

6.1 Integer & Rational Exponents Power ≤ 4

Any number to the ZERO power equals 1.

Ex) $5^0 = 1$ $(-17)^0 = 1$ $-17^0 = -1$ $\left(\frac{1}{2}\right)^0 = 1$ You need to multiply out.

BUT: 0^0 is undefined!! $\left(\frac{200x^{30}}{y^{40}}\right)^0 = 1$ 2^5 $2^4 = 16$

Flip!!

NEGATIVE EXPONENTS: $a^{-n} = \frac{1}{a^n}$

Never leave your Answer with neg. power.

*Answer is always a FRACTION

Put a 1 over it and change the power to positive.

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

c) $\frac{x^{-7}}{1} = \frac{1}{x^7}$

e) $\frac{-4^{-2}}{1} = -\frac{1}{4^2} = -\frac{1}{16}$

b) $\frac{5^{-2}}{1} = \frac{1}{5^2} = \frac{1}{25}$

d) $\frac{(-4)^{-2}}{1} = \frac{1}{(-4)^2} = \frac{1}{16}$

More for Negative Exponents: ~~*~~ only move the "-" power

- If there are any **negative exponent** terms on the numerator, **move** the negative exponent terms to the denominator.
- If there are any **negative exponent** terms on the denominator, **move** the negative exponent terms to the numerator.

$$a) \frac{6}{x^{-3}} = \frac{6x^3}{1}$$

$$b) \frac{5x^{-2}y^{-3}z^2}{1} = \frac{5z^2}{x^2y^3}$$

$$c) \frac{x^{-7}}{y^2} = \frac{1}{x^7y^2}$$

$$d) -4a^{-2}b^3 = \frac{-4b^3}{a^2}$$

PRODUCT OF POWERS: $a^x \cdot a^y = a^{x+y}$



Same base = keep the base & add the power

a) $a^{\boxed{4}} \cdot a^{\boxed{5}} = \boxed{a^9}$
base

b) $9^{\boxed{1}} \cdot 9^{\boxed{3}} \cdot 9^{\boxed{2}} = \boxed{9^6}$
base

c) $(-5)^{\boxed{2}} (-5)^{\boxed{1}} = (-5)^{\boxed{3}}$
 $= \boxed{-125}$

d) $x^{-12} \cdot x^{20} = x^8$

e) $(4a^{\boxed{2}}b^{\boxed{3}})(3a^{\boxed{4}}b^{\boxed{5}}) = \boxed{12a^6b^8}$
multiply the #'s

f) $(2n^4)(4n^3p^2)(-3np^3) = \boxed{-24n^8p^5}$

$$\text{POWER OF A POWER: } (a^x)^y = a^{xy}$$

keep the base &
multiply the power.

$$a) (a^4)^5 = a^{20}$$

$$b) (9^3)^2 = 9^6$$

$$c) (x^3)^7 = x^{21}$$

$$d) (10^2)^3 = 10^6$$

$$e) (a^{12})(a^4)^{-2} = (a^{12})(a^{-8}) = a^4$$

power
of a
power
1st

POWER OF A PRODUCT: $(ab)^n = a^n b^n$

Distribute the power to each # & variable.

$$a) (ab)^5 = a^5 b^5$$

$$b) (xyz)^2 = x^2 y^2 z^2$$

$$c) (3xy)^3 = 3^3 x^3 y^3 \\ = 27 x^3 y^3$$

$$d) (-ax^3y^4)^2 = (-1)^2 a^2 (x^3)^2 (y^4)^2 \\ = a^2 x^6 y^8$$

$$e) (-2a^2b)^3 = (-2)^3 (a^2)^3 b^3 \\ = -8 a^6 b^3$$

$$f) (-3a)^3 (2b^3) = (-3^3 a^3) (2b^3) \\ \text{do this} \\ \text{1st} \\ = (-27 a^3) (2b^3) = -54 a^3 b^3 \\ \text{times}$$

$$g) \left(a^3 b^4 \right)^{-2} \left(a^{-3} b^{-5} \right)^{-4} = \left(a^{-6} b^{-8} \right) \left(a^{12} b^{20} \right)$$

$$= a^6 b^{12}$$

$$h) \left(2m^4 n \right)^3 \left(5m^{-3} \right)^2 = \left(2^3 m^{12} n^3 \right) \left(5^2 m^{-6} \right)$$

$$= \left(8 m^{12} n^3 \right) \left(25 m^{-6} \right)$$

$$= 200 m^6 n^3$$

QUOTIENT OF POWERS: $\frac{a^x}{a^y} = a^{x-y}$

keep the base &
subtract the power.

$$a) \frac{x^{10}}{x^3} = x^{10-3} = x^7$$

$$b) \frac{x^8 y^6}{x^7 y^3} = x^1 y^3$$

$$c) \frac{9^4 9^3}{9^2} = \frac{9^7}{9^2} = 9^5$$

$$d) \frac{-4x^{15}y}{728x^{12}} = -\frac{1}{7}x^3y$$

reduce
the number

Tips: Subtract Exponent & Put Your Answer Where BIGGER Exponent is. Bigger Exp. - Small Exp

$$e) \frac{x^6 y^3 z^4}{x^3 y^8 z^4} = \frac{x^3}{y^5}$$

$$f) \frac{x^8 y^{-6} z^{-4}}{x^{-2} y^3 z^{-6}} = \frac{x^{10} z^2}{y^9}$$

$$8 - (-2) = 10$$

$$3 - (-6) = 9 ; -4 - (-6) = 2$$

POWER OF A QUOTIENT: $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

$$a) \left(\frac{3}{4}\right)^3 = \frac{3^3}{4^3} = \frac{27}{64}$$

$$b) \left(\frac{5x}{2x^2y}\right)^3 = \frac{5^3 x^3}{2^3 (x^2)^3 y^3} = \frac{125 x^3}{8 x^6 y^3}$$

$$-6 - (-9) = 3$$

$$c) \left(\frac{a^{-3} b^{-2}}{b^{-3} c^5}\right)^3 = \frac{a^{-9} b^{-6}}{b^{-9} c^{15}} = \frac{b^3}{a^9 c^{15}}$$

$$d) \left(\frac{x^4}{y^2}\right)^{-3} = \frac{x^{-12}}{y^{-6}} = \frac{y^6}{x^{12}} = \frac{125}{8x^3y^3}$$