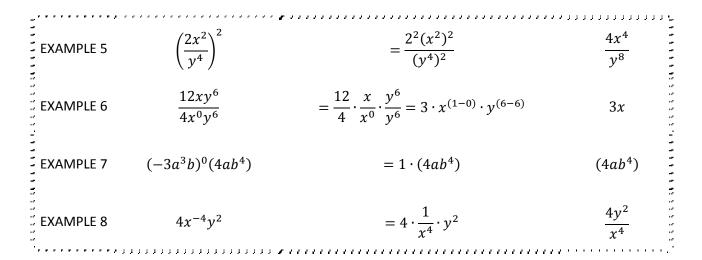# CHAPTER 5: Exponents

There are seven basic rules of exponents. If you understand how to apply each of these rules, then you'll have no problem handling the problems that involve exponents on the Math Competency Exam. The names of these rules are the way I remember them. They are not always named this way in textbooks. So you might not remember (or never taught) using these names.

Product Rule:	$x^m x^n = x^{(m+n)}$	$x^5 x^2 = x^{(5+2)} = x^7$
Quotient Rule:	$\frac{x^m}{x^n} = x^{(m-n)}$	$\frac{x^{10}}{x^4} = x^{(10-4)} = x^6$
Power Rule:	$(x^m)^n = x^{(mn)}$	$(x^5)^3 = x^{(5 \cdot 3)} = x^{15}$
Power of Product Rule:	$(xy)^k = x^k y^k$	$(xy)^5 = x^5 y^5$
Power of Quotient Rule:	$\left(\frac{x}{y}\right)^m = \frac{x^m}{y^m}$	$\left(\frac{x}{y}\right)^4 = \frac{x^4}{y^4}$
Zero Exponent:	$x^0 = 1 \; where \; x \neq 0$	$5^0 = 1$
Negative Exponent:	$x^{-k} = \frac{1}{x^k}$	$x^{-2} = \frac{1}{x^2}$

NOTE: The Product Rule and Quotient Rules require that you have the same "base". In both examples, "x" is the base. When working out more difficult problems involving exponents, break the problem down to simpler problems. Then apply the rules of exponents.

EXAMPLE 1 $(2y^3)(3y^7)$ $= (2)(3)(y^{3+7})$ $6y^{10}$

EXAMPLE 2 $(-3ab^2c^5)(-5a^2b^3c)$ $= (-3)(-5)(a^{1+2})(b^{2+3})(c^{5+1})$ $15a^3b^5c^6$

EXAMPLE 3 $\frac{10x^3y^6}{4x^2y}$ $= \frac{10}{4} \cdot \frac{x^3}{x^2} \cdot \frac{y^6}{y} = \frac{5}{2} \cdot (x^{3-2})(y^{6-1})$ $\frac{5xy^5}{2}$

EXAMPLE 4 $(2^3)^2$ $= 2^6 = 2 \times 2 \times 2 \times 2 \times 2 \times 2$ 64

EXAMPLE 5	$\left(\dfrac{2x^2}{y^4}\right)^2$	$=\dfrac{2^2(x^2)^2}{(y^4)^2}$	$\dfrac{4x^4}{y^8}$
EXAMPLE 6	$\dfrac{12xy^6}{4x^0y^6}$	$=\dfrac{12}{4}\cdot\dfrac{x}{x^0}\cdot\dfrac{y^6}{y^6}=3\cdot x^{(1-0)}\cdot y^{(6-6)}$	$3x$
EXAMPLE 7	$(-3a^3b)^0(4ab^4)$	$=1\cdot(4ab^4)$	$(4ab^4)$
EXAMPLE 8	$4x^{-4}y^2$	$=4\cdot\dfrac{1}{x^4}\cdot y^2$	$\dfrac{4y^2}{x^4}$

TRY THESE – Properties of Exponents

1. $\qquad(3xy^5z^2)(2x^0y^{-3}z)$

2. $\qquad\dfrac{30a^5b^2}{24a^4b^2}$

3. $\qquad\left(\dfrac{4x^5}{y^2}\right)^2$

4. $\qquad(2x^3y^5z)^3$

5. $\qquad\dfrac{4a^4b^7}{6a^5b^6}$

6. $\qquad(2q^4r^2s^7)(-2q^{-3}r^4s^3)$

7. $\qquad(-3x^3)^2(2x^{-1})$

8. $\qquad\left(\dfrac{3x^{11}y^4}{5z^2}\right)^2$

9. $\qquad\dfrac{2x^3y^2z^9}{6x^3y^3}$