How scientists use math

- Unconsciously – for most scientists, using math is like breathing; it's done without noticing it
- Math-skill priorities in science:
  - » Abstraction and symbolism
  - » Symmetries and representations
  - » Visualization
  - » Modeling
  - » Calculation (calculus, algebra, analysis) and quantitative reasoning (e.g., what does "big" mean)
  - » Arithmetic algorithms
- Note to teacher: focus in your grade levels tends to be on arithmetic with some quantitative reasoning and visualization; but if you never hit items higher on the list you are setting up your students to "hit the wall" in later grades

A few examples of used math in various science areas

- Genomics – unraveling the structure of DNA was done by a physicist and a biologist, based on nuclear physics, calculus, geometry, statistics, group theory
- MRI techniques – driven by atomic/nuclear physics and technology developed in particle accelerators, using calculus, wave theory, statistics, group theory, rapid visualization of complex data sets
- Climate science – complete inability to conduct experiments morally means that modeling is fundamental, but the inability to isolate climate from the rest of Earth's physical and biological systems makes data/computation unusually challenging
- Prion diseases – protein behavior depends on several orders of structure that make the same chemical behave radically differently depending on its geometrical structure

More examples

- Psychology – statistics, statistics, statistics, game theory
- Economics – calculus, statistics, game theory
- Ecology – calculus, statistics, game theory
- Others:
  - » Physics and astronomy have driven mathematics, but also benefitted from unintended collateral effects
  - » The numerous and universal uses of modeling and visualization in all science (and most non-science) endeavors challenges computer science and technology
  - » Modeling, visualization and computer technology developed for science are essential for the modern motion picture industry