

### GPS and Intersecting Circles

1. Every object on the earth has a precise location on the Earth. The location of any object on Earth can be identified by GPS coordinates.  
What does GPS stand for? \_\_\_\_\_
  
  2. GPS Coordinates correspond to the location of an object in terms of latitude and longitude on Earth. Go to <https://www.google.com/earth/> and Launch Google Earth. Then, search to find the exact GPS coordinates for:
    - a) 1500 Sullivan Rd, Aurora, IL 60506: \_\_\_\_\_
    - b) The St. Louis Gateway Arch: \_\_\_\_\_
  
  3. Determine the GPS coordinates, in terms of degrees only, for the following:
    - a) Tucson, Arizona: \_\_\_\_\_
    - b) Boise, Idaho: \_\_\_\_\_
    - c) Minneapolis, Minnesota: \_\_\_\_\_  
What is the altitude of Minneapolis in terms of meters? \_\_\_\_\_  
What is the altitude of Minneapolis in terms of feet or miles? \_\_\_\_\_
  
  4. In order for GPS receivers to identify their precise location, a mathematical principle called trilateration is used to identify the location of an object. While 3D trilateration can be difficult to visualize with 3 or more intersecting spheres, the following scenario provides a 2D example involving 3 circles where cities are used instead of satellites. Use <https://www.geocachingtoolbox.com/index.php?lang=en&page=circleIntersection&status=result> to answer the following:
    - a) If you are 1110 km from Minneapolis and 1000 km from Boise, what are the two potential states in which you are located? \_\_\_\_\_
  
    - b) Additionally, if you are 990 km from Tucson. Where is your location?  
City/State: \_\_\_\_\_  
GPS Coordinates: \_\_\_\_\_  
Altitude: \_\_\_\_\_
- \*\* Note: An additional resource for the above problem found at:  
NasaSciFiles (2007) "Case of the Technical Knockout - How Does GPS Work?"  
Retrieved from <https://youtu.be/3zRlbb0Mvb0>