Circumference of the Sun and the Planets

Grade Level: 7

Time Required: 1 class period

Countdown:
Calculators
1 Planet Table per Student

Ignition:
Archimedes, a Greek mathematician of the 3rd century, found a way to determine a more exact value of \(\pi\), the ratio of a circle’s circumference to its diameter. He showed that the value of \(\pi\) is between \(3\ 1/7\) and \(3\ 10/71\). This discovery made it possible to solve many problems involving the area of circles and the volume of cylinders.

Additionally, using a numeration system that he invented, Archimedes calculated the number of grains of sand it would take to fill the universe.

Liftoff:

A. Circumference
1. Discuss with students that “circumference” means the distance around a circle or a circular object. Using tape measures, students should measure the circumference of different body parts (head, arm, wrist, leg, waist, ankle, etc.).
2. Measure the circumference of the globe with the tape measure. Then, tell students that it is possible to determine circumference of all circular objects accurately and scientifically by using formulas. The two circumference formulas are as follows:

\[
c = \pi \times d
\]
\[
c = 2 \times \pi \times r
\]

(Circumference = \(C\); \(\pi = 3.14\); \(d=\)diameter; \(r=\)radius)
3. Demonstrate how to find the Earth’s circumference, knowing the Earth’s radius.

\[ C = 2 \pi r \]
\[ C = (2 \times 3.14) \times 6,375.5 \text{ km} \]
\[ C = 6.28 \times 6,375.5 \text{ km} \]
\[ C = 40,038.14 \text{ km} \]

4. Ask the students to complete the table attached, using calculators. You may wish to vary the information given, by supplying the diameter, thereby requiring the students to use the first formula.

(See table attached.)

5. Have students rearrange the planets according to circumference: greatest to least, least to greatest.

More ideas …

- Extend the table by finding the volume and the surface of each planet. Formulas to be used are as follows:
  
  \[
  \text{Volume (V)} = \frac{4}{3} \pi r^3 \\
  \text{Surface Area (S)} = 4 \pi r
  \]

  Scientific calculators would be useful in this experiment, if available.
- Compare the method of using the volume formula with Archimedes’ method of calculating grains in the universe.
## Circumference of the Sun and Planets

<table>
<thead>
<tr>
<th>Planet</th>
<th>(km) radius</th>
<th>(km) diameter</th>
<th>(km) circumference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth</td>
<td>6,375.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mercury</td>
<td>2,427</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Venus</td>
<td>6,056</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mars</td>
<td>3,394</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jupiter</td>
<td>71,500</td>
<td></td>
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<tr>
<td>Saturn</td>
<td>60,500</td>
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</tr>
<tr>
<td>Uranus</td>
<td>23,500</td>
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<tr>
<td>Neptune</td>
<td>23,264.5</td>
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</tr>
<tr>
<td>Pluto</td>
<td>1,200</td>
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</tr>
<tr>
<td>Sun</td>
<td>675,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moon</td>
<td>1,738</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>