

Cluster 7.11: Expressions, Equations, and Relationships

7.11A: Equations and Inequalities: Marla's Picture Puzzle

Focusing TEKS

7.11A Expressions, Equations, and Relationships. The student applies mathematical process standards to solve one-variable equations and inequalities. The student is expected to model and solve one-variable, two-step equations and inequalities. **Readiness Standard**

Additional TEKS:

7.3A Add, subtract, multiply, and divide rational numbers fluently. **Supporting Standard**

7.3B Apply and extend previous understandings of operations to solve problems using addition, subtraction, multiplication, and division of rational numbers. **Readiness Standard**

7.10A Write one-variable, two-step equations and inequalities to represent constraints or conditions within problems. **Supporting Standard**

7.11B Determine if the given value(s) make(s) one-variable, two-step equations and inequalities true. **Supporting Standard**

6.7A Generate equivalent numerical expressions using order of operations, including whole number exponents, and prime factorization. **Readiness Standard**

Focusing Mathematical Process

7.1A Apply mathematics to problems arising in everyday life, society, and the workplace.

7.1B Use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution.

7.1D Communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate.

7.1F Analyze mathematical relationships to connect and communicate mathematical ideas.

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▲ Performance Task

Marla saw a math picture puzzle posted on her social media feed. She noticed that many people solved the puzzle and got different answers. After she solved the puzzle, she decided to create one of her own and do a survey with her friends to see how many of her friends could get the correct answer. Her puzzle is shown below.

$$2 \text{ squirrel} + 7 + \text{dog} = 61$$

$$\text{squirrel} \times 2 \text{ dog} + 8 = 80$$

$$2 \text{ cat} - \text{dog} = 10$$

$$\text{squirrel} + \text{cat} \div \text{dog} = ?$$

What is the value of each animal in Marla's puzzle? What answer does Marla expect from her friends?

Answer: A squirrel is 18, a dog is 2, and a cat is 6. The answer to her puzzle is 21.

Mathematically Speaking...

In this task, students represent a picture puzzle using equations to find the values represented by the images of a squirrel, dog, and cat in the puzzle. Once the values for each animal picture are found, students use the information to substitute and solve the last line of the puzzle for the result. Students will apply the order of operations when solving.

Students may use any equivalent representations for the equations in the problem and may use any appropriate strategy to solve each line of the puzzle including inverse operations, guess and check, pictorial models, or other methods.



The focus of the task is for students to represent situations using mathematics and understand how equations are tools for finding unknown values. Students begin working with one-variable one-step equations and inequalities in Grade 6 and proceed to two-step problems in Grade 7.

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Possible Solution

One way to solve Marla's puzzle is to use variable letters in place of each animal in the picture. The squirrel can be represented as the letter s , the dog as the letter d , and the cat as the letter c . Use equations to represent each line of the puzzle with the variable letters and solve one line at a time.

For the first line of the puzzle 2 squirrels plus 7 plus 1 squirrel equals 61. The equation for this line of the puzzle is $2s + 7 + s = 61$. First combine like terms to group all the variables together. The simplified equation becomes $3s + 7 = 61$. Then use inverse operations to solve for the value of s .

$$3s + 7 = 61$$

$$3s = 61 - 7$$

$$3s = 54$$

$$s = 54 \div 3$$

$$s = 18$$

Each squirrel in the picture puzzle has a value of 18. The second line of the puzzle shows 1 squirrel times 2 dogs plus 8 equals 80. The value of s is 18 and can be substituted for the letter s in the equation for the second line of the puzzle.

$$s \times 2d + 8 = 80$$

$$18 \times 2d + 8 = 80$$

Use order of operations to combine terms appropriately. Multiplication is performed first.

$$36d + 8 = 80$$

$$36d = 80 - 8$$

$$36d = 72$$

$$d = 2$$

The value of a dog is 2 and the value of a squirrel is 18. Use this information in the third line of the problem which shows 2 cats minus 1 dog is 10.

$$2c - d = 10$$

$$2c - 2 = 10$$

$$2c = 10 + 2$$

$$2c = 12$$

$$c = 12 \div 2$$

$$c = 6$$

The value of a cat in Marla's picture puzzle is 6, the value of a dog is 2, and the value of a squirrel is 18. Use this information to substitute into the last line of the puzzle and solve for the result using order of operations.

$$s + c \div d = ?$$

$$18 + 6 \div 2 = ?$$

$$18 + 3 = ?$$

$$21$$

The solution to Marla's picture puzzle is 21.

