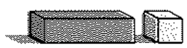
LESSON 5.3

The Distributive Law

You will need:

the Lab Gear 

HOW MANY TERMS?

For each multiplication, write an equation of the form *length · width equals area.* (You may use the Lab Gear and the corner piece to model the multiplication by making a rectangle.) In your expression for the area, combine like terms.

1. $x(2x + 5)$

2. $2x(y - 2)$

3. $y(2y + 2 - x)$

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

5. $(x + 2)(3y + 1)$

6. $(x + 2)(y - 3x + 1)$

For each multiplication, write an equation of the form *length · width · height equals volume.* (You may want to use the Lab Gear and the corner piece to model the multiplication by making a box.) In your expression for the volume, combine like terms.

7. $x(x + 2)(x + 5)$

8. $y(x + 2)(y + 1)$

9. $x(x + 5)(x + y + 1)$

Definitions: A polynomial having two terms is called a *binomial;* one having three terms is called a *trinomial.* A polynomial having one term is called a *monomial.*

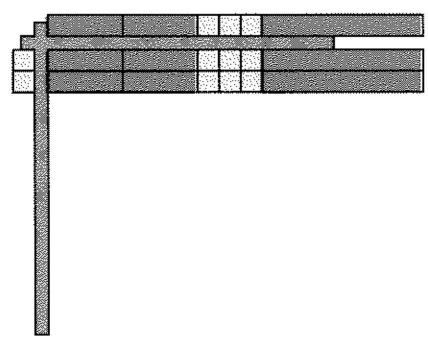
10. Report In problems 1-9, you multiplied two or three polynomials of degree 1. In each case, the product was also a polynomial. Write a report describing the patterns you saw in the products. You should use the words *monomial, binomial,* and *trinomial.* Give examples and illustrate your work with drawings of the Lab Gear. Your report should address the points listed below, but should also include any other observations you made.

- What determines the degree of the product?
- What determines the number of terms in the product?
- Compare problems having one variable to problems having two variables.

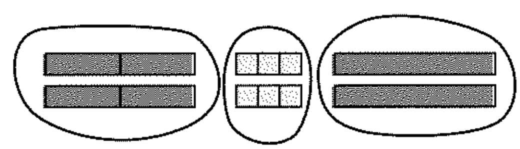
DIVISION AND THE DISTRIBUTIVE LAW

As you probably remember, you can use the corner piece to model division.

Example: Simplify $\frac{4x + 6 + 2y}{2}$



In some cases, you can use the Lab Gear in another way to show that a division like this one can be thought of as three divisions.



11. What is the result of the division?

Simplify these expressions, using the Lab Gear if you wish.

12. $\frac{10x + 5y + 15}{5}$

13. $\frac{2x + 4}{x + 2}$

14. $\frac{x^2 + 4x + 4}{x + 2}$

15. $\frac{3(y - x) + 6(x - 2)}{3}$

Another way to simplify some fractions is to rewrite the division into a multiplication and use the distributive law.

Example: To simplify $\frac{6x + 4 + 2y}{2}$:

- Rewrite the problem as a multiplication.

$$\frac{1}{2}(6x + 4 + 2y)$$

- Apply the distributive law.

$$\frac{1}{2} \cdot 6x + \frac{1}{2} \cdot 4 + \frac{1}{2} \cdot 2y$$

- Simplify.

$$3x + 2 + y$$

You can see that we could have divided every term in the numerator by 2. That is:

$$\frac{6x + 4 + 2y}{2} = \frac{6x}{2} + \frac{4}{2} + \frac{2y}{2}.$$

The single division problem was equivalent to three divisions. This example illustrates *the distributive law of division over addition and subtraction.*

Divide.

16. $\frac{9x + 6y + 6}{3}$

17. $\frac{3x^2 + 2x}{2x}$

18. $\frac{6x^2 + 4x}{2x}$

19. $\frac{2(x + 3) + 5(x + 3)}{x + 3}$

DISTRIBUTIVE LAW PRACTICE

Find these products, using the Lab Gear or any other method.

20. $2x(x - 1)$

21. $y(y + 4)$

22. $3x(x + y - 5)$

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

24. $(2x + 4)(x + y + 2)$

25. $(2y - x - 3)(y + x)$

Write equivalent expressions without the parentheses. Combine like terms.

26. $z(x + y) + z(x - y)$

27. $z(x + y) + z(x + y)$

28. $z(x + y) + x(z + y)$

29. $z(x + y) - x(z + y)$

MULTIPLYING BINOMIALS

The following problems involve multiplying two binomials of the form $ax + b$ or $ax - b$. Multiplications like this arise often in math. As you do them, look for patterns and shortcuts.

30. $(3x + 2)(5x + 6)$

31. $(3x - 2)(5x + 6)$

32. $(3x + 2)(5x - 6)$

33. $(ax + 2)(3x + d)$

34. $(2x + b)(cx - 3)$

35. When you multiply two binomials of the form $ax + b$ or $ax - b$,
   a. what is the degree of the product?
   b. how many terms are in the product?

36. When multiplying two binomials of the form $ax + b$ or $ax - b$, how do you find
   a. the coefficient of x^2?
   b. the coefficient of x?
   c. the constant term?