | |


The order of the numbers in problems 19 – 24 could be reversed.

- | | | | |
|-----------|-------------|-----------|-----------|
| 19. -1, 5 | 20. -10, -6 | 21. -3, 3 | 22. -6, 0 |
| 23. 4, 4 | 24. -4, -2 | | |

 Give students Student Sheet 83. This sheet will apply multiplying and dividing integers to real-life situations.

Answers: The expressions may vary.

1. $3 \cdot 4$; 12 yards or a gain of 12 yards
2. $3 \cdot (-4)$; -12 yards or a loss of 12 yards
3. $6 \cdot (-20)$; -\$120 or a withdrawal of \$120
4. $-45 \div (-5)$; 9 minutes
5. -5×6 ; -\$30 or \$30 deducted
6. $-1000 \div 100$; -\$10 or a loss of \$10
7. B
8. A
9. $-9F^\circ$

 Have one student summarize today's lesson. Understanding how to multiply and divide integers is very important in solving algebraic problems.

Student Sheet 82 (Number Relations: Lesson 10)

In the following chart, you are given two parts. Use these parts to find the sum and then use the same parts to find the product.

	Ex.	(1)	(2)	(3)	(4)	(5)	(6)
Sum	4						
Part	- 4	2	- 5	- 9	- 1	- 2	9
Part	8	- 1	- 10	4	0	- 2	9
Product	- 32						

In the following chart, you are given a part and the sum. Fill in the rest of the chart.

	Ex.	(7)	(8)	(9)	(10)	(11)	(12)
Sum	12	- 1	1	7	3	- 11	14
Part	7			- 5	- 4		9
Part	5	- 1	- 4			- 8	
Product	35						

In the following chart, you are given a part and the product. Fill in the rest of the chart.

	Ex.	(13)	(14)	(15)	(16)	(17)	(18)
Sum	- 12						
Part	- 8	8		- 5	4		9
Part	- 4		- 6			- 7	
Product	32	- 16	42	25	- 24	- 56	- 45

In the following chart, you are given the sum and the product. You need to find the parts.

	Ex.	(19)	(20)	(21)	(22)	(23)	(24)
Sum	- 5	4	- 16	0	- 6	8	- 6
Part	- 2						
Part	- 3						
Product	6	- 5	60	- 9	0	16	8

Student Sheet 83 (Number Relations: Lesson 10)

Write an expression that will help you solve each problem. Then solve each problem.

1. A football team gained four yards on the first three plays of the game. What are the team's total yards gained on the three plays?
2. On the next three plays, the same team lost four yards. What are the team's total yards lost on these three plays?
3. Sabrina withdrew \$20 a week from her bank account for six weeks. How much did she withdraw in the six-week period?
4. A group of students want to explore a cave passage that is at an elevation of -45 feet. If they descend at a rate of -5 feet per minute, how long will it take them to descend to the passage?
5. Susie's bank charges a \$5 service fee if her balance drops below \$300 anytime during the month. Susie's account dropped below \$300 for six months. How much was deducted from her account?
6. Al lost \$1000 on 100 shares of stock. How much did he lose on each share of stock?
7. Jimmy's watch loses five minutes every week. Which equation shows how many minutes the watch loses in one month?
A. $-4 \times (-5) = 20$ B. $4 \times (-5) = -20$
C. $4 + (-5) = -1$ D. $-4 - 5 = -9$
8. In golf, an eagle is two strokes under par, or -2 . If someone made eagles on three holes, which equation represents the number of strokes under par the person scored?
A. $3 \times (-2) = -6$ B. $-2 + 3 = 1$
C. $-3 \times (-2) = 6$ D. $-2 - 3 = -5$
9. The temperatures for four days in Homer, Alaska were -22°F , -31°F , 7°F , and 10°F . What was the average temperature for the four days?