

From One- to Two-Operation Function Table

Brief Overview:

Students will use their knowledge of patterns and number operations to create, complete, and analyze functions tables. The students will progress from one operation function tables to two operation function tables. Throughout the lessons students will connect algebra to real life problems.

NCTM Content Standard/National Science Education Standard:

- Describe, extend, and make generalizations about geometric and numeric patterns
- Represent and analyze patterns and functions, using words, tables, and graphs

Grade/Level:

Grade 5

Duration/Length:

Three - 60 minute lessons

Student Outcomes:

Students will:

- Using a real world problem students will create, complete, and define a one function table.
- Using a real world problem, students will create, complete, and define a two function table.

Prerequisite Knowledge:

- Students know how to use calculators and calculate using decimals.
- Students have knowledge of repeating and growing patterns and simple one step function tables with addition, subtraction, and multiplication.
- Students have practiced the Five Talk Moves which are research based questions that facilitate math discourse in classrooms. (Five Talk Moves are outlined in *Classroom Discussions: Using Math Talk to Help Students Learn, Grades 1-6* by Suzanne H. Chapin, Catherine O'Connor, Nancy Canavan Anderson). The Five Talk moves involve: 1) asking a question and giving wait time; 2) asking a student to explain his/her thinking, 3) asking a student to restate this student's thinking, and 4) asking students if they agree or disagree and why; or 5) asking students if they wish to add on to the explanation. (**Note: If students are not proficient in the Five Talk Moves, this prerequisite is not required for this lesson.)

Materials and Resources:

Day 1 Materials:

- Create Input/Output Function Box (See Diagram for box) Teacher Resource 1 & 2
- Make the lemonade stand sign -Teacher Resource 3
- Copy for each student- Student Resource 1, "Entrance Ticket"
- Overhead transparency copy of Teacher Resource 4 "Three Column Function Table"
- Copy for each student -Student Resource 2 "Cupcakes"
- Overhead transparency-Student Resource 2 "Cupcakes"
- Copy for each student- Student Resource Sheet 3 "Party Favors"
- Overhead Transparency-Student Resource Sheet 3 "Party Favors"
- Copy for each student- Student Resource 4 "Pizzas"
- Overhead transparency- Student Resource 4 "Pizzas"
- Copy for each student- Student Resource 5- "Exit Ticket"
- 2 Oranges (or pictures of oranges)
- ½ glass of orange juice (or picture)
- 1 glass of orange juice (or picture)
- Table
- Paper cups
- Manipulative Money
- Manipulatives such blocks, fraction pieces, poker chips available for use
- Calculators are available for use

Day 2 Materials:

- Copy for each student -Student Resource 6-"Entrance Ticket"
- 3 Stickies per student
- Copy for each student -Student Resource 7 -"Pattern Block Function Table"
- Overhead transparency-Teacher Resource 11-"Pattern Block Function Table"
- Copy for each student- Student Resource 8- "Student Activity with Pattern Blocks"
- Chart paper
- Markers
- Pattern blocks: triangles, hexagons
- Color tiles
- Calculators

Day 3 Materials:

- Copy for each student- Student Resource 9 " Entrance Ticket "
- Copy for each student-Student Resource 10 "Summative Assessment"
- Manipulative: Money
- Box with a slit for money for the car wash payment
- Calculators

Development/Procedures:

Lesson 1

From One- to Two-Operation Function Table

Pre-Assessment

Students will use manipulatives to create, draw, and extend the pattern indicated on Student Resource 1 (See Teacher Resource 5 -Answer Key), “Entrance Ticket”. Students will write a rule for the pattern.

Ask: *How did you find the rule? Explain why your rule is correct.*

How did you complete the function table for question 2?

Engage

- Show the students the Input/Output Function Box created using Teacher Resource 1.
- Note: This engagement is for students to question what is occurring and discover the relationship. Later in the lesson you will explain items placed into an Input/Output machine create a change while the object remains related to the original object.
- Have a student place one orange in the input hole in the box. Then pass $\frac{1}{2}$ glass of orange juice out the output hole to the student. Then, a student inputs two oranges into the box. Teacher outputs 1 glass of orange juice.
- Ask: *How does the Input/Output Function Box relate to a function table?* (Answer: Items change as they enter the box just as numbers change in an input output table depending upon the rule.)

Explore/Explain/Apply

Explore: Lemonade Stand

Students will determine the amount of profit in relation to number of glasses sold.)

- Set up Lemonade Stand with sign (Teacher Resource 3), cups, and table.
- Place on the overhead a blank Three Column Function Table overhead transparency (Teacher Resource 4).
- Label the Input column “Number of Glasses Sold” and the Output column “Amount of Money Earned” Leave the *Rule* blank.
- Provide calculators and money manipulatives to students.
- Explain to the students that you are selling lemonade at a lemonade stand. Call on students to tell how many glasses of lemonade they wish to buy. As students provide the number of glasses place that number of paper cups on the desk.
- Have a student give you the money for the glasses of lemonade that you sell to them. (Answer: Multiply total number of glasses by \$0.50. For instance, if 2 cups are bought, the amount of money paid is \$1.00 or $2 \times \$0.50$)
- Fill in the overhead columns *Number of Glasses Sold* and *Amount of Money Earned* based on \$0.50 per glass.
- Repeat until students start to recognize a pattern.

