Basics of exponents

$6^3 = 6 \cdot 6 \cdot 6 = 216$

multiply 3 versions of itself.

$3^4 = 3 \cdot 3 \cdot 3 \cdot 3 = 81$

$(-4)^6 = (-4)\cdot(-4)\cdot(-4)\cdot(-4)\cdot(-4)\cdot(-4) = 4096$

$-4^6 = -1 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 = -4096$

$(-4)^6 \neq -4^6$

$(-3)^2 = 9$

$-3^2 = -9$

$(-3)^3 = -27$

$-3^3 = -27$

Even powers of negative numbers are always positive

Odd powers of negative numbers are always negative

negative * negative = positive
÷ also

negative * positive = negative

$(-3)^2 = (-3)(-3) = 9$

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

$= (+9)(-3) = -27$

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

$= 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = 3^6$

$\rightarrow (3^2)^3 = 3^{2 \cdot 3} = 3^6$

Power of a power $(x^m)^n = x^{mn}$

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

$4^2 \cdot 4^3 = 4^{2+3} = 4^5$

Multiplication Property $x^m \cdot x^n = x^{m+n}$

$$\frac{a^7}{a^3} = \frac{aaaaaaa}{aaa} = a^4$$

Division Property: $\frac{a^m}{a^n} = a^{m-n}$

$x^3 = x \cdot x \cdot x$

$x^2 = x \cdot x = \frac{xx\cancel{x}}{\cancel{x}}$

$x = x = \frac{x\cancel{x}}{\cancel{x}}$

if power is invisible, assume it is to the 1st power...

$x^0 = 1 = \frac{\cancel{x}}{\cancel{x}}$

anything to zero power is always 1

(as long as $x \neq 0$)

$x^{-1} = \frac{1}{x^1}$

$$x^{-2} = \frac{1}{x} \div x = \frac{1}{x} * \frac{1}{x} = \frac{1}{x^2}$$

Keep Change flip

$$x^{-3} = \frac{1}{x^2} \div x = \frac{1}{x^2} \cdot \frac{1}{x} = \frac{1}{x^3}$$

$$x^{-n} = \frac{1}{x^n}$$ Negative exponent rule

Go back

$(-4)^6 = (-1 \cdot 4)^6 =$ $= 4096$ ✓

$(-1)^6 \quad (4)^6$

$(1)(4096) = 4096$ ✓

$(-4)^6 = (-2 \cdot 2)^6$

$= (-2)^6 (2)^6 =$

$= (64)(64) = 4096$ ✓

$$(x \cdot y)^m = x^m \cdot y^m$$

Power of Product

$$\left(\frac{x}{y}\right)^4 = \left(\frac{x}{y}\right)\left(\frac{x}{y}\right)\left(\frac{x}{y}\right)\left(\frac{x}{y}\right) = \frac{x^4}{y^4}$$

Power of Quotient $\left(\frac{x}{y}\right)^m = \frac{x^m}{y^m}$

a.) $(m^1 m^2)^3 (2m^{-7} n^6)^5$

$= m^3 m^6 \left(\frac{2n^6}{m^7}\right)^5$

$(m^3)^3 = m^9$

$= m^9 \cdot \left(\frac{2^{1\cdot 5} n^{6\cdot 5}}{m^{7\cdot 5}}\right)$

$2m^{-7} \neq \frac{1}{2m^7}$

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

$= m^9 \left(\frac{32 n^{30}}{m^{35}}\right)$

$= \frac{32 m^9 n^{30}}{m^{35}}$

$= \frac{32 n^{30}}{m^{26}}$

* $\frac{m^9}{m^{35}} = m^{9-35} = m^{-26}$

$= \frac{1}{m^{35-9}} = \frac{1}{m^{26}}$

$\frac{x^n}{x^d} = $ if $n > d$ then x^{n-d}

$=$ if $n < d$ $\frac{1}{x^{d-n}}$

$(mm^2)^3 (2m^{-7}n^6)^5 =$

$= (m^3)^3 \cdot 2^5 \; m^{-7.5} \; n^{6.5}$

product power of product

$= m^9 \; 32 \; m^{-35} \; n^{30}$

$= 32 \; m^{-35+9} \; n^{30}$

$= 32 \; m^{-26} \; n^{30}$

$= \dfrac{32 n^{30}}{m^{26}}$

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d.) $\left(\dfrac{-6a^{-4}b^{6}}{a^{-2}b^{-5}c}\right)^{-3}$

$6-(-5)$
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$= \left(-6a^{(-4)-(-2)} \; b^{(6)-(-5)} \; c^{-1}\right)^{-3}$

simplify quotient rule, negative exponent

$= \left((-6)^1 a^{-2} b^{11} c^{-1}\right)^{-3}$

$= (-6)^{1 \cdot -3} \; a^{-2 \cdot -3} \; b^{11 \cdot -3} \; c^{-1 \cdot -3}$

$= (-6)^{-3} \; a^{6} \; b^{-33} \; c^{3}$

$$= \frac{a^6 c^3}{(-6)^3 b^{33}}$$

$$= \frac{a^6 c^3}{-216 b^{33}} = -\frac{a^6 c^3}{216 b^{33}}$$