Section 2.4

TERMINOLOGY 2.4

For each of the following terms, provide 1) a definition in your own words, 2) the formal definition (as provided by your text or instructor), and 3) an example of the term using a drawing or problem.

Product

Your definition	
Formal definition	
Example	

Quotient

Your definition	
Formal definition	
Example	

READING AND SELF-DISCOVERY QUESTIONS 2.4

1. In mathematics, what are three ways we can indicate the operation of multiplication?

   X, a dot, or parentheses

2. When two integers with different signs are multiplied, what is the sign of their product?

   A negative sign

3. When two integers with the same sign are multiplied, what is the sign of their product?

   A positive sign

4. Are the sign rules for dividing integers the same as the sign rules for multiplying integers? If not, how do they differ?

   Yes, the sign rules are the same.

5. If there are an even number of negative signs in your expression, is the product + or –?

   If there are an even number of negative signs in an expression, then the sign will be positive.

6. If there are an odd number of negative signs in your expression, is the product + or –?

   If there are an odd number of negative signs in an expression, then the sign will be negative.

7. In the expression 5^4, what is the base? What is the exponent? What are the base and exponent for $(-5)^4$? What are the base and exponent for -5^4 ?

   For 5^4, the base is 5 and the exponent is 4; For $(-5)^4$, the base is –5 and the exponent is 4; For -5^4, the base is 5 and the exponent is 4.

8. If the base is negative and its exponent is an even number, is the answer positive or negative? For example, $(-3)^4$.

   When the base is negative and the exponent is an even number, the answer will be a positive number.

9. If the base is negative and its exponent is an odd number, is the answer positive or negative? For example, $(-3)^5$.

   When the base is negative and the exponent is an odd number, the answer will be a negative number.

10. Write 4^5 as a multiplication problem. Write $(-4)^5$ as a multiplication problem.

    $4^5 = 4 \times 4 \times 4 \times 4 \times 4$
    $(-4)^5 = (-4)(-4)(-4)(-4)(-4)$

CRITICAL THINKING QUESTIONS 2.4

1. Why does a positive number multiplied by a negative number give a negative number as the product?

   If you have 4×-5, this represents adding a number four times: $-5 + -5 + -5 + -5 = -20$, i.e., there is repeated addition of negative numbers.

2. Why does a negative number multiplied by a negative number give a positive number as the product?

   If you think of the pattern of going down from, for example, $2 \times -5 = -10$ to $1 \times -5 = -5$ to $0 \times -5 = 0$, then continuing the pattern means that $-1 \times -5 = 5$. In terms of money, if we define a loan as meaning you OWE money (say you OWE \$100 or HAVE –\$100), then two of those loans is $2 \times -100 = -200$, so you owe \$200. Multiplying the loan by a positive number merely increases the amount you owe; the number will always be negative. But if you pay off the original loan, you're multiplying it by a negative number (giving money back instead of taking it out), which gets rid of the loan. This means that the result MUST be a positive number. And so it is: $-2 \times -100 = 200$. This means that you're richer, which makes sense because paying off a loan has a positive value for you.

3. Compare and contrast the procedures for adding integers with the procedures for multiplying integers.

   Both go left to right. In addition, you add similar signs, and take the difference of different signs. In multiplication, opposite signs result in a negative value, while like (same-sign) values result in a positive number.

DEMONSTRATE YOUR UNDERSTANDING 2.4

1. Validate the following expressions:

a) $2 \times 4 = 8$ $\frac{8}{4} = 2$	c) $(-4) \times 2 = -8$ $\frac{-8}{2} = -4$
b) $2 \times (-4) = -8$ $\frac{-8}{-4} = 2$	d) $(-2) \times (-4) = 8$ $\frac{8}{-4} = -2$

IDENTIFY AND CORRECT THE ERROR 2.4

In the second column, identify the error(s) you find in the following worked solution. Describe the error made in the second column. Solve the problem correctly in the third column.

Problem	Describe Error	Correct Process
Evaluate for $x = -1$ $-x^2$	**$-x^2$ is not subtraction.** **The notation $\bullet -$ is an incorrect notation.**	$-(-1) \cdot (-1)$ $-(1)$ -1
Worked Solution *(What is wrong here?)*		
$-x^2$ $-(-1) \bullet -(-1)$ $(1) \bullet (1)$ **1**		