Ask: *How do you know your answer is correct? Does anyone see a pattern?* (Answer: *multiplying the number of glasses by \$0.50*)

Ask: Can anyone give me a rule for the pattern in the function table?

(Answer: $N \times \$0.50$) (Write rule in the *Rule* column on overhead)

Ask: Can you explain your answer? (For each row on the function chart, determine if the rule works.)

Ask: What does the n represent? (Answer: the number of glasses sold)

Ask: I want to buy a new backpack for \$50.00. How many glasses of lemonade do I need to sell? (Answer: 100 cups: $100 \text{ cups} \times \0.50 .) Using the function table, students provide an answer. Have students explain how they got the answer.

Student Application:

- Set up centers with manipulatives of blocks, fraction pieces, and poker chips.
- Students work in heterogeneous pairs based on math skills.
- Distribute to each student Cupcakes, Party Favors, and the Pizza blank function tables (Student Resources 2, 3, and 4 and Teacher Resources Answer Sheets 6, 7, and 8).
- Explain that the students are having a party. They will need cupcakes, party favors, and pizza for the party.
- Ask: *How will the function tables be completed given the information in the tables?*
- Rotate through centers ever 3-5 minutes.
- Observe students as they work and take notes on student comments or guide thinking, if needed.
- Use the Five Talk Moves to guide discussion and provide their rationale for the function table.

For each chart discuss:

- *How do you explain or justify your answers?* (Possible answer: checked the answers in each row by using the rule).
- *What is the relationship from input to output?* (See Rule on Teacher Resources 6, 7, and 8).
- *What is the relationship from output to input?* (Answer: *Inverse or opposite of rule: Cupcakes divide by \$0.30; Party Favors: multiply by 2, Pizza for the Party: divide by 12*)

Assessment

- Distribute Student Resource 5 Exit Ticket. (See Teacher Resource 9 for Answer Sheet).
- Students return to pairs and complete the function table.
- Students answer questions 2, 3, and 4 independently.
- Students who finish early may try to create their own function table and provide the rule.

Differentiation

- Vary the lesson with selling the lemonade for less money such as \$.01, \$.05 or \$.10 or amounts greater than \$.50 per cup.
- Continue to use cups and money to model the problem and answers. Put the amount on each cup. Add the amount on each cup. Ask: *How is repeated addition related to multiplication?* (Answer: *multiplication is a shortcut for addition, addition is multiple addition, or $2+2+2= 2(3)$*)

- Use cups and money to demonstrate the output column. Take the money and evenly put the money in each cup. Use calculator and divide the amount in output column by the number of glasses purchased.
- Draw cups in the *Number of Glasses Sold* and label each cup with amounts. Ask: *What is the inverse of multiplication.* (Answer: Division)
- Use calculators.
- Group heterogeneously.
- Have student create their own function chart or fill in the lemonade chart with larger numbers...
- Provide wait time during discussions.

Lesson 2

Pre-Assessment:

Have students complete the Entrance Ticket (Student Resource 6; See Teacher Resource 10 for Answer Sheet) at the start of class to ensure they have retained the information from the previous lesson.

Launch

- Provide each student with 3 stickies
- Make a *Word Splash/ Graffiti Wall*
- Direct: *On your stickies, write three words that relate to the function tables.* (Possible answers: *input, output, table, 2 columns, 3 columns, rule, relationships, operations, growing, decreasing, compare, patterns*) Have student place stickies on board.
- Ask: *How does each word relate to a function table?*
- Develop a student definition of a function table.

Teacher Facilitation

- Provide students with square and triangle pattern pieces.
- Have the students build a pattern with one square and two triangles at either end.
- Ask: *How many pattern pieces or blocks are there all together?* (Answer: 1 square + 2 triangles = 3 pattern pieces for blocks)
- Refer to Teacher Resource 11 for a visual of the pattern being built.
- Direct students to add 1 square to the middle of the figure with 2 triangles remaining on the end.
- Ask: *How many squares are there? How did the number of squares change?* (Answer: 2 squares; Increased to 2 squares).
- Ask: *How many pattern pieces are there in your figure?* (Answer: 2 squares + 2 triangles = 4 blocks).
- Direct students to add 2 more squares to the middle of the figure with 2 triangles remaining on the end.
- Ask: *How many squares do you have? What is the change? How many total pattern pieces are there now?* (Answer: 4 squares; Increase by 2 squares; 4 squares + 2 triangles = 6 blocks).
- Ask: *What do you predict comes next?* (Answer: two squares placed between 2 triangles; 8 squares + 2 triangles = 10 blocks or pattern pieces)