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Reasonableness



Verify the puzzle answer by using substitution of the values for a squirrel, dog, and cat throughout the original puzzle.

$2s + 7 + s = 61$	$s \times 2d + 8 = 80$	$2c - d = 10$
$2(18) + 7 + 18 = 61$	$18 \times 2(2) + 8 = 80$	$2(6) - 2 = 10$
$36 + 7 + 18 = 61$	$18 \times 4 + 8 = 80$	$12 - 2 = 10$
$43 + 18 = 61$	$71 + 8 = 80$	$10 = 10$
$61 = 61$	$80 = 80$	

Look For...

- a solution strategy to write and solve equations that represent each line of the puzzle in order to find the value for each animal in the puzzle and the final result of the problem on the last line
- correct determinations of the value of a squirrel, a dog, and a cat, along with the answer to the puzzle
- student justification of choices of solution strategy

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● Differentiation: Simplified Task

Marla saw a math picture puzzle posted on her social media feed. She noticed that many people solved the puzzle and got different answers. After she solved the puzzle, she decided to create one of her own and do a survey with her friends to see how many of her friends could get the correct answer. Her puzzle is shown below.

$$2 \text{ squirrel} + 7 + \text{cat} = 61$$

$$2 \text{ cat} - 2 = 10$$

$$\text{cat} + \text{squirrel} \div \text{cat} = ?$$

What is the value of each animal in Marla's puzzle? What answer does Marla expect from her friends? Justify your reasoning.

Answer: A squirrel is 18 and a cat is 6. The answer to her puzzle is 9.

■ Differentiation: Enriching Task

Marla saw a math picture puzzle posted on her social media feed. She noticed that many people solved the puzzle and got different answers. After she solved the puzzle, she decided to create one of her own and do a survey with her friends to see how many of her friends could get the correct answer. Her puzzle is shown below.

$$2 \text{ squirrel} + 7 + \text{cat} = 61$$

$$\text{squirrel} \times 2 \text{ dog} + 8 = 80$$

$$2 \text{ cat} - \text{dog} = 10$$

$$\text{squirrel} + \text{cat} \div \text{dog} = ?$$

What is the value of each animal in Marla's puzzle? What answer does Marla expect from her friends? What mistakes were made if some of the answers Marla got for the last line of the puzzle were 12 and 22.5? Justify your reasoning.

Answer: A squirrel is 18, a dog is 2, and a cat is 6. The answer to her puzzle is 21. For an answer of 12 the order of operations was not followed in the last line of the problem. For an answer of 22.5 the person added instead of multiplied 18 and 2d in line 2 to get a value of 27 for a dog.

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Scaffolded Task with Answers

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$$2 \text{ cat} - \text{ dog} = 10$$

$$\text{ squirrel} + \text{ dog} \div \text{ cat} = ?$$

1. Using a variable letter to represent a squirrel, what equation can be used to solve the first line of the puzzle?
 $2s + 7 + s = 61$
2. What is the value of a squirrel in the puzzle?
 18
3. Using a variable letter to represent a dog, what equation can be used to solve the second line of the puzzle?
 $18 \times 2d + 8 = 80$
4. What is the value of a dog in the puzzle?
 2
5. Using a variable letter to represent a cat, what equation can be used to solve the third line of the puzzle?
 $2c - 2 = 10$
6. What is the value of a cat in the puzzle?
 6
7. What is the answer to the last line of the puzzle based on the values for each animal?
 21

Performance Task: 7.11A
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$$2 \text{ 🐱} + 7 + \text{ 🐱} = 61$$

$$\text{ 🐱} \times 2 \text{ 🐶} + 8 = 80$$

$$2 \text{ 🐱} - \text{ 🐶} = 10$$

$$\text{ 🐱} + \text{ 🐱} \div \text{ 🐶} = ?$$

- What is the value of each animal in Marla's puzzle?
- What answer does Marla expect from her friends?

Justify your reasoning.

Procedural	0	1	2
Conceptual	0	1	2
Communication	0	1	2

Total points: _____



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1. Using a variable letter to represent a squirrel, what equation can be used to solve the first line of the puzzle?
2. What is the value of a squirrel in the puzzle?
3. Using a variable letter to represent a dog, what equation can be used to solve the second line of the puzzle?
4. What is the value of a dog in the puzzle?
5. Using a variable letter to represent a cat, what equation can be used to solve the third line of the puzzle?
6. What is the value of a cat in the puzzle?
7. What is the answer to the last line of the puzzle based on the values for each animal?

