

Integer Exponents

Laws of Exponents

(1) $x^m \cdot x^n = x^{m+n}$ Example: $x^5 \cdot x^2 = x^7$

(2) $\frac{x^m}{x^n} = x^{m-n}$, if $m > n$ Examples: $\frac{x^{10}}{x^2} = x^8$
1, if $m = n$

$\frac{1}{x^{n-m}}$, if $m < n$ $\frac{x^2}{x^6} = \frac{1}{x^4}$

(3) $(x^m)^n = x^{mn}$ Example: $(x^2)^3 = x^6$

(4) $(xy)^n = x^n y^n$ Example: $(xy)^3 = x^3 y^3$

(5) $\left(\frac{x}{y}\right)^n = \frac{x^n}{y^n}$ Example: $\left(\frac{x}{y}\right)^2 = \frac{x^2}{y^2}$

(6) $x^0 = 1$, $x \neq 0$ Example: $(2x^3 y)^0 = 1$

(7) $x^{-n} = \frac{1}{x^n}$, $\frac{1}{x^{-n}} = x^n$ Examples: $2^{-3} = \frac{1}{2^3} = \frac{1}{8}$, $\frac{1}{x^{-4}} = x^4$

(8) $\left(\frac{x}{y}\right)^{-n} = \left(\frac{y}{x}\right)^n$ Example: $\left(\frac{2}{3}\right)^{-2} = \left(\frac{3}{2}\right)^2 = \frac{3^2}{2^2} = \frac{9}{4}$

Additional Examples:

(1) $x^{-3} \cdot x^2 = \frac{x^2}{x^3} = \frac{1}{x}$ (2) $(x^{-3} y^2)^2 = x^{-6} y^4 = \frac{y^4}{x^6}$

(3) $\frac{(2x^2 y^{-3})^{-1} (x^{-3} y^4)^{-3}}{(2x^3 y^{-1})^2} = \frac{2^{-1} x^{-2} y^3 x^9 y^{-12}}{2^2 x^6 y^{-2}} = \frac{y^3 x^9 y^2}{2^2 x^6 2^1 x^2 y^{12}} = \frac{x^9 y^5}{2^3 x^8 y^{12}} = \frac{x}{8y^7}$

Practice Sheet – Integer Exponents

I. Evaluate each of the following:

(1) $3^4 =$

(4) $3^{-2} =$

(7) $\frac{1}{2^{-3}} =$

(2) $(-2)^3 =$

(5) $(-2)^{-3} =$

(8) $\left(\frac{2}{3}\right)^{-3} =$

(3) $(-4)^4 =$

(6) $\left(\frac{3}{4}\right)^3 =$

(9) $(-25)^0 =$

II. Simplify; write answers with only positive exponents and assume that all variables are non-zero:

(1) $x^4 \cdot x^5 =$

(9) $(x^{-3})^4 =$

(2) $2^3 \cdot 2^7 =$

(10) $(x^2 y^{-3})^{-3} =$

(3) $\frac{x^8}{x^4} =$

(11) $\left(\frac{x^2}{y^{-3}}\right)^2 =$

(4) $\frac{x^3}{x^9} =$

(12) $(x^2 y^3)(xy^2)^3 =$

(5) $\frac{2^8}{2^5} =$

(13) $(x^{-2} y^2)^{-3}(x^{-4} y^{-5}) =$

(6) $(x^3)^5 =$

(14) $\frac{x^{-3} y^2}{x^4 y^5} =$

(7) $x^{-3} \cdot x^5 =$

(15) $\frac{(x^2 y^{-3})^{-2}}{x^4 y^5} =$

(8) $\frac{x^{-4}}{x^{-7}} =$

(16) $\frac{(2x^2 y)^{-2}}{(3x^{-1} y^4)(xy^{-2})^3} =$

Solution Key for Integer Exponents

- I. (1) 81 (4) $\frac{1}{9}$ (7) $2^3 = 8$
- (2) -8 (5) $-\frac{1}{8}$ (8) $\frac{27}{8}$
- (3) 256 (6) $\frac{27}{64}$ (9) 1
- II. (1) x^9 (9) $\frac{1}{x^{12}}$
- (2) $2^{10} = 1024$ (10) $\frac{y^9}{x^6}$
- (3) x^4 (11) $x^4 y^6$
- (4) $\frac{1}{x^6}$ (12) $x^5 y^9$
- (5) $2^3 = 8$ (13) $\frac{x^2}{y^{11}}$
- (6) x^{15} (14) $\frac{1}{x^7 y^3}$
- (7) x^2 (15) $\frac{y}{x^8}$
- (8) x^3 (16) $\frac{1}{12x^6}$