- Ask: *What is the pattern or rule for the squares that is developing? (Answer: $N \times 2$) Can you create a function table for the pattern represented by the squares?*
- Directions: *If N is 10, build or create the figure. (Answer: 20 squares in the middle and 2 triangles on the end.)*
- Have students get into pairs. Give each pair markers and one sheet of chart paper. Have students create a function table.
- Observe students as they are working. Take note of the methods used to fill in the function tables.
- Have students share their responses for the function table.
- Inform the students that they have created the function for the square pattern only.
- Ask: *What happens to the triangle pattern? (Answer: The number of triangles remains the same while the number of squares is multiplied by 2 each time.)*
- Ask: *What is the pattern or rule that is developing for the triangles? (Answer: $+2$)*
- Have students get into pairs. Have pairs create a second function table next to the first function table on the chart paper. The Input is the change in the number of squares and the Output is the Total Number of pattern pieces or blocks. (If needed, students may use “Pattern Block Function Table”, Student Resource 7; Refer to Teacher Resource 11 “Pattern Block Function Table” for answers).
- Observe students as they are working. Take note of the methods used to fill in the function tables.
- Have students share their responses for the function table.
- Have all students complete Student Resource 7.
- Place overhead transparency of Teacher Resource 11 “Pattern Block Function Table” on the overhead.
- Ask: *What is the relationship between the first function table you made and the second function table you made? (Answer: # of Squares (Output) column and # of Squares (Input) column have the same values on both function tables.)*
- Ask: *How could we merge these tables to make a single function table? How do the columns relate to each other? (Have students fold their papers to overlap the columns “# of Squares (Output)” and “# of Squares (Input)” to indicate the relationship. (Note: See diagram to fold function charts, Teacher Resource 11)*
- Ask: *How can we merge our rule to make a single rule? (Answer: $[N \times 2] + 2$)*

Student Application

- Put students in heterogeneous pairs.
- Provide students with hexagons, squares, chart paper and markers.
- Provide students with the pattern from Student Resource 8 which indicates a pattern using the shapes and a rule: $(n \times 4) + 6$. (See answers and examples in Teacher Resource 12).
- Tell each group to find the number of edges of the squares and the hexagon that are shown in the figures. (Note: The students are looking at the edges and not the number of sides of the figure.)
- Have the students create three figures replicating the pattern shown on Student Resource 8 using the manipulatives.
- Have the students draw their patterns on their chart paper.
- Take a Gallery Walk of the student responses.
- Students share their function tables and rationale with the class. Use the Five Talk Moves to guide the discussion.
- Have students complete the function table on the Student Resource 8.

Embedded Assessment

Embedded assessment through observation of pairs and presentation of charts.

Reteaching/Extension

- Working in heterogeneous groups.
- Assemble a small group for guided practice using Student Resource 8, if needed.
- *Ask: Why isn't the rule $n \times 6 + 4$? Build that pattern Explain how the two patterns are different.* (Answer: The patterns are different because the number of hexagons is increasing in $n \times 4 + 6$ and in $n \times 6 + 4$ the number squares are increasing.)
- Have students continue to use manipulatives to build figures applying the rule.
- *Ask: How is the pattern growing?* (Answer: one more hexagon is added each time which equals 4 more sides)
- *Ask: What remains the same or constant?* (Answer: two squares on the ends or 6 sides)
- *Ask: Why is the rule: $N \times 4 + 6$?* {Answer: The pattern is increasing by multiples of 4 (the hexagon edges) plus 6 (the constant number of edges of the two squares)}.

Lesson 3

Pre-Assessment

Have students complete the Entrance Ticket (Student Resource 9; Teacher Resource 13 Answer Sheet) at the start of class to ensure that they have retained the information from the previous lesson.

Launch

Present a personal problem: *I need your help to wash my car tonight. I know you all want to come to my house to wash the car. But, I am going to a car wash and need to know how long it will take me to wash my car.*

Teacher Facilitation

- *Last night I went to the carwash and put \$2.50 into the carwash machine. For each minute that my car needed to be washed, I had to put in an additional \$2.00. Create a function table using this problem. What is the rule?* (See Teacher Resource 14 for sample responses).
- Have students act out the car wash procedure using manipulative money and the box with the slot for money.
- Provide students with markers and chart paper to solve the problem.
- As a class, the students explain their charts and solutions. Use the Five Talk Moves to guide discussion.
(See Teacher Resource 14 “Carwash” to guide the discussion and for answers.)

Student Application

- Put student into heterogeneous groupings.
- Provide students with chart paper and markers.
- Have students solve the following problem on their chart paper.
- Problem: You are ordering pizza from Paul’s Pizza Parlor tonight. The pizza cost \$10.00 a pizza, and the charge is \$3.00 for delivery.
- Have the students find a rule and create a function table.

Answer:

Rule: $(N \times 10) + 3$

Input	Output
1	13
2	23
3	33
4	43
5	53

- Students should record their thinking to share with the class.
- Have students share their chart and explanations with the class.

Reteaching/Extension

- Heterogeneous groupings.
- Use of calculators.
- Provide a blank input/output table.
- Divide the function table into two function tables representing the two operations. Then merge the tables.
- Ask: *If you have \$100 how many pizzas could you buy? (Answer: 9 pizzas) How much will it cost to buy 14 pizzas?(Answer: \$143)*

Summative Assessment

- Distribute copies of Summative Assessment Student Resource 10.
- Read the directions with the students and highlight key words.
- If students are struggling throughout the lesson above, provide the rule and have the students fill in the function table on the summative assessment.

