

Out of This World Multiplication

Brief Overview:

Through the activities of this unit, students will identify, describe, extend and create numeric patterns and functions using multiplication. This unit will develop algebraic understanding.

NCTM Content Standard/National Science Education Standard:

Understand patterns, relations, and functions

Describe, extend, and make generalizations about geometric and numeric patterns;

Represent and analyze patterns and functions, using words, tables, and graphs.

Grade/Level:

Grades 3-4

Duration/Length:

3 days (60 minutes each day)

Student Outcomes:

Students will:

- Identify and examine multiples that exist in numbers from 1 - 100.
- Represent and analyze numeric patterns using skip counting.
- Identify and model the commutative property in multiplication.
- Complete a function table using multiplication rules.

Materials and Resources:

Lesson 1

- Overhead projector
- Transparency of Teacher Resource 2
- Post-It® 20" x 23", White, Self Stick Easel Pad or large File cards
- Markers
- Pattern Block Stickers
- Amanda Bean's Amazing Dream by Marilyn Burn
- Hundred Chart, Student Resource 3
- Translucent math chips colored red and yellow 25 of each per student.
- Teacher Resource 1-3 - See Appendix A
- Student Resource - See Appendix B

Lesson 2

- Overhead Projector
- Transparencies
- Counting chips
- Pattern Block Stickers
- Amanda Bean's Amazing Dream by Marilyn Burn
- Half-inch grid paper
- Flash cards
- Pattern blocks
- Teacher Resource - See Appendix A
- Student Resource - See Appendix B

Lesson 3

- Overhead Projector
- Transparencies
- Pattern blocks
- Teacher Resource - See Appendix A
- Student Resource - See Appendix B

Development/Procedures:

Lesson 1

Pre-Assessment

- Students will complete Student Resource 1 using pattern blocks stickers.

Launch

- Beat the Teacher. (Teacher Resource 1)
- Divide students into groups of three by having them select a card from your hand.
- Students find the card on the wall chart that matches their card.
- Each group will have a recorder, a presenter and a timekeeper as marked on a card. It is the job of the recorder to write down what the group members say on the wall chart. It is the job of the facilitator to make sure the group does not lose focus. It is the job of the presenter to explain the work on the wall chart.
- Give one "thinking minute" for students to come up with ways to represent the number 24. After the minute, students will write as many math equations as they can think of that equal 24.
- Explain: The group may not repeat items nor can they go over to another group for assistance.
- The group will have five minutes to complete the list. Post your list on the wall along with the group lists. If as a class, the groups are able to compile more answers than you, the class wins. (You may choose to add an incentive such as ten free minutes after math if they have more equations than you.)

Teacher Modification: In place of having students move from desks, groups can be formed by having students remain seated and distributing large file cards for answers.

Teacher Facilitation

- Discuss the student math posters. Be sure to point out any multiplication problems.
- Show Teacher Resource 2 on a transparency.
Review multiplication vocabulary. Example: $3 \times 8 = 24$. The number 3 and the number 8 are called factors in this multiplication number sentence. The number 24 is called a product.
- Distribute additional examples of multiplication number sentences and have students point out the factors and the products.
- Explain: A multiple is what we call the product that the factors equal.
- Read Amanda Bean's Amazing Dream. Draw student attention to the multiples in her events.

After reading the story, discuss different methods of skip counting that Amanda displayed. List the different multiples that were evident in the story.

Student Application

Distribute a hundreds chart, Student Resource 3, to each student and a bag of 30 chips. 15 of the chips should be yellow. The other 15 should be red. Students will place a red chip on the multiples of three between the numbers 1 and 50. Students will then place a yellow chip on the multiples of eight between the numbers 1 and 50. Have them record their findings. (Student Resource 2 - Counting On You) Have students identify the patterns that emerge from the multiples of these numbers. See Teacher Resource 3 for answer key.

Embedded Assessment

Circulate and assess students' ability to complete Student Resource 2.

Reteaching/Extension

Reteaching - In a small group, guide students into completing Student Resource 2 by having them identify multiples of 5 and 10. Aide students in identify patterns that emerge from those numbers.

Extension - Students may work independently to complete Student Resource 3

Using the multiples of 3 and 8 from numbers 50 to 100.

Lesson 2

Pre-assessment

- Distribute half-inch grid paper, Student Resource 6, to students. Ask students to color six squares using an equal number in each row and column. Discuss the different ways students made six.

Launch

- Use an overhead to display a random amount of counting chips. The chips should be displayed in an unorganized fashion.
- Ask students the following questions:
 - How many chips are on the overhead? Guide students into realizing there is no easy way to count because they are unorganized.
 - How can the chips be organized so that they are easier to count? Guide students into arranging the chips into equal groups.

