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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. $8 \cdot 8 \cdot 8 \cdot 8 \cdot 8$ 8^5

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

3. $a \cdot a \cdot a \cdot a \cdot a \cdot a$ a^6

4. $g \cdot g \cdot g \cdot g \cdot g \cdot g \cdot g$ g^7

5. $5 \cdot 5 \cdot 9 \cdot 9 \cdot 5 \cdot 9 \cdot 5 \cdot 5$ $5^5 \cdot 9^3$

6. $s \cdot w \cdot w \cdot s \cdot s \cdot s$ $s^4 \cdot w^2$

Evaluate each expression.

7. 4^2 16

8. 5^3 125

9. 13^2 169

10. $2^3 \cdot 3^2$ 72

11. 8^{-2} $\frac{1}{64}$

12. $2^4 \cdot 5^2$ 400

13. 3^{-4} $\frac{1}{81}$

14. $3^4 \cdot 7^2$ 3,969

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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 $\mathbf{2^3 \cdot 2^2}$

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

$= 2^5$ Add the exponents.

2 $\mathbf{-2s^6(-7s^7)}$

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

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

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

3 $\mathbf{n^5 - n^{-3}}$

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

$= n^2$ Subtract the exponents.

Exercise

Multiply. Express using exponents.

1. $3^4 \cdot 3^1$ 3^5
2. $5^2 \cdot 5^5$ 5^7
3. $e^2 \cdot e^7$ e^9
4. $2a^5 \cdot 6a$ $12a^6$
5. $-3t^3 \cdot 2t^8$ $-6t^{11}$
6. $4x^2(-5x^6)$ $-20x^8$
7. $-6t^4 \cdot -3t^5$ $18t^{-9}$
8. $\left(\frac{3}{4}\right)^{-3} \cdot \left(\frac{3}{4}\right)^6$ $\frac{27}{64}$
9. $-6m^2 \cdot 4m$ $-24m^3$
10. $3s^6(-9s^{-2}h^2)$ $-27s^4h^2$
11. $9a^2(-6a^{-5})$ $-54a^{-3}$
12. $-2e^4z^{-4}(6e^{-6})$ $-12e^{-2}z^{-10}$

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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. $\frac{2^8}{2^6}$ 2^2
2. $\frac{7^9}{7^3}$ 7^6
3. $\frac{v^{14}}{v^6}$ v^8
4. $\frac{15w^7}{5w^2}$ $3w^5$
5. $\frac{21z^{10}}{7z^9}$ $3z$
6. $\frac{10m^8}{2m}$ $5m^7$
7. $\frac{(-12)^3}{(-12)^3}$ 1
8. $\frac{c^{20}}{c^{13}}$ c^7
9. $\frac{1^8}{1^6}$ 1^2 or 1
10. $\frac{x^{-2}}{x^{-4}}$ x^2
11. $\frac{100^7}{100^6}$ 100^1 or 100
12. $\frac{4^{-2}}{4^6}$ 4^{-8}