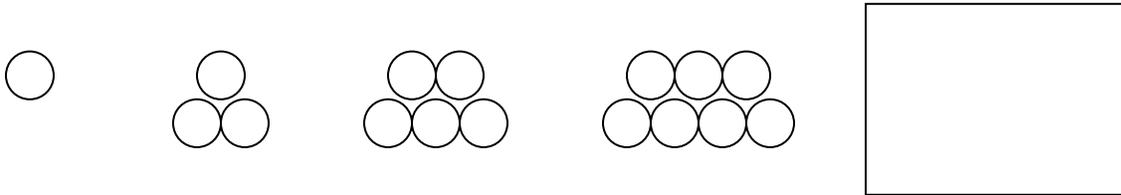
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Entrance Ticket

1. Draw the next frame of the pattern below. Identify the rule for the pattern. You may use counters to construct the pattern on your desk.



Rule: _____

Explain why your rule is correct? _____

2. Complete the table below using the rule $N \times 4$.

INPUT	OUTPUT
3	
4	
7	
9	
15	



Cupcakes

You are in charge of buying cupcakes for the party. In the tables below find the missing terms. Determine the rule.

Rule:

Cupcakes (Input)	Rule	Cost of Cupcakes (Output)
10		
15		\$4.50
		\$6.00
25		
30		\$9.00
		\$15.00

Cupcakes (Input)	10	15		25	30	
Rule						
Cost of Cupcakes (Output)		\$4.50	\$6.00			\$15.00

Challenge: Sale!! Cupcakes are on sale this week for 4 cupcakes for a dollar. How will the table above change? Create a new table to show the change in price.

Party Favors

While at the store you realize there are different size containers of party favors. You want to determine the number of items each friend will get. Complete the table below and find the rule.

Rule:

Number of Prizes in a container (Input)	Rule:	Number of Prizes each child will receive (Output)
100		50
90		45
80		
70		
60		30
40		20
10		

Challenge: When will each child receive 12 prizes? Use the table above to help you.

Pizza for the Party

You need to order pizza for a party. Determine how many slices you will have depending on the number of pizzas ordered.

Rule:



Number of Pizza Ordered (Input)	Rule:	Number of Slices Received (Output)
2		24
3		36
		48
5		
10		120
		240

Challenge: At a different pizza shop you can order a pizza with 8 slices. What will happen to the chart above? Create a new chart and determine the rule.

Number of Pizza Ordered (Input)	Rule:	Number of Slices Received (Output)
1		8
2		
3		
4		
5		

Exit Ticket



below

1. George went to the store to buy apples. Using the chart figure out how much each apple cost if there is no tax added.

Number of Apples	Rule:	Cost of Apples
1		_____
3		\$2.25
4		\$3.00
6		\$4.50
7		_____
_____		\$7.50
12		_____

2. What is the relationship or rule between the number of apples to the cost of the apples? _____

How did you come to this conclusion? _____

3. How did you figure out how many apples cost \$7.50? _____

4. If you had \$15.00 how many apples can you buy? Would you have any money left over? Explain how came to your answer. _____

Entrance Ticket

Complete the function table below and identify the rule.

Rule : _____

Input	Rule	Output
54		9
18		
72		12
42		
12		2
		5

Cut on line to make a half sheet of paper.

Entrance Ticket

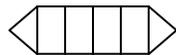
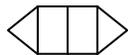
Complete the function table below and identify the rule.

Rule : _____

Input	Rule	Output
54		9
18		
72		12
42		
12		2
		5

Pattern Block Function Table

Complete the function tables for the following pattern. Use your pattern blocks to assist you.



Rule: _____

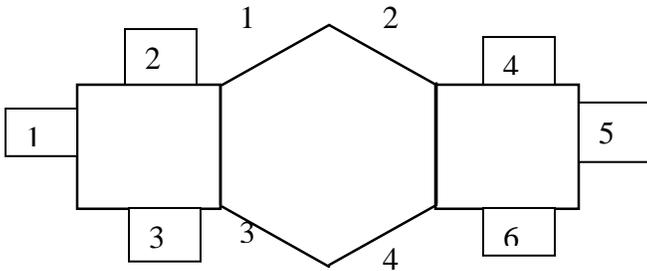
Frame (Input)	Rule	# of Squares (Output)
1		
2		
3		
4		

Fold Here

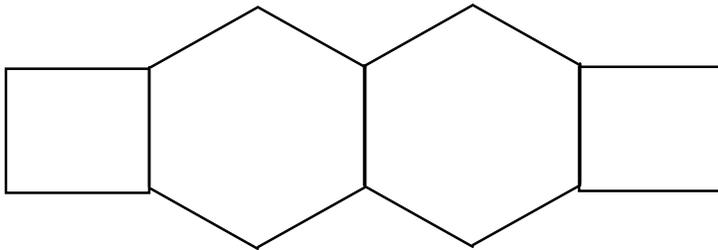
# of Squares (Input)	Rule	Total # of Blocks (Output)

