

Your Name

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Notes

## Review of Exponent Rules

# Day 1

Rules of Exponents or Laws of Exponents	Rule in Words	Example
Combining like terms	$a^x + b^x = (a+b)^x$	
Multiplication Rule	$a^x \times a^y = a^{x+y}$	
Division Rule	$a^x \div a^y = a^{x-y}$	
Power of a Power Rule	$(a^x)^y = a^{xy}$	
Power of a Product Rule	$(ab)^x = a^x b^x$	
Power of a Fraction Rule	$\left(\frac{a}{b}\right)^x = \frac{a^x}{b^x}$	
Zero Exponent	$a^0 = 1$	
Negative Exponent	$a^{-x} = \frac{1}{a^x}$	
Fractional Exponent	$a^{\frac{x}{y}} = \sqrt[y]{a^x}$	

Rules of Exponents or Laws of Exponents		Rule in Words	Example
Combining like terms	$ax + bx = (a+b)x$	add coefficients no exponent change	$-2x + 4y^2x + 6x$ $4x + 4y^2x$
Multiplication Rule	$a^x \times a^y = a^{x+y}$	multiply base Add exponents	$(10b^5)(8a^2b^5)$ $-1 \cdot 8 \cdot a^{1+2} \cdot b^{5+5}$ $-8a^3b^{10}$
Division Rule	$a^x \div a^y = a^{x-y}$ $\frac{a^x}{a^y} = a^{x-y}$	divide base Subtract exponents	$\frac{3n^8m^2}{21n^2m^3} = \frac{3}{21} n^{8-2} m^{2-3}$ $\frac{1}{7} n^6 m^{-1}$ $\frac{1}{7m}$
Power of a Power Rule	$(a^x)^y = a^{xy}$	Multiply Exponents	$(x^2)^3 = x^{2 \cdot 3} = x^6$ $x^2 \cdot x^2 \cdot x^2$
Power of a Product Rule	$(ab)^x = a^x b^x$	distribute Multiply exponents	$(8a^2b^3)^4 = 8^{1 \cdot 4} a^{2 \cdot 4} b^{3 \cdot 4}$ $512 a^8 b^{12}$
Power of a Fraction Rule	$\left(\frac{a}{b}\right)^x = \frac{a^x}{b^x}$	distribute multiply exponents on top & bottom	$\left(\frac{1n^3n^5}{8n^2}\right)^4 = \frac{1^4 n^{3+5} n^4}{8^4 n^{2 \cdot 4}}$ $\frac{1 \cdot n^8 \cdot n^4}{8^4 n^8} = \frac{n^{12}}{8^4}$
Zero Exponent	$a^0 = 1$ $a \neq 0$	base is divided by itself = 1	$(103xy)^0 = \frac{103xy}{103xy} = 1$ $103x^2y^0 = 103x^2$
Negative Exponent	$a^{-x} = \frac{1}{a^x}$	mean Fractions! Flip the place	$\frac{1p^4m^{-2}}{-5v^{-3}} = \frac{1p^4v^3}{-5m^2}$ $3^{-4} = \frac{1}{3^4}$ or $\frac{1}{x^{-2}} = x^2$
Fractional Exponent	$a^{\frac{x}{y}} = \sqrt[y]{a^x}$	index is denominator	$x^{\frac{2}{5}} = \sqrt[5]{x^2}$ $\sqrt[3]{x^7} = x^{\frac{7}{3}}$

Warm Up: complete on your notes and type answer in personal chat

$\frac{x^2 \cdot b}{x^3 \cdot b^{-6}}$ 
 $\frac{(3x^2 \cdot b)^0}{x^3 \cdot b^{-6}}$ 
 $\frac{(-2 \cdot x^2 \cdot b)^2}{(4 \cdot x^3 \cdot b^{-6})^{-4}}$

