PRODUCT OF POWERS

$(2x^4y)(3x^2y^5)(4x^3y)(5x^2y^4)(2x^7y)(3x^2y^4)(5x^6y)(6x^3y^5)$

① ② ③ ④

$(6x^6y^6)(20x^5y^5)(6x^{14}y^5)(30x^{19}y^6)$

$6 \cdot 20 \cdot 6 \cdot 30 \; x^6 x^5 x^{14} x^{19} y^6 y^5 y^5 y^6$

$216000 \; x^{6+5+14+19} \; y^{6+5+5+6}$

$\boxed{21600 \; x^{44} y^{22}}$

$$(5x^6y)(6x^{13}y^5)$$

$5 \cdot 6 \cdot x^6 x^{13} y y^5 =$

$5 \cdot 6 \cdot x^6 x^{13} y^1 y^5 =$

$30 x^{6+13} y^{1+5} =$

$$\boxed{30x^{19}y^6}$$

$$(2x^7y)(3x^7y^4)$$

$$2 \cdot 3 \cdot x^7 x^7 y y^4$$

$$2 \cdot 3 x^7 x^7 y^1 y^4 = 6 \cdot x^{7+7} y^{1+4}$$

$$= \boxed{6x^{14}y^5}$$

$$(2x^4y)(3x^2y^5)$$

$$2 \cdot 3 x^4 x^2 y y^5$$

$$2 \cdot 3 x^4 x^2 y^1 y^5 = 6 \cdot x^{4+2} y^{1+5}$$

$$= \boxed{6x^6y^6}$$

$$(4x^3y)(5x^2y^4)$$

$$4 \cdot 5\, x^3 x^2 y\, y^4 = 4 \cdot 5\, x^3 x^2 y^1 y^4$$

$$20 \cdot x^{3+2}\, y^{1+4} = \boxed{20\, x^5 y^5}$$

POWER OF POWERS

$$\underbrace{(2x^3y)^4}_{①}\ \underbrace{(3x^5y)^3}_{②}\ \underbrace{(2x^6y)^4}_{③}\ \underbrace{(5x^3y)^2}_{④}$$

$$(2^1x^3y^1)^4\ (3^1x^5y^1)^3\ (2^1x^6y^1)^4\ (5^1x^3y^1)^2$$

$$(2^4x^{12}y^4)(3^3x^{15}y^3)(2^4x^{24}y^4)(5^2x^6y^2)$$

$$2^4\cdot3^3\cdot2^4\cdot5^2\ x^{12}x^{15}x^{24}x^6\ y^4y^3y^4y^2$$

$$2^{4+4}\cdot3^3\cdot5^2\ x^{12+15+24+6}\ y^{4+3+4+2}$$

$$2^8\cdot3^3\cdot5^2\ x^{57}\ y^{13} = 17280x^{57}y^{13}$$

$$(5x^3y)^2$$

$$(5^1x^3y^1)^2 =$$

$$5^{1\cdot 2}\ x^{3\cdot 2}\ y^{1\cdot 2} =$$

$$\boxed{5^2x^6y^2} = \boxed{25x^6y^2}$$

$$(2x^6y)^4$$

$$(2^1x^6y^1)^4$$

$$2^{1\cdot 4}x^{6\cdot 4}y^{1\cdot 4}$$

$$\boxed{2^4x^{24}y^4} = \boxed{16x^{24}y^4}$$

$$(3x^5y)^3$$

$$(3^1x^5y^1)^3 =$$

$$3^{1\cdot3}x^{5\cdot3}y^{1\cdot3} =$$

$$\boxed{3^3x^{15}y^3} = \boxed{27x^{15}y^3}$$

$$(2x^3y)^4$$

$$(2^1x^3y^1)^4 =$$

$$2^{1\cdot4}\ x^{3\cdot4}\ y^{1\cdot4} =$$

$$\boxed{2^4\ x^{12}\ y^4} = \boxed{16x^{12}y^4}$$

POWER OF A QUOTIENT & NEGATIVE EXPONENTS

$$\left(\frac{2x^{-5}y}{3x}\right)^{-2} = \left(\frac{2^1 x^{-5} y^1}{3^1 x^1}\right)^{-2}$$