Student Activity with Pattern Blocks

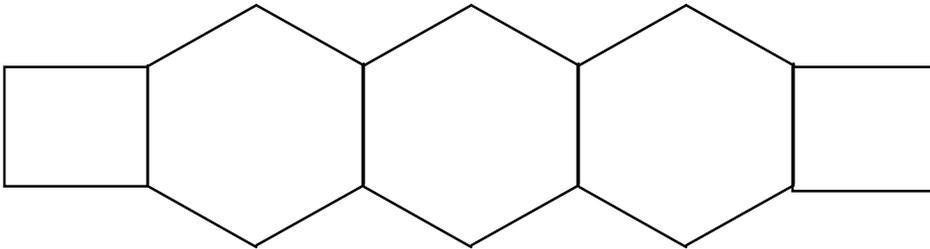
Create a function table and complete for the pattern below.
Count the edges on the pattern blocks



of edges for squares- 6
of edges for hexagon- 4



of edges for squares- ____
of edges for hexagons- ____



of edges for squares- ____
of edges for hexagons- ____

Rule: $(n \times 4) + 6$

Frame (Input)	Rule	# of edges on a hexagon	Rule (# of squares)	Total # of Edges (Output)
1				
2				
3				
4				

Entrance Ticket

Complete the function table using the rule given.

Rule: $5n + 23$

Input	Rule	Output/Input	Rule	Output
12				
17				
36				
48				
52				

Describe how you found your output using a 2 function rule.

Sally's Sub Shop



Below is a table showing the orders placed at Sally's Sub Shop. Sally charges \$4.00 for delivery and each sub is \$6.00. Help Sally find the total cost for her orders below. Find the rule below and complete the table. Explain how you know you are correct. You may use calculators and manipulatives to help you.

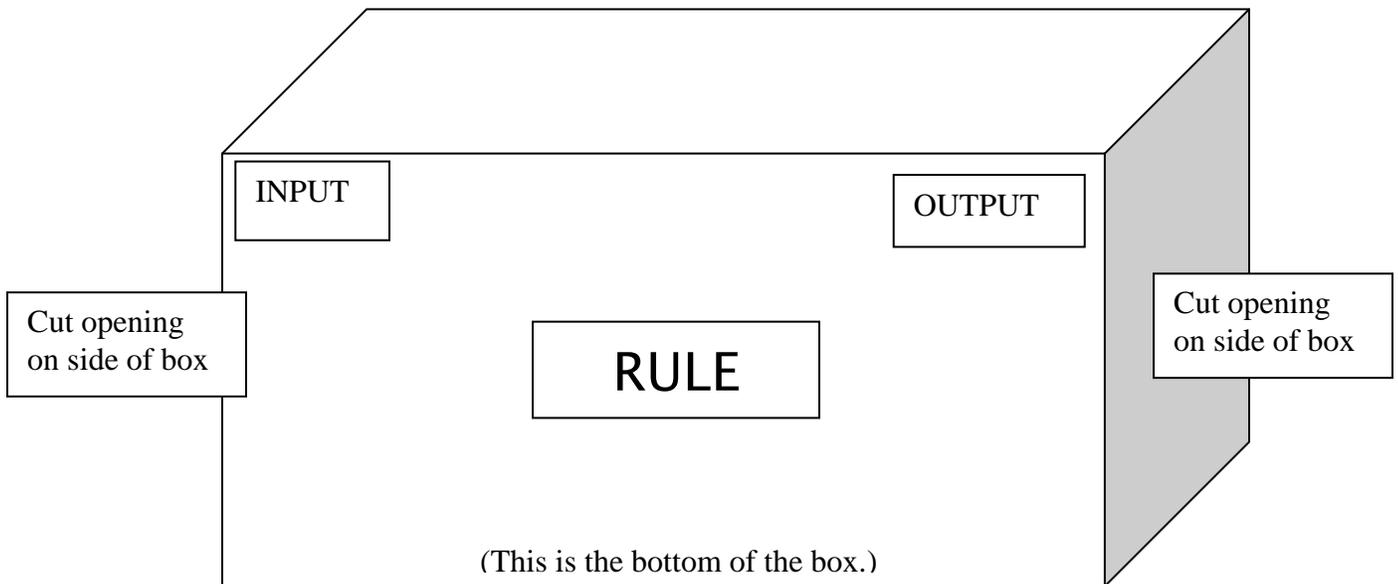
Rule: _____

Number of Subs (Input)	Rule	Output/Input	Rule	Cost of Subs (Output)
2				
8				
5				
9				
15				

