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# Exploring Multiplication Patterns

Grade Levels: **3 - 5**

## INTRODUCTION

This lesson enables students to begin the process of mastering multiplication facts. Students will learn to use *patterns* and *property theories* as strategies for recalling those facts.

## OBJECTIVES

Students will:

- develop computational fluency by exploring patterns in multiplication for products involving one-digit factors.
- understand and use the *zero property for multiplication* and the *property of one as a factor in multiplication*.

## SUGGESTED TIME ALLOWANCE

This lesson can be divided into two or three smaller lessons, each lasting about 20-25 minutes.

## MATERIALS

Student: Crayons or markers, Hundred Chart (</numbers/lesson-plan/3035.html>) , Doubles Worksheet (</multiplication/printable/3092.html>) [[Answer Key \(/multiplication/activity/3101.html\)](/multiplication/activity/3101.html)], Independent Practice Worksheet (</multiplication/activity/3093.html>) [[Answer Key \(/multiplication/activity/3102.html\)](/multiplication/activity/3102.html)], Multiplication Table (</multiplication/activity/3096.html>)[[Answer Key \(/multiplication/activity/3095.html\)](/multiplication/activity/3095.html)].

Teacher: Teacher's Chart (</multiplication/activity/3097.html>) of multiplication patterns to be printed as an overhead transparency or copied onto the board.

## PROCEDURES

1. Introduce key vocabulary: *multiple*, *factor*, *product*, *double*.
2. Display the Teacher's Chart (</multiplication/activity/3097.html>) an overhead transparency, or copy it onto the board. Hand out copies of the Hundred Chart (</numbers/lesson-plan/3035.html>).
3. Have students count by 2s, shading *multiples* of 2 yellow on their hundred chart. Ask them to examine the numbers carefully. Ask:
  - *What patterns do they notice?* (The *multiples* of 2 are even and always end in 0, 2, 4, 6 or 8.)
4. Have students count by 5s, circling the *multiples* of 5 with a blue marker on their number charts. Ask:
  - *What patterns do they notice?* (The *multiples* of 5 end in 5 or 0).
5. Model your thinking:
  - *When I look at the multiples of both 2 and 5, I see that they all end in zero. It's like counting by 10s. I notice that  $2 \times 5$  is 10.*

6. Have the students count by 9s on the number chart. Write out the multiplication sentences and answers on the chalkboard ( $9 \times 1 = 9$ ,  $9 \times 2 = 18$ , and so on) and ask students to find a pattern and discuss what they find.
  - (The sum of the *product's* digits is 9. The tens digit is 1 less than the other *factor*. Make it clear that they will have to memorize the 9s, but that these patterns may help them remember and can be used to verify the *products*.)
7. Have students look at their charts and find:
  - the *multiples* that 2 and 9 have in common (18, 36, 54, 72, 90, and so on).
  - the *multiples* that 2 and 5 have in common (10, 20, 30, 40, 50, and so on).
  - the *multiples* that 5 and 9 have in common (45, 90).
8. Ask students what would happen if they shaded in all the multiples of 1 on their charts. (They should soon realize that they'd be shading in everything.) Articulate the *property of one*:
  - *The product of a number and 1 is that same number.*
  - *Every number is a multiple of 1 and itself.*
9. To illustrate, ask several easy questions to the class at large. *What is  $8 \times 1$ ? What is  $9 \times 1$ ?* Get increasingly harder: *What is  $52 \times 1$ ? What is 1 million  $\times 1$ ?*
10. Ask students to think about multiplying with zero in terms of repeated addition. *What is  $0 + 0$ ? What is  $3 \times 0$ ? What is  $52 \times 0$ ? What is 1 million  $\times 0$ ?* Help students to determine the zero property for multiplication:
  - *the product of a number and 0 is 0.*
11. Ask students to name the double of 2 ( $2 \times 2 = 4$ ). Share the following problem:
  - For his family reunion Ariel wants to make 2 lemon pies that use 5 lemons each. How many lemons should he buy? ( $2 \times 5 = 10$ ). Then he remembers that his Uncle Bob loves lemons and is likely to eat 2 pies all by himself. Ariel better make 4 pies! How many lemons will he need to make 4 pies that require 5 lemons each?
12. Explain to students that they can arrive at the answer through the idea of the *double*. Example:
$$2 \times 5 = 10$$
$$4 \times 5 = 10 + 10$$
$$4 \times 5 = 20$$
  - *Because 4 is the double of 2, the product of any number multiplied by 4 will be double the product of that same number multiplied by 2.*
13. Ask the students to name other doubles with which this technique might work, such as
  - $4 \times 2 = 8$  and  $4 \times 6 = 24$ .
$$4 \times 6 = 24$$
$$8 \times 6 = 24 + 24$$
  - $4 \times 2 = 8$  and  $4 \times 7 = 28$ .
$$4 \times 7 = 28$$
$$8 \times 7 = 28 + 28$$
  - $4 \times 2 = 8$  and  $4 \times 8 = 32$ 
$$4 \times 8 = 32$$
$$8 \times 8 = 32 + 32$$