$\frac{x^{2-3} b^{1-(-6)}}{1} = \frac{x^{-1} b^7}{1} = \frac{b^7}{x^1}$

$\frac{1}{x^3 b^{-6}} = \frac{1}{x^3 \cdot \frac{1}{b^6}} = \frac{b^6}{x^3}$

$\frac{(-2)^2 x^{2 \cdot 2} b^{1 \cdot 2}}{4^4 x^{3 \cdot 4} b^{-6 \cdot 4}} = \frac{4 x^4 b^2}{4^4 x^{12} b^{-24}} = \frac{4^1 x^4 b^2}{4^4 x^{12} b^{24}}$

$\frac{4^{1-4} x^{4-12} b^{2-24}}{1} = \frac{4^{-3} x^{-8} b^{-22}}{1} = \frac{1}{1024 x^8 b^{22}}$

$\frac{1024 x^{16}}{b^{22}}$

☆ write so exponents positive

Warm Up: complete on your notes and type answer in personal chat

$$\frac{x^2 \cdot b^1}{x^3 \cdot b^{-6}}$$

$$x^{2-3} \cdot b^{1-(-6)}$$

$$\frac{x^{-1} b^7}{1}$$

$$\frac{b^7}{x^1}$$

$$\frac{(3x^2 \cdot b)^0}{x^3 \cdot b^{-6}}$$

$$\frac{1}{x^3 \cdot b^{-6}}$$

$$\frac{x^0 \cdot b^0}{x^3 \cdot b^{-6}}$$

$$\frac{b^6}{x^3}$$

$$\frac{(-2 \cdot x^2 \cdot b)^2}{(4 \cdot x^3 \cdot b^{-6})^{-4}}$$

$$(-2x^2 \cdot b)^2 \cdot (4x^3 b^{-6})^4$$

$$(-2)^{1 \cdot 2} x^{2 \cdot 2} b^{1 \cdot 2} \cdot 4^{1 \cdot 4} x^{3 \cdot 4} b^{-6 \cdot 4}$$

$$4 \cdot x^4 b^2 \cdot 256 x^{12} b^{-24}$$

$$1024 x^{4+12} b^{2+(-24)}$$

$$\frac{1024 x^{16} b^{-22}}{1}$$

$$\frac{1024 x^{16}}{b^{22}}$$

$$\frac{x^2 \cdot b}{x^3 \cdot b^{-6}}$$

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

$$x^{-1} b^7$$

$$\frac{b^7}{x^1}$$

$$\frac{(3x^2 \cdot b)^0}{x^3 \cdot b^{-6}}$$

$$\frac{1}{x^3 b^{-6}}$$

$$\frac{b^6}{x^3}$$

$$\frac{(-2 \cdot x^2 \cdot b)^2}{(4 \cdot x^3 \cdot b^{-6})^{-4}}$$

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

$$4^{1 \cdot -4} x^{4 \cdot -12} b^{2 \cdot -24}$$

$$4^5 x^{16} b^{-22}$$

$$\frac{1024 x^{16}}{b^{22}}$$

$$\left( \frac{x^4 \cdot b^{-2}}{-3 \cdot x^5 \cdot y^{-1} \cdot b^{-7}} \right)^2$$

$$\frac{x^{4 \cdot 2} b^{-2 \cdot 2}}{(-3)^{1 \cdot 2} x^{5 \cdot 2} y^{-1 \cdot 2} b^{-7 \cdot 2}}$$

$$\frac{1}{9} x^{8-10} b^{-4-14} y^{0-2}$$

$$\frac{1}{9} x^{-2} b^{10} y^2$$

$$\frac{b^{10} y^2}{9x^2}$$

$$(5 \cdot x^2 \cdot b)^2 \cdot x^3 \cdot b^{-6}$$

$$5^{1 \cdot 2} x^{2 \cdot 2} b^{1 \cdot 2} x^3 b^{-6}$$

$$25 x^{4+3} b^{2+-6}$$

$$25 x^7 b^{-4}$$

$$\frac{25x^7}{b^4}$$

$$(3x^2 \cdot b)^2 \cdot (3x^3 \cdot b^{-6})^{-4}$$

$$3^{1 \cdot 2} x^{2 \cdot 2} b^{1 \cdot 2} \cdot 3^{-4} x^{-4 \cdot 3} b^{-6 \cdot -4}$$