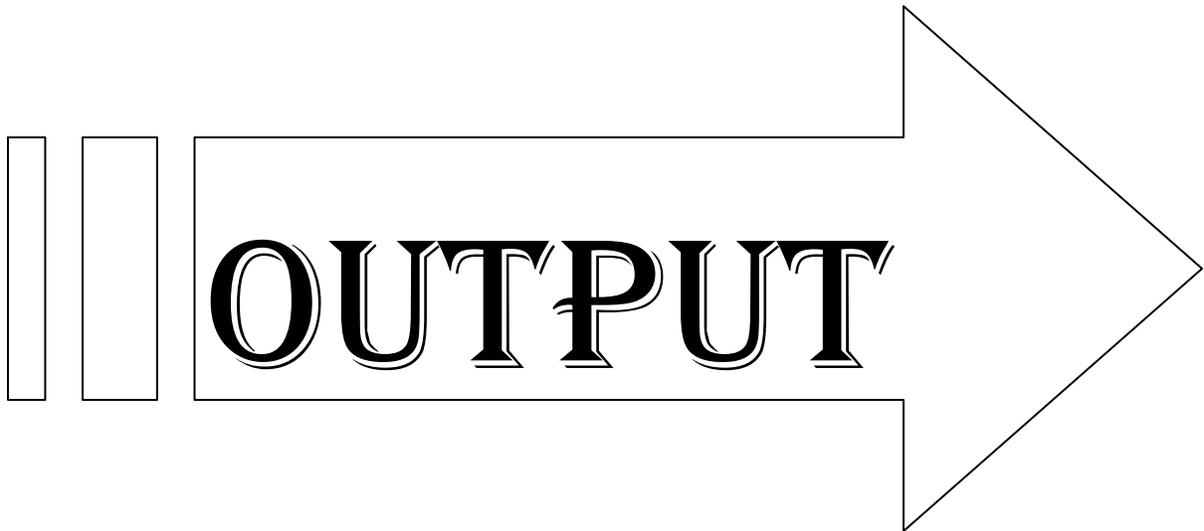
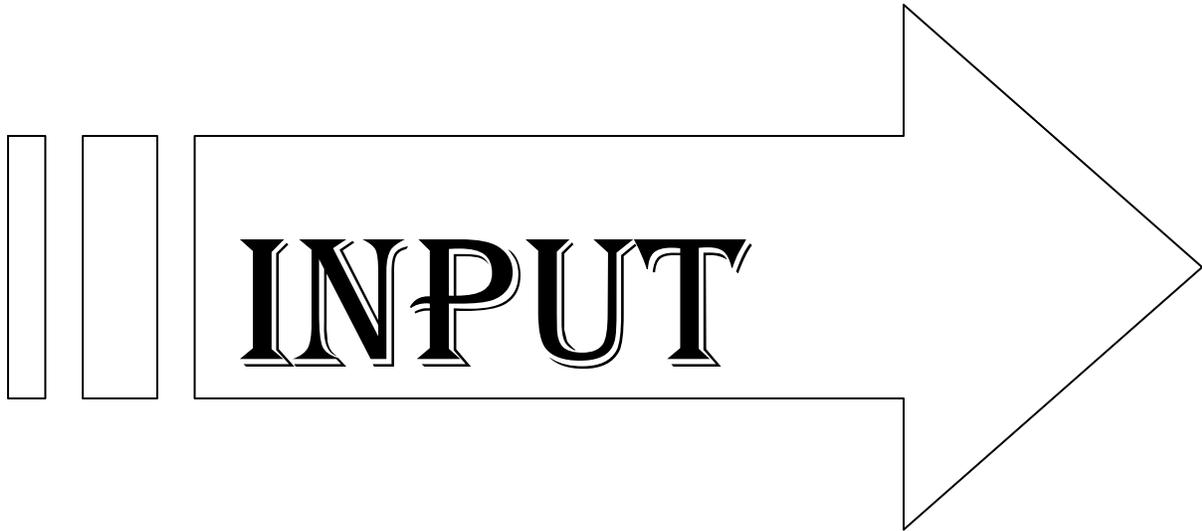
Explain how you know you are correct.

Instructions for constructing the input/output box:

1. Begin with a box that is at least the size of a shoe box. A box that holds a ream of paper is appropriate.
2. Remove the lid and cut an opening on each square end of the box that is large enough to accommodate the cards with the inputs and outputs.
3. Paste the input and output labels on the bottom of the box, as illustrated in the picture.
4. Tape a sheet protector in the center of the bottom of the box to accommodate the different rules.



5. It is recommended that you keep the numeral cards inside the box and replace the lid for easy storage.
6. Leave the numerals to be used for the outputs in the box for a more effective demonstration.





Lemonade

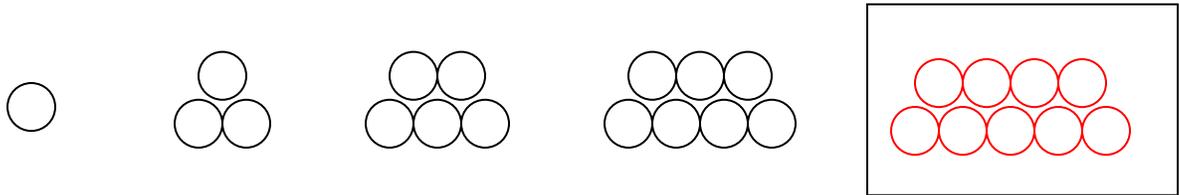
for Sale



Input	Rule	Output

Entrance Ticket- Answer Key

1. Draw the next frame of the pattern below. Identify the rule for the pattern. You may use counters to construct the pattern on your desk.



