





Scientific Notation

- The Universe appears to be described by mathematics: example Newton's Universal Law of Gravity
- Power output of the Sun: 380,000,000,000,000,000,000,000 Watts = 3.82x10²⁶ W (in LONCAPA we would write this 3.82E26 W)
- The biggest and smallest physical numbers
 - Largest: There are about 10^{80} protons in the Universe

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– Smallest: Plank Length 10⁻³⁵ meters



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More About Large Numbers

- 1,000,000,000/10,000 = 100,000
- $10^{9}/10^{4} = 10^{5} = 10^{9-4}$
- To divide, subtract exponents
- $1000/100 = 10^3/10^2 = 10^{3-2} = 10^1 = 10$
- Anything to the first power equals itself



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Large Numbers

- 10 x 10 x 10 x 10 = 10^4
- $10 \ge 10 \ge \dots$ (n times) = 10^n
- To multiply, add exponents
 - $-10,000 \ge 1,000,000 = 1,000,000,000$
 - $-10^4 \ge 10^5 = 10^{4+5} = 10^9$
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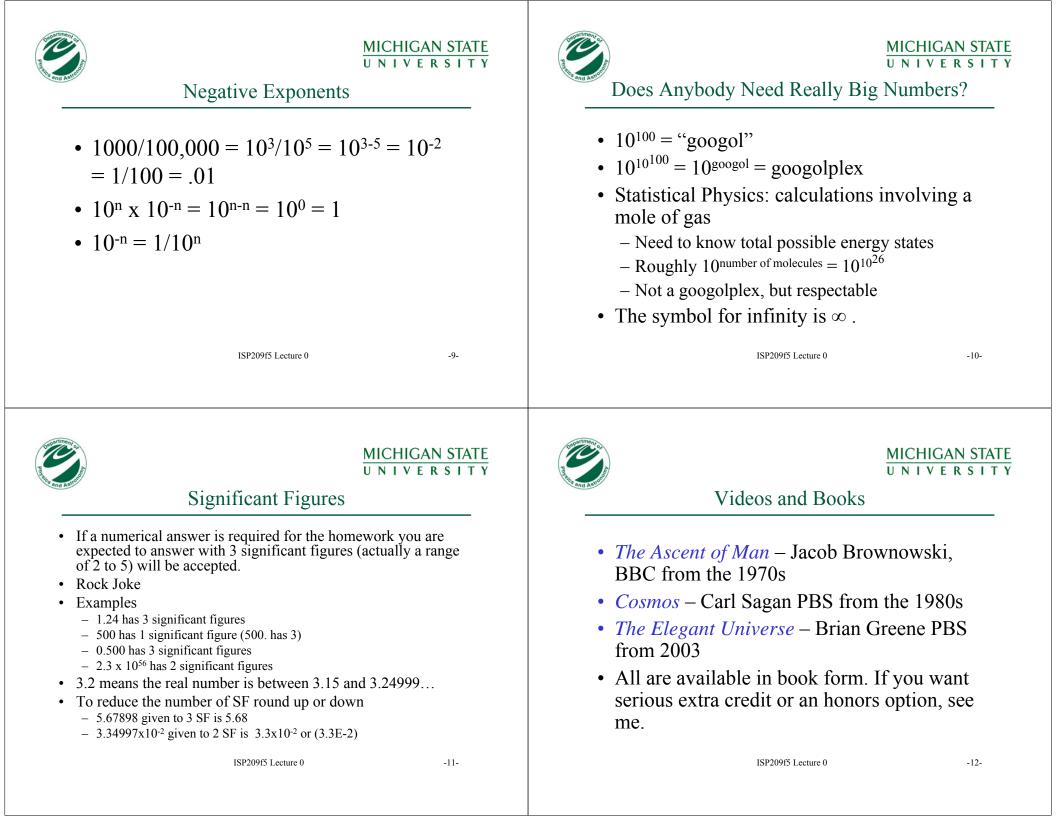


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Exponent of "0" gives 1

- $100/100 = 10^2/10^2 = 10^{2-2} = 10^0 = 1$
- Anything to the zero power equals 1

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The Scientific Method

Science

- Scientific Method
- Fact hypothesis theory model (combination of theories to describe how something works, e.g. how a supernova explosion occurs)
- inference (property inferred from theories and models)
- Theories can be proven wrong.
- Pseudoscience (not bad, just not science)
 - The hypothesis is not at risk. If data does not agree with the hypothesis, then the data is assumed to be wrong.
 - Some facts are ignored.
 - Exploit the controversies and inadequacies in a competing theory.
 - Portrayed as an underdog being punished by the scientific establishment.
 - Reliance on fear and other emotions, or reliance on a lack of knowledge
 - People who do pseudoscience usually do not publish in normal scientific journals.
- Two Examples: <u>ONE</u> <u>TWO</u> ISP209f5 Lecture 0

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