

Get the Data

Visit EOSS <http://1.usa.gov/GExOJa> to recreate this exact scene. Recommended operating system: MS Vista or later; Browser: MS Internet Explorer 8 or later.

Step 1 - Use the Date and Time menu to select the first day of a month during the year 2012. For example, the above image is for January 1, 2012 at 00:00.

Step 2 – Use the measuring tool to determine the distance between Earth and the Sun by clicking on their labels.

Step 3 – Repeat these steps for each of the 12 months in a year.

Answering Questions

Problem 1 – Create a graph of your 12 distance measurements with the horizontal axis marked in intervals of months from 1 to 12, and the vertical axis in terms of the distance in units of millions of kilometers from 0 to 150.

Problem 2 – During which month is earth closest to the Sun? Farthest from the sun?

Problem 3 – What is the average distance to the sun during a year, and by what percentage does this distance vary between its maximum and minimum values?

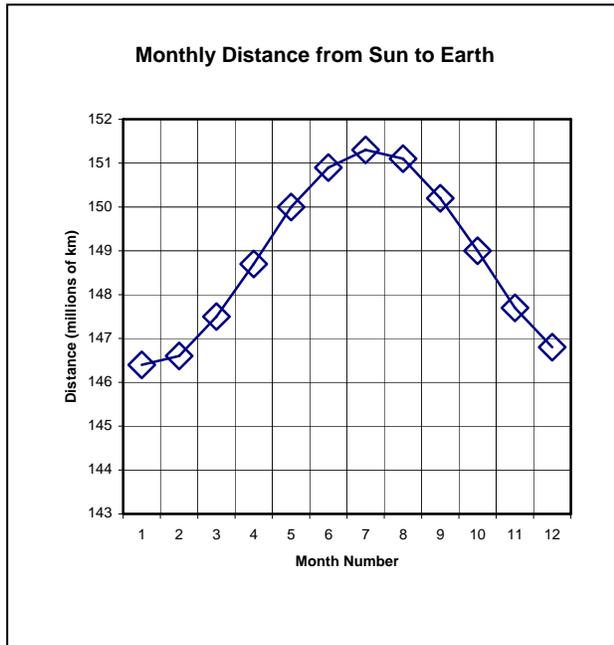
Math Challenge

The average temperature of Earth can be estimated from the formula $T = \frac{3612}{\sqrt{D}}$ where

D is the distance to the sun in millions of kilometers, and the temperature is in Kelvins. By how many degrees Celsius does the average temperature of Earth change when Earth is farthest and nearest to the sun each year?

Answer Key

Problem 1 – Create a graph of your 12 distance measurements with the horizontal axis marked in intervals of months from 1 to 12, and the vertical axis in terms of the distance in units of millions of kilometers from 0 to 150. Answer: See sample table and graph below for 2012.



Month	Distance	Month	Distance
January	146.4	July	151.3
February	146.6	August	151.1
March	147.5	September	150.2
April	148.7	October	149.0
May	150.0	November	147.7
June	150.9	December	146.8

Problem 2 – During which month is Earth closest to the Sun? Farthest from the sun?

Answer: **It is closest in January and farthest in July.**

Problem 3 – What is the average distance to the sun during a year, and by what percentage does this distance vary between its maximum and minimum values?

Answer: From the table, the average distance is 148.9 million kilometers. The change is $P = 100\% \times (151.3 - 148.9)/148.9 = +1.6\%$. and $P = 100\% \times (146.4 - 148.9)/148.9 = -1.7\%$

The average temperature of Earth can be estimated from the formula $T = 3612/\sqrt{D}$ where D is the distance to the sun in millions of kilometers, and the temperature is in Kelvins. By how many degrees Celsius does the average temperature of Earth change when Earth is farthest and nearest to the sun each year?

Answer: In January at the closest distance $T = 3612/\sqrt{146.4} = 298.5$ Kelvin or +25.5 C. In July at the farthest distance, $T = 3612/\sqrt{151.3} = 293.6$ Kelvin or +20.6 C. So the temperature change, averaged over the whole Earth during one year is about $(25.5 - 20.6) = 4.9$ degrees Celsius. This is much larger than the 'Global Warming' effect however this effect is periodic and repeats every year so that it can be accounted for in the global temperature data.