Teacher Facilitation

- Explain to students that an array is an orderly arrangement of objects in columns and rows. Arrays can be used to organize an equal number of objects into equal groups. These arrays can then be used to form multiplication sentences. Preface Amanda Bean using organized displays to help her count.

- Distribute to each student 30 chips. Model on the overhead with students how to organize 3 into an array. Line 3 chips into a row. Tell students that this array represents 1 row of 3. Ask students if there is another way to make an array for 3. Guide students to understand that they can also have 3 rows of 1.
 - Instruct students to make an array for 5 using their chips. Circulate and assess student arrays. Ask students how many arrays they can make for 5 (5 rows of 1 or 1 row of 5).
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- Display six chips on the overhead. Ask students to show 2 rows of 3. Display the array on the overhead.
 - With the array of 2 rows of 3. Write 2 rows of 3 is equal to 6, two threes is equal to 6, and $2 \times 3 = 6$.
 - Ask students if there is another way to make an array for 6. Guide students to the understanding that 3 rows of two is also equal to 6. Display the array on the overhead.
 - Ask students what should be written for this array. 3 rows of 2 is equal to 6, three twos is equal to six, and $3 \times 2 = 6$.
 - Ask students what they noticed about the arrays and sentences for $2 \times 3 = 6$ and $3 \times 2 = 6$. Students should conclude that the factors have switched but the product is the same. Explain that this is called the commutative property of multiplication.

Student Application

- Distribute a sheet of half-inch grid paper (Student Resource 6) to each student. Each student will also be given a flash card with the number 12 or 8.
- Instruct students to draw as many arrays as possible for each number. Each array should be labeled with the correct number sentence

- The commutative property should be present for each array.

Embedded Assessment

- Circulate and guide students into correctly labeling and drawing their arrays on their grid paper.

Reteaching/Extension

- **Reteaching:** In a small group, take another product and model the process of creating arrays. Discuss how each array represents the commutative property of multiplication.
- **Extension:** Ask students to find ways to express the commutative property of multiplication using real world situations. (egg carton, pack of sodas, donuts...). Have the students create multiple ways of showing the same product. For example: $3 \times 4 = 12$, $4 \times 3 = 12$, $6 \times 2 = 12$, $2 \times 6 = 12$, etc.

Lesson 3

Pre-assessment

- **Name My Rule.** Write on the board this clue, I start as 3 and end as 6. I start as 8 and end as 16. I start as 4 and end as 8. What is my rule?

Launch

- Explain to students that they will be finding the function of a given set of numbers
- Define function as a consistent relationship between a set of numbers.

Teacher Facilitation

- Ask the class to skip count by 3 to 30. As students recite each number write it on the overhead.

- Explain to students that they are going to find a rule for numbers within an in/out table.
- Draw a function table on the overhead. Remind students of how a function table works.
 - The number on the left (input) is compared to the number on the right (output). Students must think about what operations may have taken place in order for the numbers to change. The rule for the table may not be evident from the first number; they must look at the relationship of the other numbers in the table in order to find the rule that works for all changes in numbers.
- Randomly write numbers between 1 and 50 in the input part of the function table, and then write numbers in some of the output boxes to reflect the rule $\times 3$. Ask student to find the relationship between the input and output boxes.

For example: input 4 and the output would be 12, input 3 and the output would be 9.

Student Application

- Divide students into groups of three and give each student a job within their group. Each group will have a recorder, facilitator and speaker.
- Distribute a different function table to each group. Along with the table, distribute 50 counting chips.
- Using the chips, each group will solve the missing products. The facilitator will be in charge of manipulating the chips for the group. The recorder will write the output number on the function table and the rule that applies to the function table.

Embedded Assessment

- Circulate the room and assess each group's understanding of finding the rule of a function table.
- Ask individual students to explain how they found their rule.

Reteaching/Extension

- **Reteaching:** Teacher can guide students into finding the rule for a function table that they develop in their group.
- **Extension:** Provide a function table that has missing factors. (Student Resource 4) Ask students to use their chips and Student Resource 5 to solve the missing product. They will describe how they were able arrive at their solution. See Teacher Resource 4 for an answer key.

Summative Assessment:

Students will demonstrate an understanding of the commutative property of multiplication and functions by creating a pattern block creature. The students will be using the same 3 blocks for each level of the pattern. Students will predict how the creature will look after the seventh level is added (Student Resource 6). In addition students will write a brief constructed response explaining how they came to their conclusion (Student Resource 7). They also need to give their pattern block creature a name. See Teacher Resource 5 and 6 for an answer key.

