

2.4 Exponent Laws - Day 2

Ex. 1 Simplify. $(2^2)(2^2)(2^2)(2^2)$
 $= (2 \times 2)(2 \times 2)(2 \times 2)(2 \times 2)$

RECALL

a) $(2^2)^4$
 $= 2^{2 \times 4}$
 $= 2^8$

b) $(x^3)^2$
 $= x^6$

Raising a Power to an Exponent
 To raise a power to another exponent, multiply the exponents without changing the base.
Power of a Power Rule
 $(m^a)^b = m^{a \times b}$

Ex. 2 Simplify.

a) $(2x^5)^4$
 $= (2x^5)(2x^5)(2x^5)(2x^5)$
 $= 2^4(x^5)^4$
 $= 16x^{20}$

b) $(-2xy^2)^3$
 $= (-2)^3 x^3 (y^2)^3$ $\left\{ \begin{array}{l} (-2)(-2)(-2) \\ = -8 \end{array} \right.$
 $= -8x^3y^6$

Power of a Product
 The exponent is applied to each part of the base.
 $(ab)^m = a^m b^m$

Ex. 3 Simplify.

a) $\left(\frac{2}{3}\right)^3$
 $= \left(\frac{2}{3}\right)\left(\frac{2}{3}\right)\left(\frac{2}{3}\right)$
 $= \frac{2^3}{3^3}$
 $= \frac{8}{27}$

b) $\left(\frac{5}{x}\right)^2 = \frac{5^2}{x^2}$
 $= \frac{25}{x^2}$

Power of a Quotient
 The exponent is applied to each part of the base.
 $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$

Ex. 4 Simplify.

a) $(-4x^2y)^4$
 $= (-4)^4 (x^2)^4 y^4$
 $= 256x^8y^4$

$y^{-3 - (-14)}$
 $= y^{-3+14}$

b) $\frac{(2x^3y^{-1})^3}{(-2x^2y^7)^2}$
 $= \frac{2^3 x^9 y^{-3}}{(-2)^2 x^4 y^{14}}$
 $= \frac{8x^9y^{-3}}{4x^4y^{14}}$
 $= 2x^5y^{11}$

c) $(-x^5y^{-2})^3(3x^2y^3)^2$
 $= (-1)^3 x^{15} y^{-6} (3^2 x^4 y^6)$
 $= (-x^{15} y^{-6})(9x^4 y^6)$
 $= -9x^{11} y^0$
 $= -9x^{11}(1)$
 $= -9x^{11}$

Exponent Laws



Multiply powers

$$m^3 \cdot m^4$$

$$= m^{3+4}$$

$$= m^7$$

⇒ add exponents

Divide powers

$$m^6 \div m^1$$

$$= m^{6-1}$$

$$= m^5$$

⇒ subtract exponents

Power of a power

$$(m^6)^3$$

$$= m^{6 \times 3}$$

$$= m^{18}$$

⇒ multiply exponents

Mutiplication

$$3m^2 \cdot 4m^5$$

$$= 12m^7$$

⇒ Multiply the coefficients

Division

$$50m^8 \div 2m^3$$

$$= 25m^5$$

⇒ Divide the coefficients

Power of a Power

$$(4m^3)^2$$

$$= 4^2 m^6$$

$$= 16m^6$$

⇒ Exponent affects each part of the base

Ex. 5 Simplify.

$$a) (a^2 b^3)^4$$

$$= a^8 b^{12}$$

$$b) (-4m^2)^3$$

$$= (-4)^3 m^6$$

$$= -64m^6$$

$$c) (-x^3)^2 (2x^4)^3$$

$$= ((-1)^2 x^6) (2^3 x^{12})$$

$$= (x^6)(8x^{12})$$

$$= 8x^{18}$$

$$d) \frac{(5c^3d)(4c^2d^2)}{(2c^2d)^2}$$

$$= \frac{20c^5d^3}{2^2c^4d^2}$$

$$= \frac{20c^5d^3}{4c^4d^2}$$

$$= 5cd$$

$$e) \frac{(-3m^2n^6)(2m^4n^8)^3}{(4mn^2)^3}$$

$$= \frac{(-3m^2n^6)(2^3m^{12}n^{24})}{4^3m^3n^6}$$

$$= \frac{(-3m^2n^6)(8m^{12}n^{24})}{64m^3n^6}$$

Reduce

$$= \frac{-24m^{14}n^{30}}{64m^3n^6}$$

$$= \frac{-3m^{12}n^{24}}{8}$$

$$= -\frac{3}{8}m^{12}n^{24}$$

$$f) \frac{(2m^3)^4}{24m^5}$$

$$= \frac{2^4m^{12}}{24m^5}$$

$$= \frac{16m^{12}}{24m^5}$$

$$= \frac{2m^7}{3}$$

$$= \frac{2}{3}m^7$$