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Study Guide and Intervention

7NS1.2, 7NS2.1, 7AF2.1

Powers and Exponents

Expressions containing repeated factors can be written using exponents.

Example 1 **Write $7 \cdot 7 \cdot 7 \cdot 7 \cdot 7$ using exponents.**

Since 7 is used as a factor 5 times, $7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 = 7^5$.

Example 2 **Write $p \cdot p \cdot p \cdot q \cdot q$ using exponents.**

Since p is used as a factor 3 times and q is used as a factor 2 times, $p \cdot p \cdot p \cdot q \cdot q = p^3 \cdot q^2$.

Any nonzero number to the zero power is 1. Any nonzero number to the negative n power is the multiplicative inverse of nth power.

Example 3 **Evaluate 6^2.**

$6^2 = 6 \cdot 6$ Definition of exponents

$= 36$ Simplify.

Example 4 **Evaluate 5^{-3}.**

$5^{-3} = \frac{1}{5^3}$ Definition of negative exponents

$= \frac{1}{125}$ Simplify.

Exercises

Write each expression using exponents.

1. $8 \cdot 8 \cdot 8 \cdot 8 \cdot 8$

2. $4 \cdot 4 \cdot 4 \cdot 4$

3. $a \cdot a \cdot a \cdot a \cdot a \cdot a$

4. $g \cdot g \cdot g \cdot g \cdot g \cdot g \cdot g$

5. $5 \cdot 5 \cdot 9 \cdot 9 \cdot 5 \cdot 9 \cdot 5 \cdot 5$

6. $s \cdot w \cdot w \cdot s \cdot s \cdot s$

Evaluate each expression.

7. 4^2

8. 5^3

9. 13^2

10. $2^3 \cdot 3^2$

11. 8^{-2}

12. $2^4 \cdot 5^2$

13. 3^{-4}

14. $3^4 \cdot 7^2$

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7NS2.3, 7AF2.1, 7AF2.2

Multiplying Monomials

The **Product of Powers Property** states that to multiply powers that have the same base, add the exponents: $a^n \cdot a^m = a^{n+m}$.

Example **Multiply. Express using exponents.**

1 **$2^3 \cdot 2^2$**

$2^3 \cdot 2^2 = 2^{3+2}$ The common base is 2.

$= 2^5$ Add the exponents.

2 **$-2s^6(-7s^7)$**

$-2s^6(-7s^7) = (-2 \cdot -7)(s^6 \cdot s^7)$ Commutative and Associative Properties

$= (14)(s^{6+7})$ The common base is s.

$= 14s^{13}$ Add the exponents.

3 **$n^5 - n^{-3}$**

$n^5 - n^{-3} = n^{5-3}$ The common base is n.

$= n^2$ Subtract the exponents.

Exercise

Multiply. Express using exponents.

1. $3^4 \cdot 3^1$

2. $5^2 \cdot 5^5$

3. $e^2 \cdot e^7$

4. $2a^5 \cdot 6a$

5. $-3t^3 \cdot 2t^8$

6. $4x^2(-5x^6)$

7. $-6t^4 \cdot -3t^5$

8. $\left(\frac{3}{4}\right)^{-3} \cdot \left(\frac{3}{4}\right)^6$

9. $-6m^2 \cdot 4m$

10. $3s^6(-9s^{-2}h^2)$

11. $9a^2(-6a^{-5})$

12. $-2e^4z^{-4}(6e^{-6})$

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Dividing Monomials

The Quotient of Powers Property states that to divide powers that have the same base, subtract the exponents: $a^n \div a^m = a^{n-m}$.

Example **Divide. Express using exponents.**

1 $\frac{k^8}{k}$

$\frac{k^8}{k} = k^{8-1}$ The common base is k.

$= k^7$ Subtract the exponents.

2 $\frac{28g^{12}}{-4g^3}$

$\frac{28g^{12}}{-4g^3} = \left(\frac{28}{-4}\right)\left(\frac{g^{12}}{g^3}\right)$ Commutative and Associative Properties

$= (-7)(g^{12-3})$ The common base is g.

$= -7g^9$ Subtract the exponents.

3 $\frac{5^8}{5^{-5}}$

$\frac{5^8}{5^{-5}} = 5^{8-(-5)}$ Quotient of Powers.

$= 5^{13}$ Simplify.

Exercise

Divide. Express using exponents.

1. $\frac{2^8}{2^6}$ **2.** $\frac{7^9}{7^3}$ **3.** $\frac{v^{14}}{v^6}$

4. $\frac{15w^7}{5w^2}$ **5.** $\frac{21z^{10}}{7z^9}$ **6.** $\frac{10m^8}{2m}$

7. $\frac{(-12)^3}{(-12)^3}$ **8.** $\frac{c^{20}}{c^{13}}$ **9.** $\frac{1^8}{1^6}$

10. $\frac{x^{-2}}{x^{-4}}$ **11.** $\frac{100^7}{100^6}$ **12.** $\frac{4^{-2}}{4^6}$