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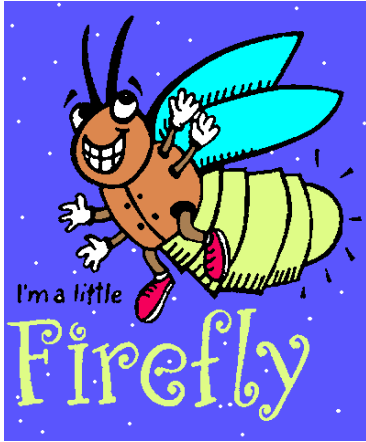
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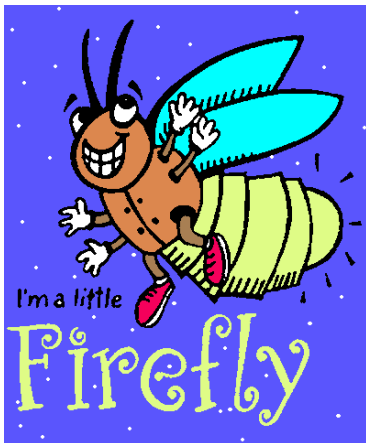
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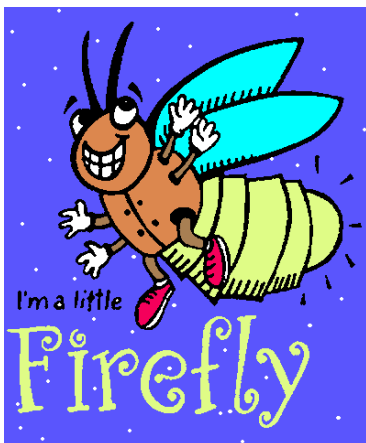
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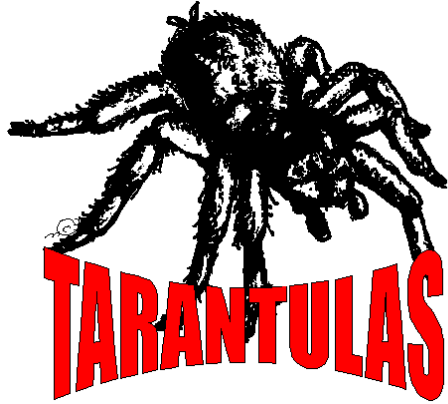
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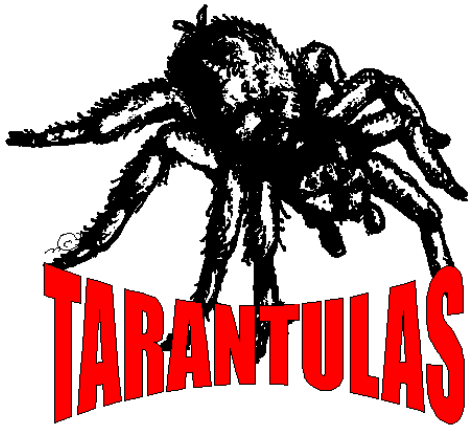
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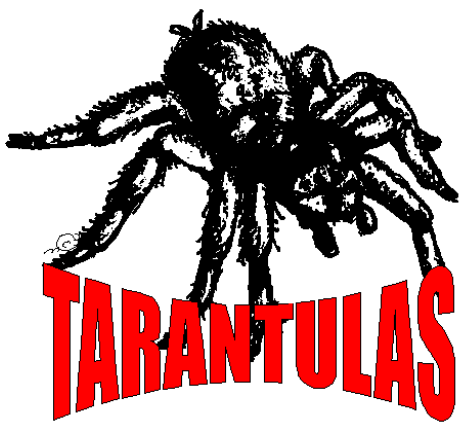
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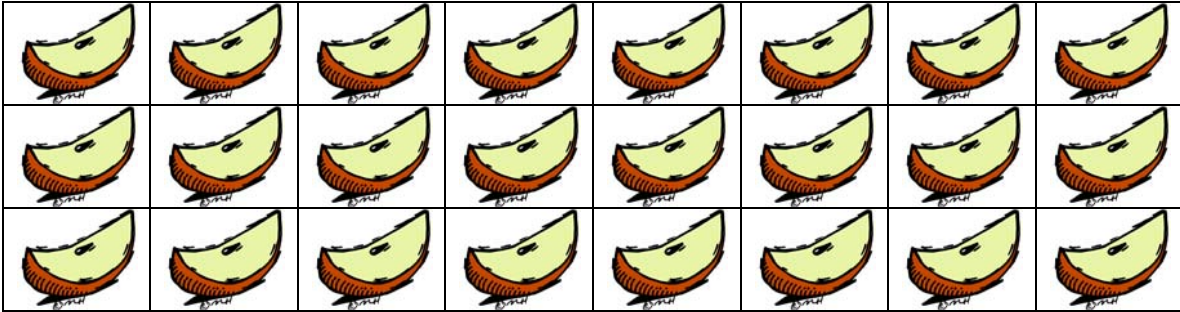
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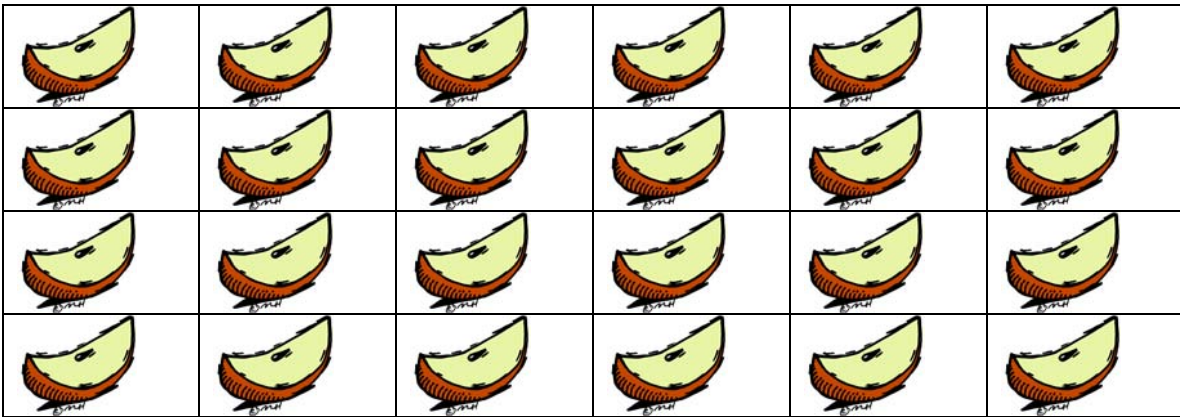
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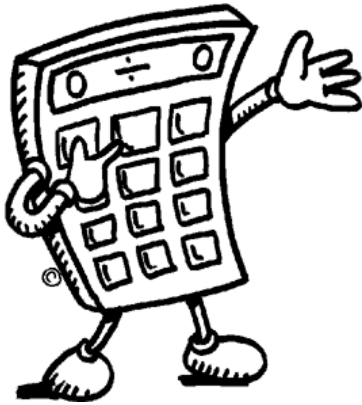


