Title: *So Many Possibilities!* (The Multiplication Rule)

Objectives	**Time frame to Complete**
Students will be able to use the Multiplication Rule to determine possible outcomes.	20 minutes
	NRS EFL
	4

Stackable Cert. Documentation	*Technology*	*Study / Life skills*	*EL-Civics*	*Career Pathways*	Police	Paramedic	Fire Rescue	Medical Asst.	EKG / Cardio	Phlebotomy	Practical Nursing	Healthcare Admin	Pharmacy Tech	IMT	AMT	HVAC	Welding	Other:					
X																							

Standard(s) Addressed in Lesson

Use Math to Solve Problems and Communicate

Benchmark(s) Addressed in Lesson

M.4.15 Identify, extend and construct arithmetic/geometric patterns and sequences that are one-step and linear or exponential.
M.4.23 Determine, using the fundamental counting principle (multiplication rule), the number of possible outcomes for a situation.
M.4.28 Confirm results with a calculator.
M.4.34 Apply mathematical ideas across a variety of settings (community, family, work).

Materials

- "So Many Possibilities!" worksheet
- calculator

Learner Prior Knowledge

multiplication

Activities

Step 1 Distribute the "So Many Possibilities!" worksheet. Explain the Multiplication Rule and read through the examples.

Step 2 Students solve the problems on the back of the worksheet. They may use a calculator as needed.

Step 3 Check answers for correctness, and save their work in their portfolios as documentation for the Basic Skills Stackable Certificate.

Assessment/Evidence

Completed worksheet

Adaptations for Beginning Students

Beginning students may work with a partner.

Adaptations for Advanced Students

Teacher Reflection/Lesson Evaluation

This lesson was created by Middletown ABLE.

So Many Possibilities!

People are often faced with choices. The number of possible outcomes for any choice is dependent upon the number of possibilities contained within the choice.

Example 1

Jean works in a doctor's office. She must wear scrubs to work each day. She has four differently patterned scrubs shirts (S1, S2, S3, and S4) and three solid colored scrubs pants (blue, gray, and green). How many possible outfits can she make using only these clothes?

The possible outcomes could be listed in a table and counted.

S1 Blue	S2 Blue	S3 Blue	S4 Blue
S1 Gray	S2 Gray	S3 Gray	S4 Gray
S1 Green	S2 Green	S3 Green	S4 Green

This problem can also be solved by multiplication. Determine the number of possibilities in each option. Then multiply the number of possibilities in each option together to determine the total number of possible outcomes.

S1	1		Blue	1
S2	1		Gray	1
S3	1		Green	1
S4	1			
---			---	
4 shirt options		x	3 pants options	= 12 possible outfits

This is called the Multiplication Rule because one multiplies the number of possibilities for each option together to determine the total number of possible outcomes.

If there are a large number of options in a given situation, it becomes difficult to list and count all of the possible outcomes. Therefore, it is easier to use the Multiplication Rule.

Consider the above scenario if Jean has 12 scrubs shirts and 7 pairs of scrubs pants.
To find the number of possible outfits (outcomes), multiply the number of options in part one (shirts) by the number of options in part two (pants). 12 x 7 = 84 possible outfits

Example 2

If Ohio creates a new series of license plates that are 2 letters followed by 5 numbers, how many license plates can be created?

For each letter, there are 26 possible choices. For each numeral, there are 10 possibilities (single digits from 0 to 9).

Letter 1	Letter 2	Numeral 1	Numeral 2	Numeral 3	Numeral 4	Numeral 5
26	26	10	10	10	10	10

To find the total number of possible outcomes (license plates), multiply the number of possibilities for each option together.

$$26*26*10*10*10*10*10 = 676*100{,}000 = 676{,}000{,}000$$

Practice

1. This Election Day, your community will elect five new officials. A Democrat, a Republican, and a third party candidate are running for each position. How many possible combinations of officers can be elected to office?

2. You are feeling lucky and you buy a "Pick 4" lottery ticket on your way home from work. How many combinations of numbers are possible?

