Worksheet on Earth and Universe Measurements and Shape
## Dr. Sarah's MAT 3610: Introduction to Geometry

goals:

- Geometric Perspectives
  I can compare and contrast multiple geometric perspectives.

Welcoming Environment: Keep it a safe place to express meaningful ideas and opinions. Actively listen to others and encourage everyone to participate. Part of the welcoming environment is to keep an open mind as you engage in our class activities, explore consensus and employ collective thinking across barriers. Maintain a professional tone, show respect and courtesy, and make your contributions matter.

1. Discuss with your group and respond: what does "geo" in geometry mean?

2. Discuss with your group and respond: what does "metry" in geometry mean?

3. If we are expecting the earth to be perfectly round, that isn't correct, as on a local scale we have mountains and more. Even on a global scale, there are some variations from a perfect sphere. Search the web for the smallest radius of the earth. List the number and the units (*km* or *mile*).

4. Search the web for the largest radius of the earth in the same units as the last question and list.

5. What is the difference between the two in the same units?

6. Compute the ratio of your last two responses $\frac{\#5}{\#4}$ and **convert to an approximation as a percentage**, which provides a quantification of the approximate % error in assuming the earth is a perfect sphere.

7. How could we know that the earth is basically a sphere on the global scale—not a flat Euclidean plane—without using technology from the 20th or 21st centuries? Discuss and write down as many ideas as your group can come up with.

8. When you are finished coming up with ideas, write them on a board, and examine the board work of other groups.

9. Long ago, Eratosthenes computed the circumference of the earth using local data about shadows and camel caravans—at midsummer's day at noon, light came in directly at Syene, Egypt, but made a shadow at Alexandria. He then abstracted to the global circumference of the earth by applying the congruence of alternate interior angles, assuming the light rays were parallel—identify the alternate interior angles below:
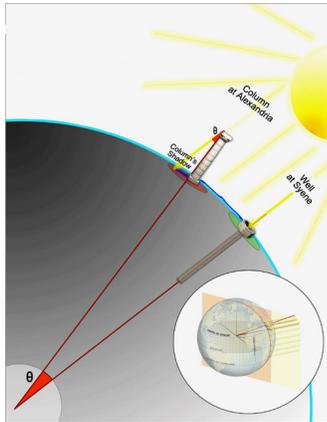
NOAA Ocean Service Education's History of Geodesy

10. Eratosthenes knew the distance between the cities as 5000 stadia, and the alternate interior angles as $7.2°$, and then set up a fraction using proportional reasoning to extend to all the way around: $\dfrac{7.2°}{360°} = \dfrac{5000 \text{ stadia}}{\text{circumference}}$. Amazingly, working with what he had at the time, Eratosthenes was only off by 2% to 15% depending on the definition of stadia. Put another way, he was 85—98% correct! Solve for that circumference of the earth.

11. Today we are engaged in an intellectual to understand the shape of space—search for
shape of the universe Euclidean
discuss with your group and write down one item you found interesting

12. search for
shape of the universe sphere
discuss with your group and write down one item you found interesting

13. search for
shape of the universe dodecahedron
discuss with your group and write down one item you found interesting

14. **Help each other and PDF responses to ASULearn**: If you are finished with the worksheet before I bring us back together, first ensure that your entire group is finished too, and if not, help each other. If your entire group is finished, then split up and pull up chairs so that you can discuss your responses with other groups. Collate your handwritten responses, preferably on this handout, into one full size multipage PDF for submission in the ASULearn assignment. I recommend you turn it in sometime today, but you have until the next class.