$3 \times 8 = 24$. 3 and 8 are factors. 24 is the product.



$6 \times 4 = 24$. 6 and 4 are factors.
Again 24 is the product.

3, 6, 4 and 8 are all multiples of 24.



Counting on You

Directions: Using your number chart, place a red chip on every 3rd number starting at one. Your first chip should be on the number 3. Now place your red chip on every 8th number starting at the number 1. Your first number should be on the number 8. Record your answers in the appropriate column.

Red	Yellow	Combined
3	8	24
6	16	48
9	24	
12	32	
15	40	
18	48	
21		
24		
27		
30		
33		
36		
39		
42		
48		

Name: _____

Date: _____

input	output
4	12
3	9
6	18
8	24
10	30

Name: _____

Date:

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Which choice shows a multiple of 4 and 6?

A) 30

B) 24

C) 18

D) 17

_____ 's Growth

Complete the table using the same pattern for each level. Draw and name your pattern block creature.

Day	1	2	3	4	5	6	7	8	9	10	
Blocks	3	6	9	12	15	18	21	24	27	30	

BCR

Step A: How many blocks would you use for the 10th level?

I would use 30 blocks.

Step B: Describe how you found the number of pattern blocks used for the tenth level. Be sure to include multiplication vocabulary you have learned. Use words, symbols and pictures in your explanation.

Sample answer:

I looked at the day box and multiplied the day times 3 to get the number of blocks for my creature. For example: For day 5, I used 5×3 to get 15 blocks. For day 7, I multiplied 7×3 to get to 21 blocks. I multiplied 7 times 3 to get to day 7.

Name _____

Date _____



A pattern to be proud
of.

Directions: Using your pattern stickers, create a repeating pattern.

Hundred Chart

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
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Name: _____

Date: _____

input	output
4	12
3	9
6	
8	
10	30

Name: _____

Date: _____

input	output

BCR

Step A: How many blocks would you use for the 10th level?

Step B

How do you know that your answer is correct?

Use what you know about function tables in your explanation.

Use words, numbers, and/or symbols in your explanation.
