What is the difference between a million, billion and trillion?

NCTM Standards: Number and Operations; Measurement; Reasoning and Proof; Communication; Representation; Connections

New Hampshire Grade Level/Span Expectations: Number and Operations; Geometry and Measurement; Problem Solving, Reasoning and Proof; and Communication, Connections and Representations.

Directions: Have students estimate the following…after each, give them the answer, and ask any of the follow up questions, if they are appropriate:

Question: How long ago was one thousand seconds?

Answer: One thousand seconds was 16 minutes, forty seconds ago.

What were you doing one thousand seconds ago? Two thousand seconds ago? How many thousands of seconds has it been since school began today?

Question: How long ago was one million seconds?

Answer: One million seconds would take up 11 days, 13 hours 46 minutes and 40 seconds.

How many million seconds have passed since the beginning of the month? Of the year? Since school began?

Question: How long ago was one billion seconds?

Answer: **One billion** seconds is a bit over 31 and one-half years.

Are you a billion seconds old? Do you know someone who is?
Do you know someone who is two billion seconds or three billion seconds old?

Question: How long ago was one trillion seconds?

Answer: One trillion seconds is slightly over 31,688 years. That would have been around 29,679 B.C., which is roughly 24,000 years before the earliest civilizations began to take shape.

Were you surprised by the size of the difference between one million seconds and one billion seconds? Between one billion seconds and one trillion seconds?

Question: if one million seconds takes up about eleven and one half days, how long is one million minutes?

Answer: One million minutes ago takes one (non-leap) year, 329 days, 10 hours and 40 minutes.

How far back in time would you have to go to get to one million minutes?
How long will it take from today until we go another one million minutes?

Question: how far back in time would we have to go to get to one billion minutes?

Answer: One billion minutes would take a bit over 1,902 years. To go back one billion minutes would put us a few years after 100 A.D.

What was happening one billion minutes ago?

Question: how far back in time would we have to go to get to one trillion minutes?

Answer: One trillion minutes was about one million, nine hundred thousand years ago.

Question: now, let's look at hours…will you live one million hours?

Answer: it's possible…although you'd have to be very, very healthy! One million hours would take about 114 years to complete.

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Directions: read each question aloud. Have your students estimate the answers first; then have them calculate them, using calculators when appropriate.

Question: You've just won one million dollars! But, the rules require that you need to spend it all in one year. How much do you have to spend per day?

Answer: Spending **one million dollars** in a year would require spending about $2739.73 per day.

Question: This means that to spend one billion dollars in a year, you'd need to spend how much per day?

Answer: Spending **one billion dollars** in a year would require spending about $2,739,726.03 per day.

Question: The United States of America's National Debt as of November 9th, 2009 at 12:00 noon Eastern Time was $12,005,269,197,960. Say this number out loud.

Answer: twelve trillion, five billion, two hundred sixty-nine million, one hundered ninety-seven thousand, nine hundred sixty dollars.

Note (for the teacher): it is important to have students practice saying very large (and very small) numbers, since this helps them develop a feeling for quantity and the relationships between quantitative magnitudes. Note that they state them correctly. One common mistake occurs by saying just the digits, for example: "twelve…zero zero five…two six nine…". Another common mistake involves adding the word **and** in incorrectly (for example) "two hundred **and** sixty-nine million".

Note (read to the class): this information can be found at this web site: http://www.brillig.com/debt_clock/ write the web site on the board, if you wish). Check it out later for yourself to see how much it has changed since noon on November 9th, 2009.

Note (read to the class): Keep in mind the National Debt isn't how much we are spending as a country…this is how much *more* we are spending as a country than we are taking in through taxes, fines, tariffs, etc. In 2008, our government collected 2.5 trillion dollars…which, if you spent just that, you'd have to spend almost $80,000 per second, or over one million dollars in the time it took you to read these two notes out loud!

Question: If we paid back one billion dollars on this National Debt each day *without adding more debt and without paying any interest,* how long would it take to pay it off?

Answer: It would be paid off somewhere around November 13th, 2042.

Question: To pay back one billion dollars a day, how much do we need to pay back per second?

Answer: Paying back one billion dollars a day would mean paying back $11,574 per second.

Question: The Gross Domestic Product (GDP) of the state of New Hampshire is approximately 50 billion dollars per year. If all New Hampshire people and businesses donated everything they ever earned to paying off the national debt under the same circumstances described above, how many years would it take?

Answer: it would take a bit over 240 years.

Million: 1,000,000
Billion: 1,000,000,000
Trillion: 1,000,000,000,000
Quadrillion: 1,000,000,000,000,000
Quintillion: 1,000,000,000,000,000,000
Sextillion: 1,000,000,000,000,000,000,000
Nonillion: 1,000,000,000,000,000,000,000,000,000,000,000

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