LESSON 3.6

Multiplication and Division

You will need:

the Lab Gear 

Notation: In algebra, the symbol ÷ is not used, perhaps because it looks too much like a + sign. To show division, use the format of a fraction.

$$\frac{6}{2} = 3$$

Or, if you're using a typewriter or computer, write it with a slash, 6/2 = 3.

In this book we will write division both ways.

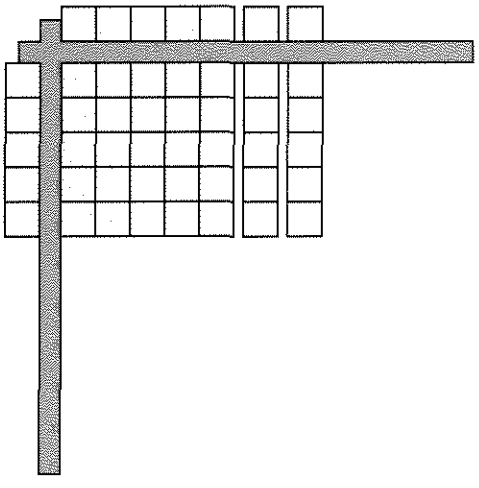
ONE MULTIPLICATION, TWO DIVISIONS

For most multiplication equations, there are two division equations. For example, corresponding to $7 \cdot 3 = 21$, we have

$$21/7 = 3 \quad \text{and} \quad 21/3 = 7.$$

With the Lab Gear, you can use a rectangle to model multiplication and division.

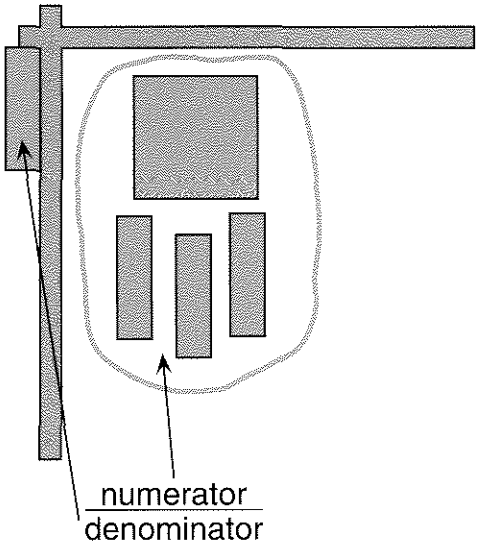
Arrange your corner piece and blocks to match this figure.



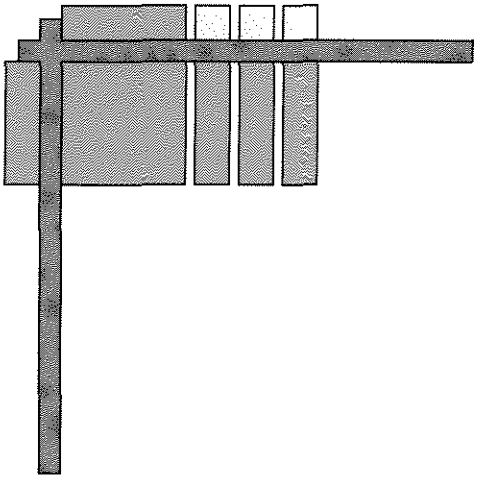
1. Write the multiplication equation that is shown by the figure.
2. Write the two division equations that are shown by the figure.
3. You could use the corner piece to set up several different divisions having numerator 12. For each, write the division equation and the corresponding multiplication equation.
4. Explain why it is impossible to set up the division 12/0 with the Lab Gear.
5. Some algebra students believe that 12/0 = 0. Explain why they are *wrong* by discussing the multiplication that would correspond to this division.
6. a. Using the corner piece, multiply $(x + 4)(x + 3)$.
   b. Write two division equations related to the multiplication.

DIVISION IN THE CORNER PIECE

Here is an example of dividing in the corner piece.