$$= \frac{2^{-2} x^{10} y^{-2}}{3^{-2} x^{-2}} = \frac{2^{-2}}{3^{-2}} \frac{x^{10}}{x^{-2}} \frac{y^{-2}}{1}$$

$$= \frac{2^{-2}}{3^{-2}} \frac{x^{10}}{x^{-2}} \frac{y^{-2}}{1} = \frac{3^2}{2^2} \cdot \frac{x^{10} x^2}{1} \cdot \frac{1}{y^2}$$

wrong place

$$= \frac{9}{4} \cdot \frac{x^{10+2}}{1} \cdot \frac{1}{y^2} = \boxed{\frac{9x^{12}}{4y^2}}$$

$$\left(\frac{3x^3y}{2x^{-5}}\right)^3 = \left(\frac{3^1x^3y^1}{2^1x^{-5}}\right)^3 = \frac{3^3x^9y^3}{2^3x^{-15}}$$

$$\frac{3^3x^9y^3}{2^3x^{-15}} = \frac{27x^9x^{15}y^3}{8} = \frac{27x^{9+15}y^3}{8}$$

wrong place

$$= \boxed{\frac{27x^{24}y^3}{8}}$$

$$\left(\frac{2x^4y}{3x^{-3}}\right)^3 = \left(\frac{2^1x^4y^1}{3^1x^{-3}}\right)^3 = \frac{2^3x^{12}y^3}{3^3x^{-9}}$$

$$\frac{2^3x^{12}y^3}{3^3\left(x^{-9}\right)} = \frac{8}{27}\frac{x^{12}x^9}{1}\frac{y^3}{1} = \frac{8x^{12+9}y^3}{27}$$

wrong place

$$= \boxed{\frac{8x^{21}y^3}{27}}$$

$$\left(\frac{3x^5y}{2x^{-4}}\right)^{-3} = \left(\frac{3^1x^5y^1}{2^1x^{-4}}\right)^{-3} = \frac{3^{-3}x^{-15}y^{-3}}{2^{-3}x^{12}}$$

$$\frac{3^{-3}\ x^{-15}\ y^{-3}}{2^{-3}\ x^{12}} = \frac{2^3}{3^3x^{12}x^{15}y^3}$$

wrong place

$$= \frac{8}{27x^{12+15}y^3} = \boxed{\frac{8}{27x^{27}y^3}}$$

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

① ② ③ ④

$$= \left(\frac{9x^{12}}{4y^2}\right)\left(\frac{27x^{24}y^3}{8}\right)\left(\frac{8x^{21}y^3}{27}\right)\cdot\left(\frac{8}{27x^{27}y^3}\right)$$

$$= \frac{9\cdot 27\cdot 8\cdot 8}{4\cdot 8\cdot 27\cdot 27}\cdot\frac{x^{12}x^{24}x^{21}}{x^{27}}\cdot\frac{y^3y^3}{y^2y^3}$$

$$= \frac{15552}{23328}\cdot\frac{x^{12+24+21}}{x^{27}}\cdot\frac{y^{3+3}}{y^{2+3}} = \frac{15552}{23328}\cdot\frac{x^{57}}{x^{27}}\cdot\frac{y^6}{y^5}$$

$$= \frac{2}{3}\,\frac{x^{57-27}}{1}\cdot\frac{y^{6-5}}{1} = \frac{2}{3}\cdot\frac{x^{30}}{1}\cdot\frac{y^1}{1} = \boxed{\frac{2x^{30}y}{3}}$$

