TOPIC 7

LESSON 7.2a

Mathematics Gymnastics

Objective

Rewriting Expressions Using the Distributive Proproperty

Warm-Up

Write a numeric expression for the opposite of each given expression.

1. $-7 - 2$

2. $3 - 9$

3. $-3 + 2$

4. $3 - (-7)$

GETTING STARTED

Where Are They?

Consider the list of linear expressions.

x + 1 2x + 2 3x + 3 4x +1 4

1. On the empty number line, plot each algebraic expression by estimating its location.

2. Explain your strategy. How did you decide where to plot each expression?

3. What assumptions did you make to plot the expressions?
Does everyone's number line look the same? Why or why not?

EXPLORE 1

Algebraic Expressions on the Number Line

Consider the four expressions plotted in the previous activity.
How can you prove that you are correct?

Graham

I can use an example by evaluating all four expressions at the same value of x and plot the values.

Let $x = 4$.

$x + 1 = 4 + 1 = 5$

$2x + 2 = 2(4) + 2 = 10$

$3x + 3 = 3(4) + 3 = 15$

$4x + 4 = 4(4) + 4 = 20$

I can plot the expressions at 5, 10, 15, and 20.

Meaghan

The expressions look similar. I can factor out the coefficient of each expression.

$x + 1$

$2x + 2 = 2(x + 1)$

$3x + 3 = 3(x + 1)$

$4x + 4 = 4(x + 1)$

So, I can plot $x + 1$ and use that expression to plot the other expressions.

1. Use Graham's strategy with a different positive value for x to accurately plot the four expressions.

A **coefficient** is a number that is multiplied by a variable in an algebraic expression.

2. Use Graham's strategy with a negative value for x to accurately plot the four expressions. How is your number line different from the number line in Question 1?

Often, writing an expression in a different form reveals the structure of the expression. Meaghan saw that each expression could be rewritten as a product of two factors.

3. What are the two factors in each of Meaghan's expressions?
What is common about the factors of each expression?

Meaghan's expressions

$x + 1$

$2x + 2 = 2(x + 1)$

$3x + 3 = 3(x + 1)$

$4x + 4 = 4(x + 1)$

4. Use Meaghan's work to accurately plot the four expressions.
Explain your strategy.

5. Meaghan noticed that the expressions formed a sequence.
Write and plot the next two terms in the sequence.
Explain your strategy.

If a variable has no coefficient, the understood coefficient is 1.

6. What property did Meaghan use when she factored out the coefficient of the expressions?

EXPLORE 2

Applying the Distributive Property

Recall that the Distributive Property states that if a, b, and c are any real numbers, then

$$a(b + c) = ab + ac.$$

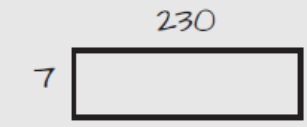
The property also holds if addition is replaced with subtraction, then

$$a(b - c) = ab - ac.$$

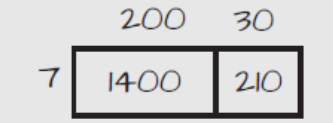
Dominique remembers that the Distributive Property can be modeled with a rectangle. She illustrates with this numeric example.

Dominique

Calculating 230 × 7 is the same as determining the area of a rectangle by multiplying the length by the width.



But I can also decompose the rectangle into two smaller rectangles and calculate the area of each. I can then add the two areas to get the total.



1400 + 210 = 1610

So, 7(230) = 1610.

1. Write Dominique's problem in terms of the Distributive Property.

You can also use area models with algebraic expressions.

2. Draw a model for each expression, and then rewrite the expression with no parentheses.

a. $6(x + 9)$

b. $7(2b - 5)$

c. $-2(4a + 1)$

d. $\frac{x + 15}{5}$

3. Use the Distributive Property to rewrite each expression in an equivalent form.

a. $3(4y + 2)$

b. $12(x + 3)$

c. $-4a(3b - 5)$

d. $-7(2y - 3x + 9)$

e. $\frac{6m + 12}{-2}$

f. $\frac{22 - 4x}{2}$

4 Simplify each expression. Show your work.

a. $-6(3x + (-4y))$

b. $-4(-3x - 8) - 34$

c. $\frac{-7.2 - 6.4x}{-0.8}$

d. $\left(-2\frac{1}{2}\right)\left(3\frac{1}{4}\right) + \left(-2\frac{1}{2}\right)\left(-2\frac{1}{4}\right)$

e. $\frac{\left(-7\frac{1}{2}\right) + 5y}{2\frac{1}{2}}$

5. Evaluate each expression for the given value. Then, use properties to simplify the original expression. Finally, evaluate the simplified expression.

a. $2x(-3x + 7)$ for $x = -1\frac{2}{3}$

b. $\frac{4.2 - 7}{1.4}$ for $x = 1.26$

c. Which form—simplified or not simplified—did you prefer to evaluate? Why?

6. A student submitted the following quiz. Grade the paper by marking each correct item with a √ or incorrect item with an X. Correct any mistakes.

Name Alicia Smith

Distributive Property Quiz

a. $2(x + 5) = 2x + 10$

b. $2(3x - 6) = 6x - 6$

c. $-3x(4y - 10) = -12xy + 30$

d. $5x(3x + 2y) = 15x + 10xy$

e. $\frac{15x + 10}{5} = 3x + 2$

f. $\frac{8x - 4}{4} = 2x + 1$

g. $12x + 4 = 3(4x + 1)$

h. $-2x + 8 = -2(x - 4)$

Name: _____ Date: _____ Class: _____

Homework HW

LESSON 7.2a

Mathematics Gymnastics

Objective Rewriting Expressions Using the Distributive Proproperty

Review

1. Ethan and Corinne are training for a marathon.
   a. Corinne runs 13.5 miles in 2 hours. What is her rate?
   b. Ethan wants to run the 26.2 miles of the marathon in 4.5 hours. At about what rate will he have to run to reach this goal? Round to the nearest tenth.
2. Fifteen seventh graders were randomly selected to see how many pushups in a row they could do. Their data are shown.
   45, 40, 36, 38, 42, 48, 40, 40, 70, 45, 42, 43, 48, 36
   a. Determine the mean of this data set.
   b. Determine the median of this data set.

3. Convert each measurement.
   a. $4\frac{1}{2}$ pounds = ____ oz
   b. 22.86 cm = ____ in.