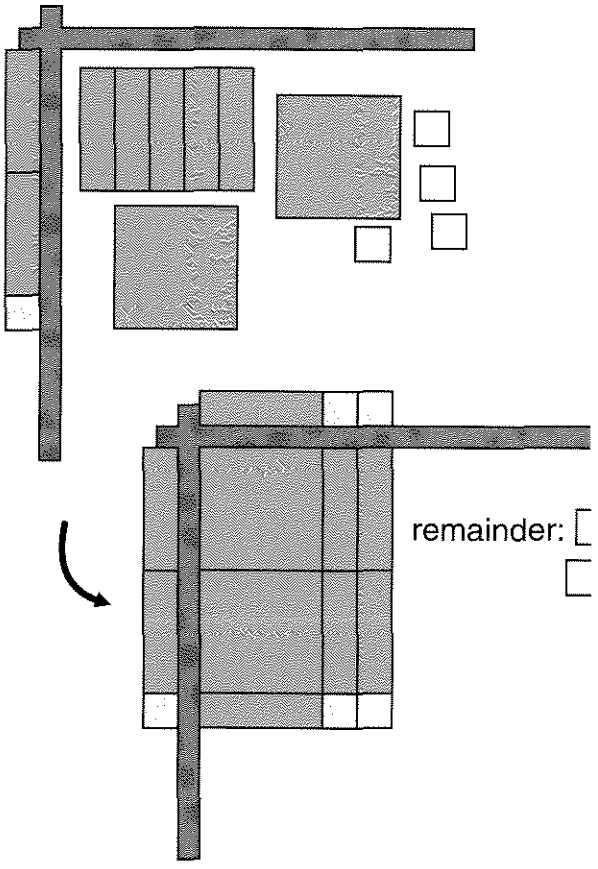
- Put the denominator to the left of the corner piece.
- Make a rectangle out of the numerator and place it inside the corner piece so that one side of the rectangle matches the denominator.



- Finally, to get the answer, figure out what blocks go along the top of the corner piece.

7. Write the division equation shown by the figure.

The denominator was a factor of the numerator, and a rectangle was formed with no pieces left over. However, in some cases, there will be a remainder. Here is an example.



8. What are the numerator, denominator, quotient, and remainder in the above division?

9. Divide.

a. $\frac{6x^2 + 3x}{3x}$ b. $\frac{9x + 3}{3}$

c. $\frac{x^2 + x + xy + y}{x + y}$ d. $\frac{xy + 2x + x^2}{x + y}$

e. $\frac{2x^2 + 6x + 4}{x + 2}$ f. $\frac{3x^2 + 10x + 5}{x + 3}$

10. For each division in problem 9, write the related multiplication equation.

11.

a. Divide. $\frac{y^2x + x^2y + 2xy + x^2 + y^2 + x + y}{x + 1}$

b. Write four multiplications having the product
$y^2x + x^2y + 2xy + x^2 + y^2 + x + y$.

MULTIPLICATION WITHOUT THE LAB GEAR

Here is a method for multiplying polynomials without the Lab Gear. To perform the multiplication $(x + 2)(3y - 4x + 5)$, write the terms along the side and the top of a table.

	$3y$	$-4x$	5
x			
2			

Then enter the products of the terms in the corresponding boxes.

	$3y$	$-4x$	5
x	$3xy$	$-4x^2$	$5x$
2	$6y$	$-8x$	10

Then combine like terms, and you are done.

$(x + 2)(3y - 4x + 5) =$
$3xy - 4x^2 - 3x + 6y + 10$

Use this method for the following products.

12. $x(2x + 3xy + y^2)$

13. $(2x - y)(x + 3y)$

14. $(2x - y)(x - 3y)$

15. $(2x + y)(x - 3y)$

16. $(2x + y)(x + 3y)$

17. $(x + xy + 2yx)(y + 2 + x)$

This method for multiplication is a way to apply the distributive law to the multiplication of polynomials. *Every term must be multiplied by every term.*

MULTIPLICATION PUZZLES

Fill in the tables, including the polynomial factors along the side and the top. All coefficients are whole numbers. Is more than one solution possible for either table?

18.

$2x^3$		$-6x$
	$-x$	-3

19.

$12xy$	$15x^2y$	
		x^2y^2

20. Create a puzzle of this type that has a unique solution. Give the solver as few terms as possible.

21. Solve a classmate's puzzle.

REVIEW WHAT'S YOUR SIGN?

22. What is the sign of the missing factor?

a. $-123.4 \cdot$ ____ $= 567.89$

b. $98.76 \cdot (-54.3) \cdot$ ____ $= -21$

c. $98.76 \cdot (-54.3) \cdot$ ____ $= 0$