Section 3.4

TERMINOLOGY 3.4

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. A sample filled-out form is available in the Introduction.

Base

Your definition	
Formal definition	
Example	

Exponent

Your definition	
Formal definition	
Example	

Product Rule for Exponents

Your definition	
Formal definition	
Example	

READING AND SELF-DISCOVERY QUESTIONS 3.4

1. For the expression 6^4, what word describes the 6? What word describes the 4?

   The 6 is the base and the 4 is the exponent.

2. When you rewrite an exponent expression as a repeated multiplication problem, what does a whole number exponent tell you about the base?

   The exponent tells you how many times to multiply the base by itself. Example: 6^4 means that you need to multiply 6 four times: 6 • 6 • 6 • 6.

3. When multiplying numbers which have the same base, how can you determine the exponent of the product?

   You can determine the exponent of the product by adding the exponents of each number with the same base.

4. For the expression $5x^4$, what is the 5 called? What is x called? What is the 4 called?

   The 5 is called the coefficient. The letter *x* is called the variable, and the 4 is called the exponent.

5. When multiplying numbers which include a numerical coefficient and a variable with an exponent, describe the procedure for multiplying the numbers. For example: $(3x^4)\ (7x^5)$.

   Multiply the numerals together and then multiply the variable expression one variable at a time. Present the product as the numeral result times the variable result.

6. The distributive property uses which mathematical operation?

   multiplication

CRITICAL THINKING QUESTIONS 3.4

1. How would you explain the Product Rule for Exponents to another student?

   The Product Rule for Exponents applies when the bases of two expressions are the same. When the bases are the same, add the exponents and present the result as the base with an exponent of the sum of the two exponents.

2. Why can we simplify the expression $2^3 \cdot 2^4$ using the Product Rule for Exponents, but not $2^3 \cdot 3^4$? Generalize your answer for any similar problem by writing a not-equal equation.

   In the first case, the bases are the same and the Product Rule for Exponents applies. In the second case, the Product Rule for Exponents does not apply because the bases are not the same.

   Generalization: $a^n b^m \neq (ab)^{n+m}$

IDENTIFY AND CORRECT THE ERRORS 3.4

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

Problem	Describe Error	Correct Process
1. Write the product in exponent form: $3^2 \cdot 2^3$ **Worked Solution** *(What is wrong here?)* $3^2 \cdot 2^3$ $x^a \cdot x^b = (x \cdot x)^{a+b}$ $(6)^{2+3}$ $\mathbf{6^5}$	**The student has failed to observe that the product rule for exponents cannot be followed when the bases are not the same.**	$3^2 \cdot 2^3$
Problem	**Describe Error**	**Correct Process**
2. Write the product in exponent form: $4^2 \cdot 4^5$ **Worked Solution** *(What is wrong here?)* $4^2 \cdot 4^5$ $(4)^{2 \cdot 5}$ $\mathbf{4^{10}}$	**The student has multiplied the exponents (which is what should be done when raising a power to a power) instead of adding them (applying the product rule for exponents).**	$4^2 \cdot 4^5$ $(4)^{2+5}$ 4^7