

Exponents Review

a^n means a multiplied by itself n times

Examples: $3^2 = 3 \cdot 3 = 9$

$$(-5)^3 = (-5)(-5)(-5) = -125$$

Exponent Rules

If m and n are rational numbers and no denominators are 0.

Zero Exponent: $a^0 = 1$, for $a \neq 0$

(A nonzero number raised to the 0 power equals 1.)

Examples: $5^0 = 1$

$$(-2)^0 = 1$$

Negative Exponent: $a^{-n} = \frac{1}{a^n}$ and $\frac{1}{a^{-n}} = a^n$

Examples: $9^{-2} = \frac{1}{9^2} = \frac{1}{81}$

$$\frac{1}{2^{-3}} = 2^3 = 8$$

$$7x^{-5}y^2 = 7 \cdot \frac{1}{x^5} \cdot y^2 = \frac{7y^2}{x^5}$$

Rational Exponent: $a^{m/n} = \sqrt[n]{a^m} = (\sqrt[n]{a})^m$

Example: $27^{2/3} = (\sqrt[3]{27})^2 = (3)^2 = 9$

Product Rule: $a^m \cdot a^n = a^{m+n}$

(Multiply the same base, add the exponents.)

Example: $x^2 \cdot x^7 = x^{2+7} = x^9$

Quotient Rule: $\frac{a^m}{a^n} = a^{m-n}$

(Divide the same base, subtract the exponents.)

Example: $\frac{x^9}{x^4} = x^{9-4} = x^5$

Power Rule: $(a^m)^n = a^{m \cdot n}$

(Exponent raised to an exponent, multiply exponents.)

Example: $(5^3)^8 = 5^{3 \cdot 8} = 5^{24}$

Product Raised to a Power: $(ab)^n = a^n b^n$

(Raise each factor to the n th power)

Example: $(7y)^4 = 7^4 y^4 = 2401y^4$

Quotient Raised to a Power: $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

(Raise the numerator and denominator to the n th power)

Example: $\left(\frac{x}{8}\right)^3 = \frac{x^3}{8^3} = \frac{x^3}{512}$

Practice

Evaluate

1. $(-4)^2$

2. -4^2

3. $\left(\frac{3}{8}\right)^0$

4. $2^3 \cdot 2^{-5}$

5. $\frac{4^9}{4^3}$

6. $\left(\frac{1}{7}\right)^3 \left(\frac{1}{7}\right)^{-4}$

7. $(-3)^2 + (-2)^3$

8. $64^{1/2}$

9. $\left(\frac{16}{25}\right)^{1/2}$

Simplify. Write all answers with positive exponents.

10. $\frac{x^4}{x^7}$

11. $x^5 \cdot x^{-2}$

12. $(3x^4)^2$

13. $2x^0$

14. $(y^4)^{-2}$

15. $\left(\frac{-5x^2}{y^3}\right)^2$

16. $\frac{a^2 b^7}{(2b^2)^5}$

17. $(-y^{-3})^{-2}$

18. $(x^{1/2} y^2)^4$

19. $x^{1/2} x^{1/3}$

20. $\frac{y^{-3/4}}{y^{-7/4}}$

1. 16
2. -16
3. 1
4. $\frac{1}{4}$
5. 4096
6. 7
7. 1
8. 8
9. $\frac{4}{5}$
10. $\frac{1}{x^3}$
11. x^3
12. $9x^8$
13. 2
14. $\frac{1}{y^8}$
15. $\frac{25x^4}{y^6}$
16. $\frac{a^2}{32b^3}$
17. y^6
18. x^2y^8
19. $x^{5/6}$
20. y