

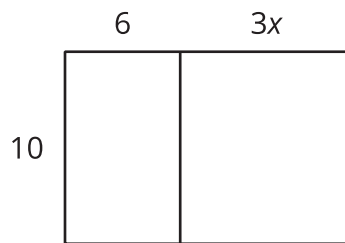


# Expanding and Factoring

Let's use the distributive property to write expressions in different ways.

## 19.1 Expressions for Area

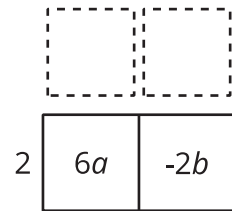
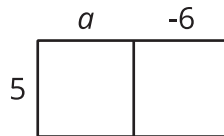
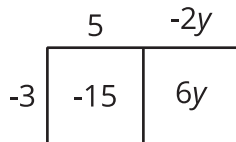
Write as many expressions as you can that represent the area of this rectangle.



## 19.2

## Factoring and Expanding with Negative Numbers

In each row, write the equivalent expression. If you get stuck, use a diagram to organize your work. The first row is provided as an example. Diagrams are provided for the first three rows.



| factored          | expanded          |
|-------------------|-------------------|
| $-3(5 - 2y)$      | $-15 + 6y$        |
| $5(a - 6)$        |                   |
|                   | $6a - 2b$         |
| $-4(2w - 5z)$     |                   |
| $-(2x - 3y)$      |                   |
|                   | $20x - 10y + 15z$ |
| $k(4 - 17)$       |                   |
|                   | $10a - 13a$       |
| $-2x(3y - z)$     |                   |
|                   | $ab - bc - 3bd$   |
| $-x(3y - z + 4w)$ |                   |



### Are you ready for more?

1. Expand to create an equivalent expression that uses the fewest number of terms:  $\left(\left(\left(x + 1\right) \frac{1}{2}\right) + 1\right) \frac{1}{2} + 1$ .
2. If we wrote a new expression following the same pattern so that there were 20 sets of parentheses, how could it be expanded into an equivalent expression that uses the fewest number of terms?

## 19.3 Seeing Structure

Factor each expression. Be prepared to explain your reasoning.

1.  $3 \cdot 15 + 4 \cdot 15 - 5 \cdot 15$

2.  $3x + 4x - 5x$

3.  $3(x - 2) + 4(x - 2) - 5(x - 2)$

4.  $3\left(\frac{5}{2}x + 6\frac{1}{2}\right) + 4\left(\frac{5}{2}x + 6\frac{1}{2}\right) - 5\left(\frac{5}{2}x + 6\frac{1}{2}\right)$



## Lesson 19 Summary

Properties of operations can be used in different ways to rewrite expressions and create equivalent expressions. For example, the distributive property can be used to **expand** an expression such as  $3(x + 5)$  to get  $3x + 15$ .

|     |      |      |
|-----|------|------|
|     | $x$  | $5$  |
| $3$ | $3x$ | $15$ |

The distributive property can also be used in the other direction to **factor** an expression such as  $12x - 8$ . In this case, we know the product and need to find the factors.

The terms of the product go inside:

|     |    |
|-----|----|
|     |    |
| 12x | -8 |

Think of a factor each term has in common:  $12x$  and  $-8$  each have a factor of 4. The common factor can be placed on one side of the large rectangle:

|   |       |      |
|---|-------|------|
|   |       |      |
| 4 | $12x$ | $-8$ |

Now think: "4 times *what* is  $12x$ ?" and "4 times *what* is  $-8$ ?" Write the other factors on the other side of the rectangle:

|     |       |      |
|-----|-------|------|
|     | $3x$  | $-2$ |
| $4$ | $12x$ | $-8$ |

So,  $12x - 8$  is equivalent to  $4(3x - 2)$ .