Rule: increase by 2 circles or + 2

Explain why your rule is correct. Sample Response: I know my answer is correct because each frame increases by 2 circles. One circle was added to the bottom row and one to the top row.

2. Complete the table below using the rule $N \times 4$.

INPUT	OUTPUT
3	12
4	16
7	28
9	36
15	60

Cupcakes Answer Key

You are in charge of buying cupcakes for the party. In the table below find the missing terms. Determine the rule.

Rule: $N \times .30$

Cupcakes (Input)	Rule	Cost of Cupcakes (Output)
10	$N \times .30$	\$3.00
15	$N \times .30$	\$4.50
20	$N \times .30$	\$6.00
25	$N \times .30$	\$7.50
30	$N \times .30$	\$9.00
50	$N \times .30$	\$15.00

Cupcakes (Input)	10	15	20	25	30	50
Rule	$\times .30$					
Cost of Cupcakes (Output)	\$3.00	\$4.50	\$6.00	\$7.50	\$9.00	\$15.00

Challenge: Sale!! Cupcakes are on sale this week for 4 cupcakes for a dollar. How will the table above change? Create a new table to show the change in price.

Party Favors Answer Key

While at the store you realize there are different size containers of party favors. You want to determine the number of items each friend will receive. Complete the table below and find the rule.

Rule: $N \div 2$

Number of Prizes in a container (Input)	Rule:	Number of Prizes each child will receive (Output)
100	$N \div 2$	50
90	$N \div 2$	45
80	$N \div 2$	40
70	$N \div 2$	35
60	$N \div 2$	30
50	$N \div 2$	25
40	$N \div 2$	20
10	$N \div 2$	10

Challenge: When will each child receive 12 prizes? Use the table above to help you. _____ **24 prizes in the container** _____

Pizza for the Party Answer Key

You need to order pizza for the party. Each pizza is cut into 12 slices. Determine how many slices you will have depending on the number of pizzas ordered.

Rule: $N \times 12$



Number of Pizza Ordered (Input)	Rule:	Number of Slices Received (Output)
2	$N \times 12$	24
3	$N \times 12$	36
4	$N \times 12$	48
5	$N \times 12$	60
10	$N \times 12$	120
20	$N \times 12$	240

Challenge: At a different pizza shop you can order a pizza with 8 slices. What will happen to the chart above? Create a new chart and determine the rule.

_____ The rule will change from 12 to 8 because the rule is determined by the number of slices per pizza. _____

Number of Pizza Ordered (Input)	Rule: $N \times 8$	Number of Slices Received (Output)
1	$N \times 8$	8
2	$N \times 8$	16
3	$N \times 8$	24
4	$N \times 8$	32
5	$N \times 8$	40

1. George went to the store to buy apples. Using the chart below figure out how much each apple cost if there is no tax added.



Number of Apples	Rule: multiple by 0.75	Cost of Apples
1	$\times 0.75$	___\$0.75___
3	$\times 0.75$	\$2.25
4	$\times 0.75$	\$3.00
6	$\times 0.75$	\$4.50
7	$\times 0.75$	___\$5.25___
___10___	$\times 0.75$	\$7.50
12	$\times 0.75$	___\$9.00___

2. What is the relationship or rule between the number of apples to the cost of the apples? **___Multiple by 0.75 or $0.75N$ or $N \times 0.75$ ___**

How did you come to this conclusion? **___Answers may vary___**

3. How did you figure out how many apples cost \$7.50? **___Answers may vary___**

4. If you had \$15.00 how many apples can you buy? Would you have any money left over? Explain how came to your answer. **___20___**
___You will not have any money leftover. I divided \$15.00 by 0.75 so I could go from output to input and find out I could buy 20 apples. ___

Entrance Ticket

Complete the function table below and identify the rule.

Rule : $\underline{\quad} N \div 6 \underline{\quad}$

Input	Rule	Output
54	$\div 6$	9
18	$\div 6$	3
72	$\div 6$	12
42	$\div 6$	7
12	$\div 6$	2
30	$\div 6$	5

Cut on line to make a half sheet of paper.

Entrance Ticket

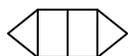
Complete the function table below and identify the rule.

Rule : $\underline{\quad} N \div 6 \underline{\quad}$

Input	Rule	Output
54	$\div 6$	9
18	$\div 6$	3
72	$\div 6$	12
42	$\div 6$	7
12	$\div 6$	2
30	$\div 6$	5

Pattern Block Function Table

Complete the function tables for the following pattern.



