

Multiplying rule: Add the exponents

1.  $a^6 \cdot a^7 = a^{13}$

2.  $x^2 \cdot x^4 = x^6$

3.  $2b^3 \cdot 3b^4 = 6b^7$

4.  $5x^4 \cdot 3x = 15x^5$

5.  $a^2b^5 \cdot 3a^4b^7 = 3a^6b^{12}$

6.  $2^9 \cdot 2^4 = 2^{13}$

Power rule: Multiply the exponents

7.  $(a^5)^6 = a^{30}$

8.  $(a^3b^5)^1 = a^3b^5$

9.  $(x^2y^4z^4)^3 = x^6y^{12}z^{12}$

10.  $(2^5)^6 = 2^{30}$

11.  $(2xy^2)^3 = 8x^3y^6$

12.  $(3a^4b^5)^2 = 9a^8b^{10}$

Division: Subtract the exponents

13.  $\frac{a^6}{a^3} = a^3$

14.  $\frac{x^{18}}{x^9} = x^9$

15.  $\frac{a^4}{a^9} = \frac{1}{a^5}$

16.  $\frac{a^3b^4}{ab^3} = a^2b$

17.  $\frac{x^2y^5}{x^7y^2} = \frac{y^3}{x^5}$

18.  $\frac{24a^3b^6c^7}{30a^2b^7c^5} = \frac{4ac^2}{5b}$

When types are mixed always do the power rule first!

19.  $(a^3b^2)^3 (a^5b)^2 = a^{19}b^8$   
 $(a^9b^6)(a^{10}b^2)$

20.  $(2x^3y^5)(x^4y^6)^3 = 2x^{15}y^{23}$   
 $2x^3y^5 x^{12}y^{18}$

21.  $\frac{(2x^3y^2)^2}{6xy^3} = \frac{4x^6y^4}{6xy^3} = \frac{2x^5y}{3}$

22.  $\frac{4x^{12}y^4}{(2x^2y^4)^3} = \frac{4x^{12}y^4}{8x^6y^{12}} = \frac{1x^6}{2y^8}$

23.  $\frac{(x^4y^6)(2x^2y^3)^2}{(4xy^2)^2(x^3y^3)^2} = \frac{4x^8y^{12}}{16x^8y^{10}} = \frac{4x^8y^{12}}{16x^8y^{10}} = \frac{4x^8y^2}{16x^8y^{10}} = \frac{y^2}{4}$

24.  $(2a^3b)^4 (ab^8)^2 (3a^2b^3)^3 = 16a^{20}b^4 a^2b^{16} 27a^6b^9$   
 $(16)(27)a^{28}b^{29}$

25.  $\frac{2^{10} \cdot 2^6}{2 \cdot 2^5} = \frac{2^{16}}{2^6} = 2^{10} = 1024$

$432a^{28}b^{29}$

# Negative Exponents

Name: Master

Simplify: Always have final answers with "positive" exponents.

1.  $5^{-1} = \frac{1}{5}$

3.  $4^{-3} = \frac{1}{64}$

5.  $(5x)^{-2} = \frac{1}{25x^2}$

7.  $7^{-4} \cdot 7^3 = 7^{-1} = \frac{1}{7}$

9.  $2n^{-3} = \frac{2}{n^3}$

11.  $x^{-1}y^2 = \frac{y^2}{x}$

13.  $(4^{-1})^{-3} = 4^3 = 64$

15.  $\frac{6^{-2}}{6^{-3}} = \frac{6^3}{6^2} = 6$

17.  $\left(\frac{4}{5}\right)^{-2} = \frac{5^2}{4^2} = \frac{25}{16}$

19.  $x^{-3} \cdot x^8 = x^{-11} = \frac{1}{x^{11}}$

21.  $(2 \cdot 3)^{-3} = 6^{-3} = \frac{1}{216}$

23.  $2x^3 \cdot x^{-5} = 2x^{-2} = \frac{2}{x^2}$

25.  $(a^2 \cdot a^{-5})^2 = (a^{-3})^2 = \frac{1}{a^6}$

27.  $\left(\frac{a^{-6}}{a^{-2}}\right)^{-1} = \frac{a^6}{a^2} = a^4$

29.  $\left(\frac{b^{-3}}{b^{-6}}\right)^4 = \frac{b^{-12}}{b^{-24}} = b^{12}$

31.  $\left(\frac{1}{2} \cdot \frac{1}{4}\right)^{-1} = \left(\frac{1}{8}\right)^{-1} = 8$

33.  $\frac{18x^{-2}y^5}{3x^{-2}y^4} = 6y$

2.  $3^{-2} = \frac{1}{9}$

4.  $2^{-2} = \frac{1}{4}$

6.  $5x^{-2} = \frac{5}{x^2}$

8.  $3^6 \cdot 3^{-8} = 3^{-2} = \frac{1}{9}$

10.  $(2n)^{-3} = \frac{1}{8n^3}$

12.  $a^{-2}b^0c^3 = \frac{c^3}{a^2}$

14.  $(2^{-3})^{-2} = 2^6 = 64$

16.  $\frac{d^{-3}}{d^{-5}} = \frac{d^5}{d^3} = d^2$

18.  $\left(\frac{3}{2}\right)^{-3} = \frac{2^3}{3^3} = \frac{8}{27}$

20.  $m^4 \cdot m^{-11} = m^{-7} = \frac{1}{m^7}$

22.  $2 \cdot 3^{-3} = \frac{2}{27}$

24.  $3x^2 \cdot (3x^2)^{-1} = \frac{3}{3x^2} = \frac{1}{x^2}$

26.  $(b^5 \cdot b^{-7})^3 = (b^{-2})^3 = \frac{1}{b^6}$

28.  $\left(\frac{n^{-3}}{n}\right)^{-2} = \frac{n^6}{n^{-2}} = n^8$

30.  $\left(\frac{y^5}{y^{-2}}\right)^{-3} = \frac{y^{-15}}{y^6} = \frac{1}{y^{21}}$

32.  $(3^{-1} + 4^{-1})^{-2} = \left(\frac{1}{3} + \frac{1}{4}\right)^{-2} = \left(\frac{4}{12} + \frac{3}{12}\right)^{-2} = \left(\frac{7}{12}\right)^{-2} = \frac{144}{49}$

34.  $\frac{a^{-2}b^3c^0}{3a^4b^{-3}c^{-5}} = \frac{b^6c^5}{3a^6}$

For the next two, remember to do the power rule first.

35.  $\frac{(2y)(3y^2z^4)^2}{(yz^{-2})^{-3}(y^2z^{-3})}$

$2y(9y^4z^8) = 18y^5z^8$   
 $\frac{18y^5z^8}{(y^{-3}z^6)(y^2z^{-3})} = \frac{18y^5z^8}{y^{-1}z^3} = 18y^6z^5$

36.  $\frac{5x^2y(4xy^3)^2}{(2x^4y^2)^3} = \frac{5x^2y(16x^2y^6)}{8x^{12}y^6}$

$= \frac{10x^4y^7}{x^{12}y^6} = \frac{10y}{x^8}$