Study Guide: 5.17– Patterns

Standard: 5.17- The student will describe the relationship found in a number pattern and express the relationship

What you need to be able to do:

- Describe numerical and geometric patterns formed by using concrete materials and calculators.
- Describe the relationship found in patterns, using words, tables, and symbols to express the relationship.

Essential Understandings:

- Patterns and functions can be represented in many ways and described using words, tables, and symbols.
- That mathematical relationships exist in patterns.
- An expression uses symbols to define a relationship and shows how each number in the list, after the first number, is related to the number before it.
- Expressions can be numerical or variable or a combination of numbers and variables.
- There are an infinite number of patterns.

Key Vocabulary:

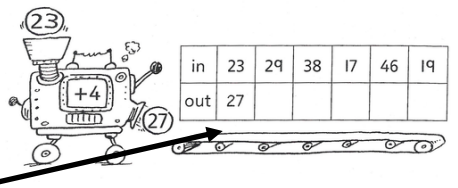
Numerical– expressed in numbers

Pattern– a sequence that follows a rule or rules

Sequence– a set of things (usually numbers in math) that are in order

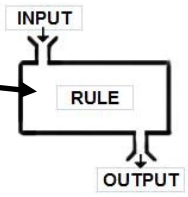
6, 9, 12, 15, 18

1st term 4th term



Term– each number or part of a sequence

Rule– tells you how to continue the pattern; in an input/output table or function machine, it tells you the relationship between the input and the output



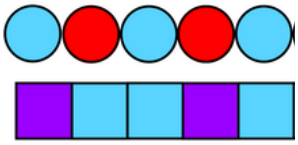
Growing pattern– A pattern that increases or decreases by a constant difference.

Examples of growing numerical patterns are

- 6, 9, 12, 15, 18 (rule is add 3)
- 5, 7, 9, 11, 13 (rule is add 2)
- 2, 4, 8, 16, 32 (rule is x 2)
- 32, 30, 28, 26, 24 (rule is - 2)
- 1, 5, 25, 125, 625 (rule is x 5)

Repeating pattern– A basic unit of the pattern is repeated.

Examples of repeating geometric patterns



Example of repeating numerical pattern: 1,2,1,2,1,2

Expression- Has no equal sign.

Variable– an unknown, represented by a symbol

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To determine the rule of **numerical patterns**, use a caret (V) between numbers. Decide if the pattern is INCREASING or DECREASING.

Increasing number patterns use addition or multiplication in the rule.

Decreasing number patterns use subtraction or division in the rule.

2, 6, 10, 14
v v v
+4 +4 +4

In this pattern, the numbers are *increasing,* or getting larger.
We know the operation will be either addition or multiplication. So we figure out how to get from 2 to 6 using addition and multiplication. Write both down:

2 **x 3** = 6 2 **+4** = 6

x3

Each possible rule must be tested to see if all of the numbers follow the pattern. 6x3 does not equal 10. The rule for this pattern is **Add 4.**

Patterns can also be in the form of a table.

INPUT	OUTPUT
2	**8**
3	**12**
?	**16**
5	**?**

Compare the INPUT column to the OUTPUT column.

In this pattern, the numbers are *increasing,* or getting larger.

We know the operation will be either addition or multiplication.

2 **x4** = 8 2 **+6**= 8

Each possible rule must be tested to see if all of the numbers follow the pattern. 3+6 does not equal 12. The rule for this pattern is **x4.**

Use the rule to complete the missing boxes.

Rules for patterns can also be expressed with **variables**.

Pizzas (n)	Number of Slices
2	**16**
4	**32**
5	**40**
12	**?**

Determine the pattern between the INPUT (Pizza) and OUTPUT (Number of Slices) column.

The pattern is x8.

The rule can be expressed as ***n* x 8**.

The most important thing to remember is to make sure you check the rule against all numbers in the table or pattern! Don't stop after the first set of terms!

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Practice:

1.

A number machine uses a rule to change numbers. This table shows the results.

Number Machine Results

Input	Output
20	5
36	9
44	11
84	21

Which could be the rule the number machine uses to change the input numbers to the output numbers?

- **A** Add 15
- **B** Subtract 15
- **C** Divide by 4
- **D** Multiply by 4

2.

Which rule can be used to find the next number in this increasing pattern?

3, 4, 6, 9, 13, 18, 24, __

- **A** Add 7 to 24
- **B** Add 6 to 24
- **C** Add 5 to 24
- **D** Add 3 to 24

3.

What is the 7th term in this decreasing pattern?

73, 64, 56, 49, 43, . . .

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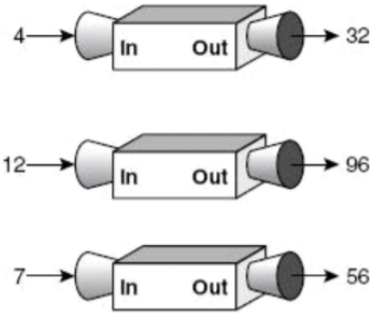
Practice:

4. Determine the pattern in the table below:

x	y
101	86
99	84
85	70
69	54

a) x – 14
b) x – 15
c) y – 15
d) y + 15

5. A function machine uses a rule to change numbers into other numbers.
The picture below shows what happened when the numbers 4,12, and 7 went into the machine.



What number will come out of the machine if the number 9 goes into it?

6. Michael used a rule to make the number pattern shown.

1, 2, 4, 8, 16
If the pattern continues in the same way, what should Michael do to determine the 6th number?

A Multiply 8 by 2

B Multiply 16 by 2

C Multiply 2 by 2

D Multiply 4 by 2

7. This table shows how much money Tiffany has in her savings at the end of each month. If the pattern continues, what is the total amount of money that Tiffany will have in her savings at the end of 9 months ?

A $70

B $49

C $56

D $63

Tiffany's Savings

Month	Savings
1	$7
2	$14
3	$21
4	$28
5	$35
6	$42