Math Magic: Making a model of our solar system

Issue #12: proportion to model size of (grades 7-12) An Index of All Math Magic Activities

GUESSING THE DIAMETER OF THE SUN IF THE DIAMETER OF EARTH = 1 INCH

Holding my thumb and finger about an inch apart I asked a group of middle school students, "If the diameter of the earth is this distance, **guess how much larger or smaller the sun would be**:

- ___ the size of a BB
- ___ the size of a softball
- ___ the size of a basketball
- ___ the size of a circle who's diameter reaches from the floor to the ceiling (9-10 feet high)
- ___ a two-story high weather balloon (18-20 feet high)

There are no wrong answers because these are just guesses. We need more information to create a scale model. We will do that next.

USING PROPORTION TO MAKE A MODEL

After some discussion we decide that we need to know the actual diameters of the earth and the sun to create a scale model. Below are the approximate (≈) sizes rounded to the nearest thousands in miles.

diameter of the earth ≈ 8,000 miles
diameter of the sun ≈ 864,000 miles

Using the information above, help the class discover ways of determining how big the sun would be if the earth is about the size of a ping pong ball (roughly one inch). Have students record their work and solution on the back.

One way of doing this would be to set up a proportion and solve by cross multiplication.

$$\frac{1 \text{ inch}}{8000 \text{ mi}} = \frac{x \text{ inches}}{864{,}000 \text{ miles}}$$ (and solve as shown below)

$8000x = 864{,}000 \qquad x = 864{,}000 \div 8{,}000$

x = **108 inches or 9 feet** for the diameter of the sun which ≈ the floor to ceiling model.

I then drew the partial circle on the whiteboard to the amazement of all assembled including myself

USING THE SAME SCALE COMPUTE

DIAMETERS OF PLANETS AND SUN WHERE 1 IN = 8000 MI

MODELS OF SIZES OF SOME OTHER PLANETS

PLANET	ACTUAL SIZE	MODEL SIZE
MERCURY	3,000 miles (mi.)	
VENUS, EARTH	8,000 mi.	1 inch (in.)
JUPITER	143,000 mi.	
SATURN	75,000 mi.	
URANUS	32,000 mi.	
OUR SUN	864,000 mi.	108 in. or 9 feet

FINDING AND USING A SCALE WHERE THE PLANET SIZES CAN BE FIT ON THIS PAGE

The problem: getting the largest body or sun to fit on this page so that the smallest can also be seen.

The scale of 1mm = 8000 mi has the model of the sun at 108 mm or 10.8 cm fit the page, but earth or anything smaller (Mercury) would be barely visible as a mm or the thickness of a dime.

The **scale of 1 mm = 4000 mi** works better. The sun and even the smallest planets will fit on one page this size. Using that scale, fill in the chart. Then draw and label the planets and the sun on the back of this paper.

PLANET	ACTUAL SIZE	MODEL SIZE
MERCURY	3,000 miles (mi.)	
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Discussion of diameter, circle, and sphere needed. More on area and volume next. KEY HERE.