$$3^2 x^4 b^2 \cdot 3^{-4} x^{-12} b^{24}$$

$$3^{2+-4} x^{4+-12} b^{2+24}$$

$$3^{-2} x^{-8} b^{26}$$

$$\frac{3^{-2} x^{-8} b^{26}}{9x^8}$$

$$\left( \frac{x^4 \cdot b^{-2}}{-3 \cdot x^5 \cdot y^{-1} \cdot b^{-7}} \right)^2$$

$$(5 \cdot x^2 \cdot b)^2 \cdot x^3 \cdot b^{-6}$$

$$(3x^2 \cdot b)^2 \cdot (3x^3 \cdot b^{-6})^{-4}$$

$$\frac{(3x^2 \cdot b)^2}{(3x^3 \cdot b^{-6})^4}$$

$$\frac{3^{1 \cdot 2} x^{2 \cdot 2} b^{1 \cdot 2}}{3^{1 \cdot 4} x^{3 \cdot 4} b^{-6 \cdot 4}}$$

$$3^{2-4} x^{4-12} b^{2--24}$$

$$3^{-2} x^{-8} b^{26}$$

$$\frac{b^{26}}{9x^8}$$

Day 1 HWK With Solutions

HWK 1

$$\frac{x^{-5} \cdot b^{-8}}{x^4 \cdot b} = \frac{1}{b^9 \cdot x^9}$$

HWK 2

$$\frac{(3x^2 \cdot b)^4}{x^5 \cdot b^6} = 625 \cdot b^{10} \cdot x^3$$

HWK 3

$$\frac{(3x^3 \cdot b)^0}{(4x^4 \cdot b^6)^2} = \frac{16 \cdot b^{12} \cdot x^8}{1}$$

$$4^{1-2} 4^{-2} 6^{-2} \rightarrow 4^{-2} \frac{-8}{x^8} \frac{1}{b^{12}}$$

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HWK 4

$$\left( \frac{x^5 \cdot b^{-3}}{2 \cdot x^3 \cdot y^{-2} \cdot b^6} \right)^3 = \frac{-6 \cdot y^6}{8 \cdot b^{27}}$$

HWK 5

$$(6 \cdot x^3 \cdot b)^3 \cdot x^{-4} \cdot b^5 = 216 \cdot b^8 \cdot x^5$$

HWK 6

$$\frac{(4x^3 \cdot b)^2 \cdot (2x^3 \cdot b^8)^2}{4x^{12}} = \frac{b^{14}}{4x^{12}}$$

$$\begin{array}{r} x^5 \cdot 3 \cdot b^{-3 \cdot 3} \\ \hline (-2)^3 \cdot x^3 \cdot y^{-2 \cdot 3} \cdot b^{6 \cdot 3} \\ -2 \cdot -2 \cdot -2 \\ \hline x^{15} \cdot b^{-9} \cdot y^0 \\ -8x^9 \cdot y^{-6} \cdot b^{18} \\ \hline 1 \cdot x^{15-9} \cdot b^{-9-18} \cdot y^0 = -6 \\ -8 \\ \hline x^6 \cdot b^{-27} \cdot y^6 \\ -8 \\ \hline x^6 \cdot y^6 \\ -8b^{27} \end{array}$$

$$\begin{array}{r} 4^{1-2} \quad 3 \cdot -2 \quad 1 \cdot -2 \quad 1 \cdot -2 \quad -3 \cdot 2 \quad 8 \cdot 2 \\ 4 \quad x \quad b \quad \cdot 2 \quad x \quad b \\ \hline \frac{1}{4^2} \quad \frac{-6+6}{1} \quad \frac{-2+16}{1} \quad \frac{2}{1} \\ \hline 4 \cdot x^{-12} \cdot b^{14} \\ \hline 4 \cdot \frac{1 \cdot b^{14}}{4x^{12}} \\ \hline \frac{b^{14}}{4x^{12}} \end{array}$$

