**Grade 6 Math
Unit 6: Patterns in Mathematics**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Lesson 1: Representing and identifying patterns**

When trying to visualize a pattern based on a table of values, it can be helpful to represent the pattern using a visual.

In the example below, we know that the first row starts with two blocks. When represented using a visual, it becomes easier to see that after row 1, three additional blocks are added on each row. In this example, the pattern can be described as: “The blocks start at 2 and increase by 3 each time.” It is also important to realize that the rows start at 1 and increase by 1 each time, which is also a pattern.



1A) Represent the following table of values using visuals, then describe the pattern using numbers and words.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Day | 1 | 2 | 3 | 4 |
| Number of apples  | 3 | 5 | 7 | 9 |

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1B)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Age (months) | 1 | 2 | 3 | 4 |
| Weight (pounds) | 6 | 8 | 10 | 12 |

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1C)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Year  | 1 | 2 | 3 | 4 |
| Number of branches | 4 | 9 | 14 | 19 |

|  |
| --- |
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2A) Create a table of values and a visual representation of the following word problem: A train has 8 wheels and tows cars which each have 4 wheels.

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| --- | --- | --- | --- | --- |
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2B) Create a table of values and a visual representation of the following word problem: A tree is planted when it has five branches. Each year, 3 new branches grow.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
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2C) Create a table of values and a visual representation of the following word problem: There is 6cm of snow on the ground. During a storm, 5cm of snow fall each hour for three hours.

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**Lesson 2: Patterns and algebraic equations**

Patterns can be expressed using algebraic equations which can be used predict terms not in a table of values. In the example below, a calling plan cost $10 per month, plus $2 for each minute of use. This pattern can be described using the algebraic expression y = 2x + 10 where y is the total cost per month, 2 is the cost per minute, x is the number of minutes, and 10 is the monthly cost of $10. Therefore, by replacing x with the number of minutes used that month, we can find out how much the total cost was for that month.

For example, if the person used the phone for 5 minutes, we substitute 5 for x. In the equation below, we can see that the total cost for that month would be $20.

y = 2x +10
y = 2(5) + 10
y = 10 + 10
y = 20

|  |  |
| --- | --- |
| Number of minutes | Total monthly cost |
| 0 | $10 |
| 1 | $12 |
| 2 | $14 |
| 3 | $16 |
| 4 | $18 |

1. Complete the following tables of values using the algebraic expressions provided.

A) To play paintball, it costs $20 to enter the field, and $5 for every package of paintballs. This can be expressed using the algebraic equation y = 5x + 20

|  |  |
| --- | --- |
| Number of packages  | Total cost |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |

What does y represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
What does 5 represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
What does x represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
What does 20 represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

B) To go camping at Terra Nova National Park, you have to pay a $15 entrance fee, plus $7 for each camper. This can be described using the algebraic equation y = 7x + 15

|  |  |
| --- | --- |
| Number of campers  | Total cost |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |

What does y represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
What does 7 represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
What does x represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
What does 15 represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

C) For a much needed massage, Mr. Field pays $100 for the first 60 minutes and $2 for every minute thereafter. This can be described using the equation y = 2x + 100

|  |  |
| --- | --- |
| Number of additional minutes | Total cost |
| 2 |  |
| 4 |  |
| 6 |  |
| 8 |  |
| 10 |  |

What does y represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
What does 2 represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
What does x represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
What does 100 represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Lesson 3: Formulating algebraic equations from tables of values**

It is possible to use the data contained in a table of values to formulate an algebraic equation. In the example below, a flight costs $500 and each piece of luggage costs an additional $50. This can be represented by the equation y = 50x + 500. In this case, y is the total cost of the flight, 50 is the cost per bag, x is the number of bags, and 500 is the cost for the flight alone.

|  |  |
| --- | --- |
| Number of bags | Total cost of flight ($) |
| 0 | 500 |
| 1 | 550 |
| 2 | 600 |
| 3 | 650 |

In tables of value, remember that the x variable will always be on the left hand side and the y variable will always be on the right hand side. Therefore, x represents the number of bags and y represents the total cost of the flight. These are known as **variables** because they change depending how many bags are brought onboard. In this case, the flight costs $500. This is known as a **constant**, because it always stays the same amount, no matter how many bags are brought onboard.
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Here’s a second example. For every dollar Mr. Field earns, Mr. Lambe earns $3. What’s up with that? This can be represented by the equation y = 3x where y is the total amount that Mr. Lambe makes, x is the total amount that Mr. Field makes, and 3 represents the fact that Mr. Lambe makes 3 times as much as Mr. Field. In this example, there is no constant.

