Imperial Valley College
Math Lab

FACT SHEET: LAWS OF EXPONENTS

For any nonzero *a* and *b*, and any rational numbers *m* and *n*:

1) $a^0 = 1$

2) $a^1 = a$

3) $a^m \cdot a^n = a^{m+n}$

4) $\dfrac{a^m}{a^n} = a^{m-n}$

5) $(a^m)^n = a^{mn}$

6) $(ab)^n = a^n b^n$

7) $\left(\dfrac{a}{b}\right)^n = \dfrac{a^n}{b^n}$

8) $a^{-n} = \dfrac{1}{a^n}$

9) $\left(\dfrac{a}{b}\right)^{-n} = \left(\dfrac{b}{a}\right)^n = \dfrac{b^n}{a^n}$
[Note how Property (9) is a combination of properties (7) and (8)]

10) $a^{m/n} = \sqrt[n]{a^m} = \left(\sqrt[n]{a}\right)^m$

Note: 0^0 is undefined, but Property (1) is true for all $a \neq 0$.

Note: To understand why Property (1) is true, look at the case of Property (4) where $m = n$.

Note: Property (6) is true for any number of factors inside the parentheses.
"Everything inside the parentheses is raised to the n^{th} power."
For example, $(abc)^n = a^n b^n c^n$, $(abcd)^n = a^n b^n c^n d^n$, etc.

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Caution: Watch out for negative exponents in Property (4). For example, $\dfrac{x^7}{x^{-5}} \neq x^2$.

Following the rule carefully, notice that $\dfrac{x^7}{x^{-5}} = x^{7-(-5)} = x^{7+5} = x^{12}$.

Or, using Properties (8) and (3): $\dfrac{x^7}{x^{-5}} = \dfrac{x^7 \cdot x^5}{1} = x^{7+5} = x^{12}$.

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Caution: A negative sign is essentially the number – 1. Notice that $(-3)^2 = (-3)(-3) = 9$.

Following Property (6) carefully, we get the same result: $(-3)^2 = (-1 \cdot 3)^2 = (-1)^2 \cdot 3^2 = 1 \cdot 9 = 9$.

HOWEVER, $-3^2 = -9$ since $-3^2 = (-1)3^2 = (-1)(9) = -9$.

* *It is important to understand why* $(-3)^2 = 9$ *while* $-3^2 = -9$.*