

## Mth126 Problem Solving Activities

**Overview.** These are non-routine problems. You will need to look up some key pieces of information on the internet. Google ([www.google.com](http://www.google.com)) and Wolfram Alpha ([www.wolframalpha.com](http://www.wolframalpha.com)) are two good places to look. The first exercise is just to get you familiar with some of Wolfram Alpha. After that, you are on your own!

Use whatever resources you like, but be sure you interpret your answers thoughtfully and *be prepared to present your answers and defend your reasoning* in class on Monday, 1/31. Note that there may be more than one ‘reasonable’ answer to some questions.

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1. **Wolfram Alpha (and Google) Warm-up:** Go to [www.wolframalpha.com](http://www.wolframalpha.com) and try to get it to answer the following questions. (You may have to play with the wording a bit to get the right answer – be persistent. Summarize the results.
  - a. Type in your birthday (day, month, and year).  
*Answers vary*
  - b. Let  $n$  = your current age, rounded to the nearest year. Calculate  $n!$  (i.e., the factorial of your current age).  
*Answers vary*
  - c. How many planets are there in the Milky Way galaxy?  
 *$2 \times 10^{40}$  (according to Wolfram Alpha, 1/30/2011 – that’s a LOT of planets!)*
  - d. How many calories are there in a Milky Way candy bar?  
*262 Calories (according to Wolfram Alpha, 1/30/2011)*
  - e. How thick is a dollar bill? (if Wolfram Alpha doesn’t know, ask Google!)  
*0.0043 inches or (or about 1/233 inch) according to Answers.com, among others)*
  - f. What is the current national debt of the United States? (compare with <http://www.usdebtclock.org/>)  
*\$14,092,494,500,000, or about \$14 trillion, or about  $\$1.4 \times 10^{13}$  (as of 1/30/2011).*
  - g. What is the current distance from the Earth to the moon?  
*243,271 miles (Wolfram Alpha, 1/30/2011)*
  - h. How many inches are in a mile?  
*63,360 inches (12 in / ft \* 5280 ft / mi)*
  - i. What is the size of the Earth?  
*Earth has an average radius of 3956.6 miles. This gives it a circumference of nearly 25,000 miles. (Wolfram Alpha, 1/30/2011)*
  - j. Just for kicks, try a few other questions (type in your birthdate, your hometown, or even “poker hands”). Want to amaze your smarty-pants friends who took calculus? Ask them to integrate  $f(x) = x/(x+1)$ . Then have Wolfram Alpha do it in a flash (“integrate  $x/(x+1)$ ”).  
*Answers will vary.*
  - k. You know, with tools like this at our disposal, we might have to start rethinking what we teach our kids....
  
2. **National Debt in dollar bills:** If crisp \$1 bills were stacked up, one on top of the other, how high would the stack be if its value were equal to the current US National Debt? Report your answer in a meaningful context – is it as tall as a sky scraper? Does it reach into outer space? All the way to Mars? (Bonus question: how high did the stack grow in the time it took you to answer this problem?)

*Estimating 14 trillion dollar bills gives about 960,000 miles. This is about 4 times the distance from Earth to the moon. It is growing at between \$200,000 and \$1,000,000 per minute, and it took me three minutes to answer this question, the debt has grown by \$600,000 to \$3,000,000. That represents a change in length of 1 to 3 football fields in length just in the time it took me to find my answer.*

3. **National Debt in seconds:** What was happening on Earth 1 million seconds ago? How about 1 billion seconds ago? 1 trillion seconds ago? 14 trillion seconds ago?

*1 million seconds is only about 11 or 12 days ago.*

*1 billion seconds was 31 or 32 years ago. Most of the students in Mth126 were not yet born.*

*1 trillion seconds ago was about 32,000 years ago. This is about the time of the earliest known cave paintings. Neanderthals were just about to go extinct. (source: Wikipedia's [Timeline of prehistory](#) article, 1/30/2011)*

*14 trillion seconds ago was over 450,000 years ago. Modern humans were just a twinkle in Mother Nature's eye (homo erectus was walking about, but homo sapiens would not appear until about 300,000 years ago). (source: Wikipedia's [Timeline of prehistory](#) article, 1/30/2011)*

4. **National Debt in feet:** How far do you travel when you walk 1 million inches? 1 billion inches? (have you walked around the Earth yet?) If you had a space ship, where might you be if you traveled 14 trillion inches?

*1 million inches is about 16 miles. You could do it in a day (if you had to!)*

*1 billion inches is about 16,000 miles. That's about 2/3 of the circumference of the Earth.*

*1 trillion inches is about 16,000,000 miles. That's 640 laps around the Earth, It takes a beam of light about 1.4 minutes to travel this far. It won't quite get you to Mars (less than 1/3 of the way there at the optimal launch time), but it would get you to the Moon and back more than 30 times!*

5. **And finally, a bit of counting:** How many different license plates are possible if they have three digits (0-9) followed by three letters? Wolfram Alpha says there are about 2.085 million households in Wisconsin. Are we in danger of running out of license plate codes in Wisconsin?

*If repeats are allowed, there would be  $10^3 \times 26^3 = 17,576,000 \approx 17.6$  million license plate combinations. Each household could have at least 8 cars and still have enough codes. I think we're ok for a while (especially considering there are different code configurations for cars vs. trucks vs. commercial vehicles, and personalized license plates don't have to follow those rules at all!).*