Goal
The goal of this homework is to reinforce the lecture material on Geodesy, Map Projections and Coordinate Systems by having you identify attributes and perform hand calculations related to coordinate systems and distances between points on a spherical earth.

1. Map Projection Parameters

In Exercise 3, you have used two forms of the Albers Equal Area Projection:

(1) USA Contiguous Albers Equal Area Conic

(2) North America Albers Equal Area Conic
Layer Properties: NED30m_Clip

(a) What earth datum is used in these coordinate systems?

(b) What map projection is used in these coordinate systems?

(c) Prepare a map showing the outline of the continental United States for each projection. Show on the map the Central Meridian, Latitude of Origin and the Standard Parallels. Use the Web Mercator view to draw these lines. Some additional information to help with doing this is given at: http://www.caee.utexas.edu/prof/maidment/giswr2016/Visual/LivingAtlas.pptx

(d) The geographic coordinates of UT Austin are: 30° 17' 10" N and 97°44' 22" W. Assuming a spherical earth with radius 6371.0 km, calculate the distances in meters that UT Austin is south of the latitude of origin and west of the central meridian for the NAD83 Albers projection (the first of the two given above).

(e) Create a point feature for UT Austin in geographic coordinates and use ArcGIS Pro to project its location to the NAD83 Albers projection. Use the Add XY Coordinates function in ArcGIS Pro to find its projected coordinates. Compare those with the ones you worked out in part (d) assuming a spherical earth.

(f) Take the Basin feature class used in Exercise 3 and find its Shape_Length and Shape_Area in both of the above map projections. Are these quantities the same in both projections?
2. Sizes of DEM Cells

The National Water Model uses 1 km cells to describe the land-atmosphere water balance on the earth’s surface. The locations of UT Austin and USU Logan, are shown below. Assuming the earth is spherical with a radius of 6371 km, determine the equivalent lengths of the lines AB and BC in decimal degrees at these locations.