Day 3

Example 1

$$\frac{(-1 \cdot x^2 \cdot b)^2}{(-3 \cdot x^3 \cdot b^{-6})^{-3}}$$

$$\frac{(-1x^2b)^{2 \cdot 2}}{(-3x^3b^{-6})^{-3 \cdot 2}}$$

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

$$\frac{1 \cdot (-3)^6 x^8 b^{-36}}{729 x^{26} b^{-32}}$$

$$\frac{729 \cdot x^{26}}{b^{32}}$$

Example 2

$$\frac{(2 \cdot x^2 \cdot b)^2}{(-3 \cdot x^3 \cdot b^{-6})^0}$$

$$\frac{(2x^2b)^{2 \cdot 2}}{1}$$

$$2^{2 \cdot 2} x^{4 \cdot 2} b^{2 \cdot 2}$$

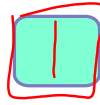
$$2^4 x^8 b^4$$

$$16x^8b^4$$

$$= 8 \cdot |b^3| \cdot x^6$$

Example 3

$$\frac{(4 \cdot x^2 \cdot b)^{-2}}{(8 \cdot x^3 \cdot b^{-6})^{10}}$$



When you simplify fractional powers if you get an odd exponent it needs absolute value bars to make sure it is positive!

Example 4

$$\frac{(10^1 x^2 \cdot b^1)}{(6^1 x^3 \cdot b^{-6})^{-2}} (4^1 x^{-2} b^1)^{\frac{1}{2}}$$

$$\frac{10^1 x^2 b^1}{6^{1 \cdot -2} x^{3 \cdot -2} b^{-6 \cdot -2}} \cdot \frac{4^{1 \cdot \frac{1}{2}} x^{-2 \cdot \frac{1}{2}} b^{1 \cdot \frac{1}{2}}}{1}$$

$$10 \cdot 6^2 \cdot \sqrt{4} \cdot x^{2 \cdot -1} b^{-1} \cdot \frac{2 \cdot x^{-1} b^{\frac{1}{2}}}{1}$$

$$10 \cdot 36 \cdot 2 \cdot x^{-2} b^{-1} \cdot 2 \cdot x^{-1} b^{\frac{1}{2}}$$

$$720 |x^7| b^{-2\frac{1}{2}}$$

$$\frac{720 \cdot |x^7|}{b^2}$$

Example 5

$$\left(\frac{x}{(2x^3 \cdot b^{-6})^{-4}}\right)^{\frac{5}{2}} \cdot (3x^2 \cdot b)^2$$

$$\frac{x^{5/2}}{(2x^3 \cdot b^{-6})^{-4 \cdot \frac{5}{2}}} \cdot \frac{3^{1 \cdot 2} x^{2 \cdot 2} b^{1 \cdot 2}}{1}$$

$$\frac{3^2 x^{5/2} \cdot x^4 \cdot b^2}{2^{1 \cdot -10} x^{3 \cdot -10} b^{-6 \cdot -10}}$$

$$\frac{9 \cdot 2^{10} \cdot x^{5/2+4} \cdot b^{2-60}}{1}$$

$$9 \cdot 2^{10} \cdot x^{36\frac{1}{2}} \cdot b^{-58}$$

$$\frac{9216 \cdot x^{36\sqrt{x}}}{b^{58}}$$

$$\frac{9216 \cdot x^{30} \cdot \sqrt{x^{13}}}{b^{58}}$$

Example 6

negative exponents mean flipped fractions

$$\left(\frac{(x^8 \cdot b)^{-2}}{(3 \cdot x^5 \cdot b^{-7})^4}\right)^{\frac{-1}{2}} \cdot \left(\frac{3 \cdot x}{(2 \cdot x^4 \cdot b^{-7})^{-5}}\right)^{-2} \cdot (x^6 \cdot b)^3$$