14. Hand out the Doubles Worksheet (</multiplication/printable/3092.html>) that develops the concept of the double and complete it with your students until the pattern is clear. *Answer Key* (</multiplication/activity/3101.html>)
15. Hand out one or more of the Independent Practice Worksheet (</multiplication/activity/3093.html>) for students to practice finding the product. *Answer Key* (</multiplication/activity/3102.html>)

## ASSESSMENT

- Have each student answer the Assessment Questions (</multiplication/activity/3098.html>) .
- Review multiplication facts daily, using patterns and properties for recalling those facts that are not yet automatic.
- Students should be able to:
  - recognize patterns in multiplication for products involving one-digit factors.
  - understand and use the *zero property for multiplication* and the *property of one* as a factor in multiplication.
  - understand and use the technique of the double to solve for more difficult products.
  - know multiplication facts by using the patterns of factors 2, 5, and 9.
- Checking for automaticity should be ongoing and can be as simple as calling out facts for individuals to give products as quickly as they can. This can be done while standing in the cafeteria line or during other windows that occur in a typical school day. A variety of games can be used as tools to assess students and promote memorization.

## EXTENSION ACTIVITIES

- Have students complete the Multiplication Table (</multiplication/activity/3096.html>) through  $9 \times 9$ . For extra credit, challenge them to complete the table through  $12 \times 12$ . Remind them to use what they have learned about patterns and properties to help. *Answer Key* (</multiplication/activity/3095.html>)
- Hand out the Extension Worksheet (</multiplication/activity/3099.html>) . You may wish to go over the answers as part of a class discussion. *Answer Key* (</multiplication/activity/3104.html>)
- Hand out the Enrichment Worksheet (</algebra/activity/3100.html>) and have students solve for  $n$ . *Answer Key* (</multiplication/activity/3105.html>)

Visit these sites for more Web resources:

Multiplication games from A+ Math

<http://aplusmath.com/Games/index.html> (<http://aplusmath.com/Games/index.html>)

Math in literature. Lists books with multiplication themes

<http://archon.educ.kent.edu/Oasis/Resc/Educ/mathkidslit.html>  
(<http://archon.educ.kent.edu/Oasis/Resc/Educ/mathkidslit.html>)

Multiplication flashcards

<http://aplusmath.com/Flashcards/multiplication.html> (<http://aplusmath.com/Flashcards/multiplication.html>)

## NCTM STANDARDS CORRELATIONS

### National Council of Teachers of Mathematics

- Number and Operations: Develop fluency in multiplying whole numbers; develop and use strategies to estimate the results of whole-number computations and to judge the reasonableness of such results; understand and use properties of operations.

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