↑ by calculator

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

$$\frac{2^{-2}x^{10}y^{-2}}{3^{-2}x^{-2}} \cdot \frac{3^{3}x^{9}y^{3}}{2^{3}x^{-15}} \cdot \frac{3^{-3}x^{-15}y^{-3}}{2^{-3}x^{12}} \cdot \frac{2^{3}x^{12}y^{3}}{3^{3}x^{-9}}$$

$$\frac{2^{-2}2^{3}}{2^{3}\cdot 2^{-3}} \quad \frac{3^{3}\cdot 3^{-3}}{3^{-2}3^{3}} \cdot \frac{x^{10}x^{9}x^{-15}x^{12}}{x^{-2}x^{-15}x^{12}x^{-9}} \cdot \frac{y^{-2}y^{3}y^{-3}y^{3}}{1}$$

$$\frac{2^{-2+3}}{2^{3-3}} \cdot \frac{3^{3-3}}{3^{-2+3}} \cdot \frac{x^{10+9-15+12}}{x^{-2-15+12-9}} \cdot \frac{y^{-2+3-3+3}}{1}$$

$$\frac{2^{1}}{2^{0}} \cdot \frac{3^{0}}{3^{1}} \cdot \frac{x^{31-15}}{x^{-26+12}} \cdot \frac{y^{-5+6}}{1} = \frac{2}{1} \cdot \frac{1}{3} \cdot \frac{x^{16}}{x^{-14}} \cdot \frac{y^{1}}{1} = \frac{2}{3}\frac{x^{16+14}\cdot y^{1}}{1}$$

$$= \boxed{\frac{2}{3}x^{30}y^{1}}$$

NEGATIVE EXPONENTS LAWS

$$\underbrace{(x^{-2}y)^{-3}}_{①}\underbrace{(x^{2}y)^{-4}}_{②}\underbrace{(x^{-5}y)^{2}}_{③}\underbrace{(x^{8}y)^{-4}}_{④}$$

$$= (x^{6}y^{-3})(x^{-8}y^{-4})(x^{-10}y^{2})(x^{-32}y^{-4})$$

$$= \frac{x^{6}}{y^{3}} \cdot \frac{1}{x^{8}y^{4}} \cdot \frac{y^{2}}{x^{10}} \cdot \frac{1}{x^{32}y^{4}}$$

$$= \frac{x^{6}}{x^{8}x^{10}x^{32}} \cdot \frac{y^{2}}{y^{3}y^{4}y^{4}} = \frac{x^{6}}{x^{50}} \frac{y^{2}}{y^{11}}$$

$$= x^{6-50}\, y^{2-11} = x^{-44}\, y^{-9} = \boxed{\frac{1}{x^{44}y^{9}}}$$

$$\frac{(x^{-2}y)^{-3}}{①}\quad\frac{(x^{2}y)^{-4}}{②}\quad\frac{(x^{-5}y)^{2}}{③}\quad\frac{(x^{8}y)^{-4}}{④}$$

$$= (x^{6}y^{-3})\,(x^{-8}y^{-4})\,(x^{-10}y^{2})\,(x^{-32}y^{-4})$$

$$= \frac{x^{6}x^{-8}x^{-10}x^{-32}}{}\cdot\frac{y^{-3}y^{-4}y^{2}y^{-4}}{}$$

$$= \frac{x^{6}}{x^{8}x^{10}x^{32}}\cdot\frac{y^{2}}{y^{3}y^{4}y^{4}} = \frac{x^{6}y^{2}}{x^{50}y^{11}}$$

$$= x^{6-50}y^{2-11} = x^{-44}y^{-9} = \boxed{\frac{1}{x^{44}y^{9}}}$$

$$\underbrace{(x^{-2}y)^{-3}}_{(1)} \quad \underbrace{(x^{2}y)^{-4}}_{(2)} \quad \underbrace{(x^{-5}y)^{2}}_{(3)} \quad \underbrace{(x^{3}y)^{-4}}_{(4)}$$

$$(x^{6}y^{-3})(x^{-8}y^{-4})(x^{-10}y^{2})(x^{-32}y^{-4})$$

$$x^{6}\,x^{-8}\,x^{-10}\,x^{-32}\,y^{-3}\,y^{-4}\,y^{2}\,y^{-4}$$

$$x^{6-8-10-32}\,y^{-3-4+2-4} = x^{6-50}\,y^{-11+2}$$

$$= x^{-44}\,y^{-9} = \frac{1}{x^{44}}\cdot\frac{1}{y^{9}} = \boxed{\frac{1}{x^{44}y^{9}}}$$

