NAME ________________________________

Module 11 Simplifying Algebraic Expressions with Polynomials

Lesson 1 Applying Rules of Exponents

independent practice

Simplify.

1. $2^4 \cdot 2^6$ **$2^{10} = 1{,}024$**
2. $3^{-3} \cdot 3^6$ **$3^3 = 27$**
3. $3^2 \cdot 2^3$ **simplest form**
4. $(x^2y^3)(x^4y^6)$ **x^6y^9**
5. $x^2y^0z^{-4}$ **$\frac{x^2}{z^4}$**
6. $r^{-3}s^5$ **$\frac{s^5}{r^3}$**
7. $(ab)^4$ **a^4b^4**
8. $(2c^2d)^3$ **$8c^6d^3$**
9. $(-2a^4b^3)^2(a^5b)$ **$4a^{13}b^7$**
10. $\left(-\frac{3}{4}c\right)^2$ **$\frac{9}{16}c^2$**
11. $(0.4x^2y^4)^2$ **$0.16x^4y^8$**
12. $\left(\frac{3}{4}x^2y^{-2}\right)\left(\frac{2}{3}x^5y^8\right)^3$ **$\frac{2}{9}x^{17}y^{22}$**
13. $8a(b^4c^5)^3$ **$8ab^{12}c^{15}$**
14. $(5^2c^2d^3)^{-2}$ **$\frac{1}{625c^4d^6}$**
15. $\frac{2^5}{2^3}$ **$2^2 = 4$**
16. $\frac{3^6}{3^8}$ **$\frac{1}{3^2} = \frac{1}{9}$**
17. $\left(\frac{x}{2}\right)^{-3}$ **$\frac{8}{x^3}$**
18. $\frac{x^{-3}}{x^5}$ **$\frac{1}{x^8}$**
19. $\frac{2x^3y}{4x^2y^3}$ **$\frac{x}{2y^2}$**
20. $\frac{15x^2y^3z^5}{18xy^{-2}z^{-4}}$ **$\frac{5xy^5z^9}{6}$**
21. $\left(\frac{8^{-2}x^3y^4}{z^{10}}\right)^0$ **1**
22. $\frac{3^4x^2y^{-4}}{3^2x^3y^{-5}}$ **$\frac{9y}{x}$**
23. $\frac{(a^4b^5c)^2}{(ab^2)^{-2}}$ **$a^{10}b^{14}c^2$**
24. $\frac{(3m^{-3}n^2p^4)^{-2}}{2m^4n^{-3}p)^{-1}}$ **$\frac{2m^{10}}{9n^7p^7}$**

Journal

1. Meko says that $2^3 \cdot 3^4$ is 6^7. Show Meko his mistake and help him find the correct way to simplify this expression.
2. Nora does not believe it makes sense that a^0 is one. Use the following pattern to convince her: $10^4 = 10{,}000$, $10^3 = 1{,}000$, $10^2 = 100$, . . .
3. Give an example to show that $(x^a)^b = x^{ab}$.
4. Explain the method used for multiplying expressions involving exponents in your own words.
5. Explain the method used for dividing expressions involving exponents in your own words.

Cumulative Review

Solve each equation or system of equations.

1. $3x - 4 = 5$ **$x = 3$**

2. $4a - 6 = 12$ **$a = 4.5$**

3. $2(d - 2) = 18$ **$d = 11$**

4. $4z + 18 - 5z = 2z + 21$ **−1**

5. $x = 2$
   $2x + y = 7$ **(2, 3)**

6. $y = 4x$
   $x - y = 6$ **(−2, −8)**

7. $3x + y = 6$
   $5x - y = -2$ **(0.5, 4.5)**

8. $x - 2y = 15$
   $3x + 2y = 13$ **(7, −4)**

9. Joe makes \$8.25 per hour mowing lawns. This week he made \$198. How many hours did he work? **24 hours**

Possible Journal Answers

1. Meko multiplied the bases and applied the *multiplication rule of exponents* incorrectly. The expression, $2^3 \cdot 3^4$, has different bases (2^3 has a base of 2 and 3^4 has a base of 3). So, the *multiplication rule of exponents* does not apply, and the expression cannot be simplified in that way. The correct way to simplify the expression is to calculate the value of each factor separately and then, multiply those values together; $2^3 \cdot 3^4 = (2 \cdot 2 \cdot 2) \cdot (3 \cdot 3 \cdot 3 \cdot 3) = (8) \cdot (81) = 648$.

2. In the pattern, each value is divided by 10. When this pattern is continued, $10^1 = 10$ and $10^0 = 1$. To continue the pattern even further, $10^{-1} = 0.1$. Each time the exponent is decreased by one, the decimal is moved one place to the left for a base of 10.

3. One example,which can be used, is $(2^2)^3$. Since 2^2 is the same as $2 \cdot 2$, this expression can be rewritten $(2 \cdot 2)^3$. Expanding $(2 \cdot 2)^3$ yields $(2 \cdot 2) \cdot (2 \cdot 2) \cdot (2 \cdot 2)$ or 2^6. Because $6 = 2 \cdot 3$, this can be rewritten $2^{2 \cdot 3}$. So, $(2^2)^3 = 2^{2 \cdot 3}$.

4. Expressions with exponents may be simplified only if they have the same bases. To multiply the expressions, leave the bases the same and add the exponents.

5. Rational expressions with exponents may be simplified only if they have the same bases. To divide the expressions, leave the bases the same and subtract the exponents. If the value of the exponent in the numerator is greater than the value of the exponent of the denominator, the denominator will cancel to one. If the value of the exponents is the same in the numerator and denominator, the value of the expression is equal to exactly one. If the value of the exponent in the denominator is greater the value of the exponent of the numerator, the numerator will cancel to one. This rule is true provided the value of the denominator is not equal to zero.