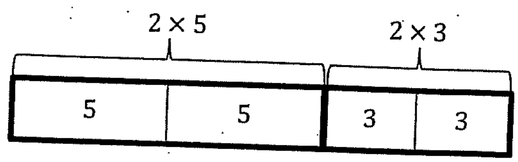
# Lesson 11: Factoring Expressions

## Classwork

### Example 1

a. Use the model to answer the following questions.




How many fives are in the model?

2

How many threes are in the model?

2

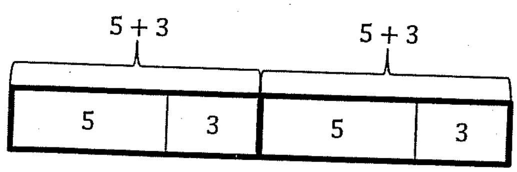
What does the expression represent in words?

The sum of two groups of five and two groups of three.

What expression could we write to represent the model?

$2 \times 5 + 2 \times 3$

b. Use the new model and the previous model to answer the next set of questions.




How many fives are in the model?

2

How many threes are in the model?

2

What does the expression represent in words?

Two groups of the sum of 5 and three

What expression could we write to represent the model?

$(5+3)+(5+3)$ or $2(5+3)$

c. Is the model in part (a) equivalent to the model in part (b)?

Yes, because both expressions have two 5's and two 3's. Therefore $2 \times 5 + 2 \times 3 = 2(5+3)$

d. What relationship do we see happening on either side of the equal sign?

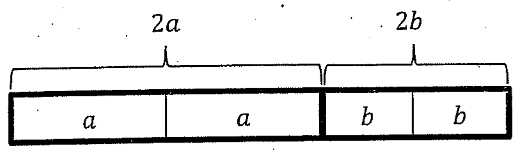
On the left-hand side, 2 is being multiplied by 5 and then by 3 before adding the products together. On the right-hand side, the 5 and 3 are added first and then multiplied by 2.

e. In Grade 5 and in Module 2 of this year, you have used similar reasoning to solve problems. What is the name of the property that is used to say that $2(5 + 3)$ is the same as $2 \times 5 + 2 \times 3$?

The name of the property is the distributive property.

### Example 2

Now we will take a look at an example with variables. Discuss the questions with your partner.




What does the model represent in words?

a plus a plus b plus b, two a's plus two b's, two times a plus two times b.

What does $2a$ mean?

There are 2 a's or $2 \times a$

How many $a$'s are in the model?

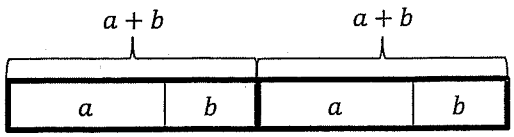
2

How many $b$'s are in the model?

2

What expression could we write to represent the model?

$2a + 2b$




How many $a$'s are in the expression?

2

How many $b$'s are in the expression?

2

What expression could we write to represent the model?

$(a+b) + (a+b) = 2(a+b)$

Are the two expressions equivalent?

Yes. Both models include 2 a's and 2 b's. Therefore $2a + 2b = 2(a+b)$.

**Example 3**

Use GCF and the distributive property to write equivalent expressions.

1. $3f + 3g =$ $3(f+g)$

What is the question asking us to do?

Rewrite the expression as an equivalent expression in factored form, which means the expression is written as the product of factors. The number outside of the ( ) is the GCF.

How would Problem 1 look if we expanded each term?

$3 \cdot f + 3 \cdot g$

What is the GCF in Problem 1?

3

How can we use the GCF to rewrite this expression?

3 goes on the outside, and $f+g$ will go on the inside of the Parentheses. $3(f+g)$.

2. $6x + 9y =$ $3(2x + 3y)$

What is the question asking us to do?

Rewrite the expression as an equivalent expression in factored form, which means the expression is written as the product of factors. The number outside the ( ) is the GCF.

How would Problem 2 look if we expanded each term?

$2 \cdot 3 \cdot x + 3 \cdot 3 \cdot y$

What is the GCF in Problem 2?

The GCF is 3.

How can we use the GCF to rewrite this expression?

Factor out a 3 from both terms and place it in front of the ( ). I will place what is left in the terms inside the ( ): $3(2x+3y)$

3. $3c + 11c =$ $c(3+11)$

Is there a greatest common factor in Problem 3?

Yes, when I expand, I can see that each term has a common factor c.

$3 \cdot c + 11 \cdot c$

Rewrite the expression using the distributive property.

$c(3+11)$

4. $24b + 8 =$ $8(3b+1)$

Explain how you used GCF and the distributive property to rewrite the expression in Problem 4.

I expanded each term. I know that 8 goes into 24.

$2 \cdot 2 \cdot 2 \cdot 3 \cdot b + 2 \cdot 2 \cdot 2$

Why is there a 1 in the parentheses?

When I factor out a number, I am leaving behind the other factor that multiplies to make the original number.

$1 \times 8 = 8$

How is this related to the first two examples?

In the first two examples, we could rewrite the expressions by thinking about groups.

## Exercises

1. Apply the distributive property to write equivalent expressions.

   a. $7x + 7y$ 7(x+y)

   b. $15g + 20h$ 5(3g+4h)

   c. $18m + 42n$ 6(3m+7n)

   d. $30a + 39b$ 3(10a+13b)

   e. $11f + 15f$ f(11+15)

   f. $18h + 13h$ h(18+13)

   g. $55m + 11$ 11(5m+1)

   h. $7 + 56y$ 7(1+8y)

2. Evaluate each of the expressions below.

   a. $6x + 21y$ and $3(2x + 7y)$ $x = 3$ and $y = 4$

   6(3)+21(4)
   18 + 84
   102

   3(2(3)+7(4))
   3(6+28)
   3(34)
   102

   b. $5g + 7g$ and $g(5 + 7)$ $g = 6$

   5(6)+7(6)
   30 + 42
   72

   6(5+7)
   6(12)
   72

c. $14x + 2$ and $2(7x + 1)$ $x = 10$

$14(10) + 2$
$140 + 2$
$142$

$2(7(10) + 1)$
$2(70 + 1)$
$2(71)$
$142$

Skip d. Explain any patterns that you notice in the results to parts (a)–(c).

Skip. e. What would happen if other values were given for the variables?

## Closing

How can you use your knowledge of GCF and the distributive property to write equivalent expressions?

We can use our knowledge of GCF and the distributive property to change expressions from standard form to factored form.

Find the missing value that makes the two expressions equivalent.

| | |
|---|---|
| $4x + 12y$ | $\underline{4}(x + 3y)$ |
| $35x + 50y$ | $\underline{5}(7x + 10y)$ |
| $18x + 9y$ | $\underline{9}(2x + y)$ |
| $32x + 8y$ | $\underline{8}(4x + y)$ |
| $100x + 700y$ | $\underline{100}(x + 7y)$ |

Explain how you determine the missing number.

I would expand each term and determine the greatest common factor. The GCF is the number that is placed on the blank line.