



Get the Data

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

Step 1 – Click on the ‘Visual Controls’ tab and make sure that the following items are selected with a ‘white spot’: stars, planetary bodies, labels, orbit lines and metric.

Step 2 - Activate the Distance Tool and measure the distance from Earth to the Sun. Adjust the Date and Time with the slider until Venus is exactly on this measurement line. Note the date and time.

Step 3 – Leave the Distance Tool in the ‘on’ state and advance the Date and Time until Earth and Venus are again lined up with the sun. Note the date and time. Repeat through the end of 2012.

Answering Questions

On March 6, 2012 at 7:15 PM EDT, the

Problem 1 – What is the average number of days between alignments?

Problem 2 – How long does it take for Venus and Earth to be once again lined up the way they were for 2004?

Problem 3 – How many degrees apart are the alignments located along the circle of Earth's orbit? What regular geometric figure has this angular property?

Math Challenge

After the June 5, 2012 transit of Venus concludes, it will be a long time before the next pair of transits occurs. If the first transit of this pair occurs on December 10, 2117, when will the next transit of this pair occur?

Answer Key

7

Problem 1 – What is the average number of days between alignments?

Answer: The Alignments occurred on June 8, 2004; January 13, 2006; August 17, 2007; March 27, 2009; October 28, 2010 and June 6, 2012. The days between each pair were 584, 581, 588, 580 and 587 for an average interval of 584 days. This is called the Synodic Period of Venus relative to Earth.

Problem 2 – How long does it take for Venus and Earth to be once again lined up the way they were for 2004?

Answer: It takes almost exactly **8 years** ($2012 - 2004 = 8$)

Problem 3 – How many degrees apart are the alignments located along the circle of Earth's orbit?

Answer: There were five of these alignments, so the angular separation is $360/5 = \mathbf{72 \text{ degrees}}$. This means that a regular pentagon can be inscribed inside the orbit of Earth whose vertices are the locations (dates) when Earth and Venus could be lined up with the sun, if the orbits were all in the same plane.

Challenge Question: **After the June 5, 2012 transit of Venus concludes, it will be a long time before the next pair of transits occurs. If the first transit of this pair occurs on December 10, 2117, when will the next transit of this pair occur?**

Answer: The time between line-ups is 584 days, and it takes 5 of these to elapse before the geometry of the planets lets the next transit occur. The elapsed time is then $5 \times 584 \text{ days} = 2920 \text{ days}$, so adding 2920 days to December 10, 2117 we get the date **December 8, 2125**.