

Basics

**Product
Rule**

**Quotient
Rule**

**Tape here
to paper**

**Zero
Exponent
Rule**

**Power
Rule**

**Negative
Exponent
Rule**

What is an exponent? tells how many

times to multiply the base

base 4³ exponent

EX: 1) $5^3 = 125$ 2) $-6^2 = -36$ 3) $(-6)^2 = 36$ 4) $\left(\frac{3}{4}\right)^2 = \frac{9}{16}$

Product Rule: Multiply like or same bases. Keep the base and add their exponents.

Think: $2^3 \cdot 2^4 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 2^7$

EX: 1) $6^2 \cdot 6^3 = 6^5$ 2) $x^3 \cdot x^5 = x^8$

3) $y^3 \cdot y^5 \cdot y^4 = y^2$ 4) $5^1 \cdot 5^8 \cdot 5^3 = 5^{12}$

5) $3y^4 \cdot 6y^2 \cdot y^1 = 18y^3$
multiply coefficients

Quotient Rule: Divide like or same bases. Keep the base and subtract their exponents. Top minus the bottom.

EX: 1) $\frac{4^9}{4^3} = 4^{9-3} = 4^6$ 2) $\frac{b^5}{b^3} = b^{5-3} = b^2$

3) $\frac{10x^5}{5x^{-3}} = 2x^{5-(-3)} = 2x^8$ 4) $\frac{8x^9y^7}{2x^2y} = 4x^7y^6$

or cancel: $\frac{6^7}{6^2} = \frac{\cancel{6} \cancel{6} \cancel{6} \cancel{6} \cancel{6} \cancel{6} 6}{\cancel{6} \cancel{6}} = 6^5$

EXPONENTS

Zero Exponent Rule: Any non-zero number or variable raised to a power of zero will equal one.

Think: $\frac{5}{5} = 1$ 1) $9^0 = 1$

$\frac{x^5}{x^5} = x^0 = 1$ 2) $-6^0 = -1$

3) $(-6)^0 = 1$

Power Rule: when a power is raised to another power, then multiply both powers. (parentheses)

Think: $(4^3)^2 = 4^3 \cdot 4^3 = 4^6$

EX: 1) $(2^5)^2 = 2^{10}$ 2) $(t^4)^3 = t^{12}$

3) $(3x^4)^3 = 27x^{12}$ 4) $(2x^4y^2)^3 = 8x^{12}y^6$

Negative Exponent Rule: Move the base and the negative exponent to the bottom or top of a fraction and change to a positive exponent.

EX: 1) $2x^3 = \frac{2x^3}{1}$ 2) $\frac{1}{4^{-2}} = 4^2$

3) $\frac{z^{-4}}{6x^{-5}} = \frac{x^5}{6z^4}$ 4) $12^{-3} = \frac{1}{12^3}$

Section 7.5

Scientific Notation

When writing large or small numbers, you can use **scientific notation** as an alternate form. A number in scientific notation is expressed as the product of two factors. The first factor is at least 1 but less than 10, and the second factor is a power of 10.

When a number is converted from **standard form** to scientific notation, the power of 10 is positive if the decimal moves left. If the decimal moves right, the power is negative.

Express the following in scientific notation.

5,870

Move the decimal point 3 places to the left to get a number between 1 and 10. The power of 10 is 3.

$$\underline{5,870} = 5.87 \times 10^3$$

0.00015

Move the decimal point 4 places to the right to get a number between 1 and 10. The power of 10 is -4.

$$\underline{0.00015} = 1.5 \times 10^{-4}$$

4.2×10^6

Because the power of 10 is 6, move the decimal point 6 places to the right.

$$4.2 \times 10^6 = \underline{4,200,000}$$

3.6×10^{-4}

Because the power of 10 is -4, move the decimal point 4 places to the left.

$$3.6 \times 10^{-4} = \underline{0.00036}$$

Express the following in standard form.

PRACTICE

Express each number in scientific notation.

4,100

$$4.1 \times 10^3$$

0.0000054

$$5.4 \times 10^{-6}$$

9,920,000

$$9.92 \times 10^6$$

0.008

$$8 \times 10^{-3}$$

70,500

$$7.05 \times 10^4$$

0.000301

$$3.01 \times 10^{-4}$$

Express each number in standard form.

5×10^2

500

1.45×10^5

145,000

6.072×10^6

6,072,000

4.8×10^{-3}

0.0048

7.41×10^{-5}

0.0000741

1.9×10^{-4}

0.00019