3. Your family is planning a cross-country bus tour beginning in New York City; stopping in Cincinnati, St. Louis, and Denver; and ending in San Francisco. There are three routes from NYC to Cincinnati, two routes from Cincinnati to St. Louis, four routes from St. Louis to Denver, and three routes from Denver to San Francisco. How many different tour routes are possible?

The Multiplication Rule becomes a little more complicated if some of the choices are reduced. For example, if you are buying a "Pick 4"lottery ticket but are not allowed to choose the same number more than once, you have fewer possibilities.

Number 1	Number 2	Number 3	Number 4
10 choices (0-9)	9 choices	8 choices	7 choices

$$10*9*8*7 = 5040$$

Challenge

4. How many possible license plates could be created if Ohio used three unique letters and three unique numbers?

So Many Possibilities!

People are often faced with choices. The number of possible outcomes for any choice is dependent upon the number of possibilities contained within the choice.

Example 1

Jean works in a doctor's office. She must wear scrubs to work each day. She has four differently patterned scrubs shirts (S1, S2, S3, and S4) and three solid colored scrubs pants (blue, gray, and green). How many possible outfits can she make using only these clothes?

The possible outcomes could be listed in a table and counted.

S1 Blue	S2 Blue	S3 Blue	S4 Blue
S1 Gray	S2 Gray	S3 Gray	S4 Gray
S1 Green	S2 Green	S3 Green	S4 Green

This problem can also be solved by multiplication. Determine the number of possibilities in each option. Then multiply the number of possibilities in each option together to determine the total number of possible outcomes.

S1	1		Blue	1
S2	1		Gray	1
S3	1		Green	1
S4	1			
---			---	
4 shirt options		x	3 pants options	= 12 possible outfits

This is called the Multiplication Rule because one multiplies the number of possibilities for each option together to determine the total number of possible outcomes.

If there are a large number of options in a given situation, it becomes difficult to list and count all of the possible outcomes. Therefore, it is easier to use the Multiplication Rule.

Consider the above scenario if Jean has 12 scrubs shirts and 7 pairs of scrubs pants.
To find the number of possible outfits (outcomes), multiply the number of options in part one (shirts) by the number of options in part two (pants). 12 x 7 = 84 possible outfits

Example 2

If Ohio creates a new series of license plates that are 2 letters followed by 5 numbers, how many license plates can be created?

For each letter, there are 26 possible choices. For each numeral, there are 10 possibilities (single digits from 0 to 9).

Letter 1	Letter 2	Numeral 1	Numeral 2	Numeral 3	Numeral 4	Numeral 5
26	26	10	10	10	10	10

To find the total number of possible outcomes (license plates), multiply the number of possibilities for each option together.

26*26*10*10*10*10*10 = 676*100,000 = 676,000,000

Practice

1. This Election Day, your community will elect five new officials. A Democrat, a Republican, and a third party candidate are running for each position. How many possible combinations of officers can be elected to office?

3*3*3*3*3 = 243

2. You are feeling lucky and you buy a "Pick 4" lottery ticket on your way home from work. How many combinations of numbers are possible?

10*10*10*10 = 10,000

3. Your family is planning a cross-country bus tour beginning in New York City; stopping in Cincinnati, St. Louis, and Denver; and ending in San Francisco. There are three routes from NYC to Cincinnati, two routes from Cincinnati to St. Louis, four routes from St. Louis to Denver, and three routes from Denver to San Francisco. How many different tour routes are possible?

3*2*4*3 = 72

The Multiplication Rule becomes a little more complicated if some of the choices are reduced. For example, if you are buying a "Pick 4"lottery ticket but are not allowed to choose the same number more than once, you have fewer possibilities.

Number 1	Number 2	Number 3	Number 4
10 choices (0-9)	9 choices	8 choices	7 choices

10*9*8*7 = 5040

Challenge

4. How many possible license plates could be created if Ohio used three unique letters and three unique numbers?

Letter 1	Letter 2	Letter 3	Number 1	Number 2	Number 3
26	25	24	10	9	8

26*25*24*10*9*8 = 11,232,000