|  |  |
| --- | --- |
| Mr. Field’s earnings ($) | Mr. Lambe’s earnings ($) |
| 0 | 0 |
| 1 | 3 |
| 2 | 6 |
| 3 | 9 |

1. In an awesome video game that Mr. Field would definitely know about, it costs 300 stars for the SUPER MEGA HYPER BLASTER 3000. In order to blow your enemies to smithereens, it requires energy packs which cost 100 stars each. Create an algebraic equation for this problem based on the table below.

|  |  |
| --- | --- |
| Number of energy packs | Total cost (stars) |
| 0 | 300 |
| 1 | 400 |
| 2 | 500 |
| 3 | 600 |

Before trying to formulate an algebraic equation, first identify what the different parts of the equation represent.

|  |  |
| --- | --- |
| x |  |
| y |  |
| 300 |  |
| 100 |  |

Now, try formulating the equation. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. For every minute that Brad spends studying, Amy spends 5 minutes.

|  |  |
| --- | --- |
| Number of minutes Brad spends studying | Number of minutes Amy spends studying |
| 10 | 50 |
| 20 | 100 |
| 30 | 150 |
| 40 | 200 |

Before trying to formulate an algebraic equation, first identify what the different parts of the equation represent.

|  |  |
| --- | --- |
| x |  |
| y |  |
| 5 |  |

Now, try formulating the equation. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Lesson 4: Graphing using algebraic equations**

1) Andy has $50 in a jar in his bedroom and adds $10 each week.

A) Write an algebraic equation to represent the word problem above.

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B) Complete the table of values below using the algebraic equation.

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|  |  |

C) Complete the graph, including title, labelled axes, and appropriate scales.



2) 500 bottles have been collected for the spring fair and 20 more are collected each day.

A) Write an algebraic equation to represent the word problem above.

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B) Complete the table of values below using the algebraic equation.

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|  |  |
|  |  |

C) Complete the graph, including title, labelled axes, and appropriate scales.



**Lesson 5: The preservation of equality**

The preservation of equality is the concept that when working with an equation, whatever operation (i.e. addition, subtraction, multiplication, division) is performed on one side must be performed on the other.

Take, for example, the equation 3n = 9. If we want to add 2 to one side, we must do the same to the other. This is demonstrated below.

3n + 2 = 9 + 2
3n + 2 = 11

Therefore, the concept of preservation of equality proves that 3n = 9 and 3n + 2 = 11 are equivalent equations. This can also be demonstrated pictorially using scales. If you look at the two sets of scales below, you can see that if you added two blocks to each side of the first scale, it would look the same as the second scale, further demonstrating that the equations are equal to one another.

 

1) Use balance scales to determine whether or not the two equations provided are equal to one another.

A) 2n + 2 = 6 and 2n + 3 = 7



B) 3p = 6 and 3p + 3 = 8



C) k + 3 = 8 and k + 5 = 10



D) 3r + 1 = 4 and 3r + 5 = 11



E) y + 2 = 3 and y + 5 = 6



F) 2b = 4 and 2b + 2 = 8



REMEMBER: AS LONG AS YOU DO TO ONE SIDE OF AN EQUATION WHAT YOU DO TO THE OTHER SIDE, THE TWO EQUATIONS WILL REMAIN EQUIVALENT!

2) Make an equivalent equation to 2y + 3 = 7 by doing the following operations:

A) Add 1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

B) Subtract 3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

C) Multiply by 2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3) Make an equivalent equation to 3c + 2 = 5 by doing the following operations:

A) Add 3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

B) Subtract 1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

C) Multiply by 3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4) Make any equivalent equation for the following algebraic equations.

A) 2r + 4 = 10

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B) 3h – 2 = 7

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5) Which of the following equations is equivalent to 3p – 2 = 4?

A) 3p – 3 = 2 B) 3p – 1 = 3 C) 6p – 4 = 6 D) 6p – 2 = 8

6) Which of the following equations is equivalent to 2p = 6?

A) 2p + 1 = 8 B) 2p – 2 = 8 C) 4p = 12 D) 6p = 12

7) Which of the following equations is equivalent to p + 6 = 7?

A) 2p + 6 = 14 B) p + 12 = 14 C) p + 7 = 9 D) 2p + 12 = 14

8) Make any equivalent equation for the following equations. Write the equations below.

A)

 

 3n + 1 = 7 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

B)



 2n + 3 = 9 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_