$(x^8 y)^{-4}$ DEAL W/ NEGATIVE FIRST METHOD

$(x^8 y^1)^{-4} = \boxed{(x^8 y^1)^{-4}}$ w.o-y place

$= \dfrac{1}{(x^8 y^1)^4}$

$= \dfrac{1}{x^{8(4)} y^{1(4)}} = \boxed{\dfrac{1}{x^{32} y^4}}$

$$\left(x^{8}y\right)^{-4}$$

KEEP NEGATIVES UNTIL THE END

$$\left(x^{8}y^{1}\right)^{-4} = x^{8(-4)} \cdot y^{1(-4)} = x^{-32}y^{-4}$$

$$= x^{-32}\,y^{-4} = \frac{1}{x^{32}} \cdot \frac{1}{y^{4}}$$

wrong place

$$= \boxed{\frac{1}{x^{32}y^{4}}}$$

$$\left(x^{-5}\,y\right)^2$$

DEAL W/ NEGATIVE FIRST METHOD

$$\left(x^{-5}\,y^1\right)^2 = \left(\frac{1}{x^5}\cdot\frac{y^1}{1}\right)^2 = \left(\frac{y^1}{x^5}\right)^2$$

$$= \frac{y^{1(2)}}{x^{5(2)}} = \boxed{\frac{y^2}{x^{10}}}$$

$$\left(x^{-5}y\right)^2$$

keep negatives until the end

$$(x^{-5}y^1)^2 = x^{-5(2)}y^{1(2)}$$

$$= x^{-10}y^2 = x^{-10}y^2$$

wrong place

$$= \frac{1}{x^{10}} \cdot \frac{y^2}{1} = \boxed{\frac{y^2}{x^{10}}}$$

$(x^{-2}y)^{-3}$ keep negative until end <u>way</u>

$(x^{-2}y^{1})^{-3} = x^{-2\cdot(-3)}\ y^{1\cdot(-3)}$

$= x^{6}y^{-3} = x^{6}y^{-3}$

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

$= \boxed{\frac{x^6}{y3}}$

y^{-3} ← wrong place

↙

$$\left(x^{-2}y\right)^{-3}$$

DEAL W/ NEGATIVE FIRST METHOD

$$\left(x^{-2}y\right)^{-3} = \boxed{\left(x^{-2}y\right)^{-3}}$$ — wrong place

wrong place

$$= \frac{1}{\left(x^{-2}y\right)^{3}} = \frac{1}{x^{-2(3)}y^{1(3)}} = \frac{1}{x^{-6}y^{3}}$$

$$= \frac{1}{x^{-6}y^{3}} = \boxed{\frac{x^{6}}{y^{3}}}$$

wrong place

$(x^{-2}y)^{-3}$ inside out method

$(x^{-2}y^1)^{-3} = \left(\frac{1}{x^2} \cdot \frac{y^1}{1}\right)^{-3}$

$= \left(\frac{y^1}{x^2}\right)^{-3}$

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

$= \frac{y^{-3}}{x^{-6}}$ → wrong place / wrong p

$= \boxed{\frac{x^6}{y^3}}$

$$\left(x^2 y\right)^{-4}$$

DEAL W/ NEGATIVE FIRST METHOD

$$\left(x^2 y^1\right)^{-4} = \boxed{\left(x^2 y^1\right)^{-4}} \rightarrow \text{wrong place}$$

$$= \frac{1}{\left(x^2 y^1\right)^4}$$

$$= \frac{1}{x^{2(4)} y^{1(4)}} = \boxed{\frac{1}{x^8 y^4}}$$

$$(x^2 y)^{-4}$$ keep negatives until end way

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

$$= x^{-8} y^{-4} =$$

x^{-8} y^{-4} wrong place

$$= \frac{1}{x^8} \cdot \frac{1}{y^4}$$

$$= \boxed{\frac{1}{x^8 y^4}}$$