$$\left(\frac{x^{8 \cdot -2} b^{1 \cdot -2}}{3^{4 \cdot 4} x^{5 \cdot 4} b^{-7 \cdot 4}}\right)^{-\frac{1}{2}} \cdot \left(\frac{2^{-5} x^{-20} b^{35}}{3x}\right)^{-2} \cdot x^{6 \cdot 3} b^{1 \cdot 3}$$

$$\frac{x^{-16 \cdot -\frac{1}{2}} b^{-2 \cdot -\frac{1}{2}}}{3^{16} x^{20 \cdot -\frac{1}{2}} b^{-28 \cdot -\frac{1}{2}}} \cdot \frac{2^{-5 \cdot -2} x^{-20 \cdot -2} b^{35 \cdot -2}}{3^{1 \cdot 2} x^{1 \cdot 2}} \cdot \frac{x^{18} b^3}{1}$$

$$\frac{x^8 b^1}{3^{-2} x^{-10} b^{14}} \cdot \frac{2^{-10} x^{-40} b^{70}}{3^2 x^2} \cdot \frac{x^{18} b^3}{1}$$

$$\frac{3^2 x^{8 - (-10)} b^{1 - 14}}{3^2 \cdot 2^{10}} \cdot \frac{x^{-40 - 2 + 18} b^{70 + 3}}{1}$$

$$\frac{9 x^{18} b^{-13}}{9 \cdot 1024} \cdot \frac{x^{-24} b^{73}}{1}$$

$$\frac{9}{9 \cdot 1024} \cdot \frac{x^{18 + (-24)} b^{-13 + 73}}{1}$$

$$\frac{x^{-6} b^{60}}{1024 x^6}$$

can you believe that crazy thing simplified to this!

HWK 1

$$\left(\frac{(-2 \cdot x^2 \cdot b)^5}{(-4 \cdot x^{-4} \cdot b^{-2})^{-1}}\right)^3 = 2097152 \cdot b^9 \cdot x^{18}$$

HWK 2

$$\left(\frac{(3 \cdot x^2 \cdot b)^0}{(-2 \cdot x^4 \cdot b^{-7})^6}\right)^{\frac{-2}{3}} = \frac{16 \cdot x^{16}}{b^{28}}$$

HWK 3

$$\left(\frac{(3 \cdot x^2 \cdot b)^{-4}}{(-5 \cdot x^2 \cdot b^{-5})^0}\right)^2 = \frac{1}{6561 \cdot b^8 \cdot x^{16}}$$

HWK 4 (this problem is tough because coefficient)

$$\frac{6 \cdot x^2 \cdot b}{(4 \cdot x^{-3} \cdot b^5)^{-3}} \cdot (3 \cdot x^{-4} \cdot b)^2 = \frac{1152 \cdot b^2 \cdot \sqrt{3}}{x^{13}}$$

HWK 5

$$\left(\frac{x^{20}}{(3 \cdot x \cdot b^{-5})^{-5}}\right)^{\frac{2}{5}} \cdot (4 \cdot x^{-2} \cdot b)^{-3} = \frac{9 \cdot x^{16}}{64 \cdot b^{13}}$$

HWK 6

$$\left(\frac{(x^9 \cdot b)^{-6}}{(8 \cdot x^6 \cdot b^{-6})^3}\right)^{\frac{-1}{3}} \cdot \left(\frac{5 \cdot x}{(3 \cdot x^3 \cdot b^{-6})^{-4}}\right)^{-3} \cdot (x^7 \cdot b)^{-2} = \frac{8 \cdot b^{66}}{66430125 \cdot x^{29}}$$