

Section 5.1: Exponents

Essential Question:

What are the laws of exponents?

Things to remember...

Zero Power $m^0 = 1$

Exponent Laws

1) $m^x \cdot m^y = m^{x+y}$ *add*

2) $\frac{m^x}{m^y} = m^{x-y}$, $m \neq 0$ *subtract*

3) If $m \neq 0, 1, \text{ or } -1$, then $m^x = m^y$ if and only if $x = y$ *If bases are same, then exponents equal*

Same Exponent Laws

4) $(am)^x = a^x \cdot m^x$

5) $\left(\frac{a}{m}\right)^x = \frac{a^x}{m^x}$, $m \neq 0$

6) If $x \neq 0$, $a > 0$ and $m > 0$, then $a^x = m^x$ if $a = m$ *If exponents are the same, then the bases are equal.*

Power of a Power

7) $(m^x)^y = m^{xy}$ *(mult-powers)*

Negative Power

8) $m^{-x} = \frac{1}{m^x}$

9) $\frac{1}{m^{-x}} = m^x$ **NO NEG. exponents*

An expression is simplified when it does not contain negative exponents or power of powers.

Examples

1) $8^{-1} = \frac{1}{8^1} = \frac{1}{8}$

2) $\left(\frac{2}{3}\right)^{-2} = \frac{2^{-2}}{3^{-2}} = \frac{3^2}{2^2} = \frac{9}{4}$
Flip fraction power becomes opposite #
 OR $\left(\frac{3}{2}\right)^2 = \frac{3^2}{2^2} = \frac{9}{4}$

3) $\frac{4 \cdot 3^{-2}}{1} = \frac{4^1}{3^2} = \frac{4}{9}$

4) $(2^{-1} \cdot 4^{-1})^{-1} = 2^1 \cdot 4^1 = 8$

$$5) (2^{-1} + 4^{-1})^{-1} = \left(\frac{1}{2} + \frac{1}{4}\right)^{-1}$$

$$= \left(\frac{3}{4}\right)^{-1} = \left(\frac{4}{3}\right)^1 = \boxed{4/3}$$

6)

*Simplify the parentheses ()

$$\left(\frac{12}{6}\right)^3 = (2)^3 = \boxed{8}$$

$$7) \frac{8^n \cdot 3^n}{4^n}$$

$$= \left(\frac{8 \cdot 3}{4}\right)^n = \left(\frac{24}{4}\right)^n = (6)^n = \boxed{6^n}$$

8)

Distribute

$$x^{-3}(x^5 + x^3)$$

$$x^{-3} \cdot x^5 + x^{-3} \cdot x^3$$

$$x^2 + x^0 = \boxed{x^2 + 1}$$

$$9) \frac{3a^3 \cdot 6a^6}{a^{-1}} \Rightarrow \frac{18a^9}{a^{-1}} = a^1(18a^9)$$

2 ways

$$a^1(3a^3 \cdot 6a^6) = \boxed{18a^{10}}$$

$$18a^{10}$$

10)

$$\frac{3a^3 - 6a^6}{a^{-1}}$$

Distribute

$$a^1(3a^3 - 6a^6) = \boxed{3a^4 - 6a^7}$$

Section 5.1 Summary:

① Anything to zero power = 1

② $X^a \cdot X^b = X^{a+b}$ if mult. same base \rightarrow add powers

③ $\frac{X^a}{X^b} = X^{a-b}$ if divide same base \rightarrow subtract powers

④ $(a \cdot b)^x = a^x \cdot b^x$

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

} you can bring the power in if you are mult. or dividing
* Not if you add or subtract

⑥ $(a^x)^y = a^{x \cdot y}$ power to a power \rightarrow multiply

⑦ $a^{-x} = \frac{1}{a^x}$

⑧ $\frac{1}{a^{-x}} = \frac{a^x}{1}$

} No negative exponents, move the base and exponent to the opposite side
numerator \rightarrow den. OR denominator \rightarrow numer.