Rule: $2n + 2$

Frame (Input)	Rule	# of Squares (Output)
1	$\times 2$	2
2	$\times 2$	4
3	$\times 2$	6
4	$\times 2$	8

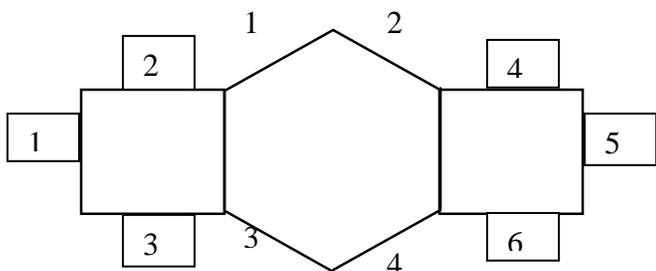
Fold Here

# of Squares (Input)	Rule	Total # of Blocks (Output)
2	$+2$	6
4	$+2$	8
6	$+2$	10
8	$+2$	12

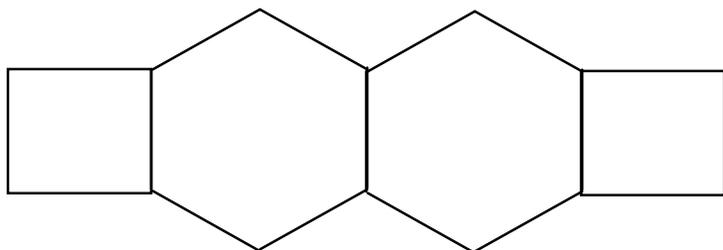
* Note: The dotted line is where students will need to fold their paper to make the output on top of the input in order to see the relationship between input and output. See directions on lesson plan.

Student Activity with Pattern Blocks

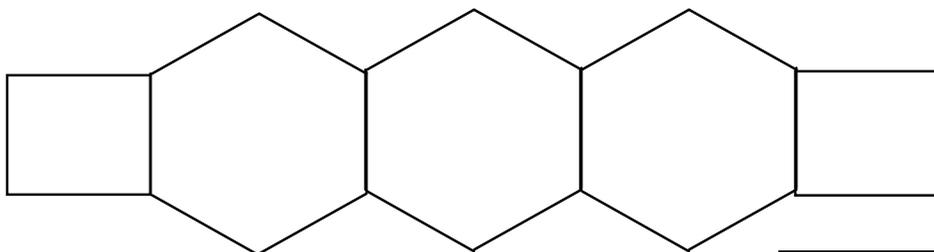
Create a function table and complete for the pattern below.
Count the edges on the pattern blocks



of edges for squares- 6
of edges for hexagon- 4



of edges for squares- 6
of edges for hexagons- 8



Rule: $(n \times 4) + 6$

of edges for squares- 6
of edges for hexagons- 12

Frame (Input)	Rule	# of edges on a hexagon	Rule (# of squares)	Total # of Edges (Output)
1	$\times 4$	4	$+ 6$	10
2	$\times 4$	8	$+ 6$	14
3	$\times 4$	12	$+ 6$	18
4	$\times 4$	16	$+ 6$	22

Entrance Ticket- Answer Key

Complete the function table.

Rule: $5n + 23$

Input	Rule	Output/Input	Rule	Output
12	$\times 5$	60	$+ 23$	83
17	$\times 5$	85	$+ 23$	108
36	$\times 5$	180	$+ 23$	203
48	$\times 5$	240	$+ 23$	263
52	$\times 5$	260	$+ 23$	283

Describe how you found your output using a 2 function rule.

_____ Answers will vary. Students should explain how to break the rule into $\times 5$ than add 23. _____

Car Wash

Last night I went to the carwash and put \$2.50 into the carwash machine. For each minute that my car needed to be washed, I had to put in an additional \$2.00. Create a function table using this problem.

Sample Response:

Write what is happening as you think aloud:

\$2.50 goes in the machine no matter how long I will be there

For every minute it will cost me \$2.00 on top of the \$2.50

So for one minute it will be

Time (Input)				Price (Output)
1	X 2	Which is 2	Than + \$2.50	so it will be \$4.50
2	X 2	4	+ 2.50	\$6.50
3	X 2	6	+ 2.50	\$8.50
4	X 2	8	+ 2.50	\$10.50
5	X 2	10	+ 2.50	\$12.50
6	X 2	12	+ 2.50	\$14.50

What is the rule? $N \times 2 + 2.50$

I was at the carwash for 10 minutes. How much money did I spend? \$22.50

How did you find your answer? Explain why you are correct? I plugged 10 into the rule for the table so my problem was $(10 \times 2) + 2.50$ which is \$22.50.

Based on the pattern in the table I was able to come up with the rule without having to continue the pattern.

Sally's Sub Shop



Below is a table showing the orders placed at Sally's Sub Shop. Sally charges \$4.00 for delivery and each sub is \$6.00. Help Sally find the total cost for her orders below. Find the rule below and complete the table. Explain how you know you are correct. You may use calculators and manipulatives to help you.

Rule: $(N \times 6) + 4$

** If students are struggling throughout the lesson give them the rule and have them fill out the table and explain how they filled it out.

Number of Subs (Input)	Rule $\times 6$	Output/Input =	Rule $+ 4$	Cost of Subs (Output)
2	$\times 6$	12	$+ 4$	16
8	$\times 6$	48	$+ 4$	52
5	$\times 6$	30	$+ 4$	34
9	$\times 6$	54	$+ 4$	58
12	$\times 6$	72	$+ 4$	76

Explain how you know you are correct.

 I know that each sub is \$6.00 so that is the first function I have to complete which is multiplying. I can write $N \times 6$. Then I know that each order I will need to add \$4.00 no matter how many subs I order. So I will add 4. My complete rule is then is $(N \times 6) + 4$.
