**Student Name:** **Grade:**

# Physical Geology 101 Laboratory
# Topographic Map Lab I – Topo Basics

**Introduction & Purpose:**

Topographic maps are much scaled down two-dimensional paper models of the Earth's three-dimensional land surface. The characteristic that makes topographic maps unique are contour lines, which are map symbols that express surface relief – ground elevation changes across a given tract of land. Each contour line represents a continuous set of surface point locations that have equal elevation. The topographic ("topo" for short) map is an ingenious invention that helps humans navigate across the Earth's surface, and analyze the Earth's surface morphology, and geology.

Learning how to create and read topographic maps can be difficult, especially for those people who are not graphically and/or three-dimensionally minded. However, if the basic concepts of contour lines, map scale, and coordinate positioning systems are properly understood, then the ability to read topographic maps will come much easier. The purpose of this lab is to learn how to read, interpret, utilize, and create topographic maps and topographic map profiles.

**The major objectives of this laboratory exercise are as follows:**

1) Be able to interpret all the necessary map information, including map scale, declination, contour interval, map symbols, and map coordinates.
2) Be able to locate and identify features on a map, including the use of map coordinates, identifying geographic features

## Part I. Topographic Maps: Contouring & Relief

**Instructions**: Carefully read and analyze the section 9A in your lab manual – pages 168 through 184. Then complete the following exercises found on pages 185 and 186 in your lab manual. Please use the copies of the figures in the worksheet to complete your answers/

**Section 9A Questions and Answer Sheet**

**1.** Draw contour lines with 100-foot intervals on Figure 9.15. Refer to Fig 9.6 in manual if needed.

**2.** Draw contour lines with 10-foot intervals on Figure 9.16. Refer to Fig 9.6 in manual if needed.

**3.** Color/shade in the area that represents the top of the highest hill on the map in Fig. 9.17. Then label the following features: Ridgeline with "*Ridge*"; Round hill with "*H*", Saddle with "*S*".

**4.** Place the correct contour value in empty box on map in Figure 9.18. Then color/shade in the area that represents the lowest elevation on the map. Finally, label the closed depression on the map with the initials "CD".

**5.** Complete the topographic map in Figure 9.19 using a contour interval of 10 feet. Make sure to label each contour line with its exact elevation above sea level. Make note of the closed depression contour lines.

**6.** Refer to map in Figure 9.20 for completing the following questions:

**a)** The contour interval = ___meters **b)** Total map relief = ____ meters

**c)** What is the slope gradient from "X" to "Y"? = _____ meters per km

**d)** Draw a road from Point "A" to Point "B" such that the road's slope gradient **does not** exceed 20 meter drop per kilometer. Hint: Why do hiking trails have "switchbacks"?

# Work Sheet for Part I. - Questions #1 through #4

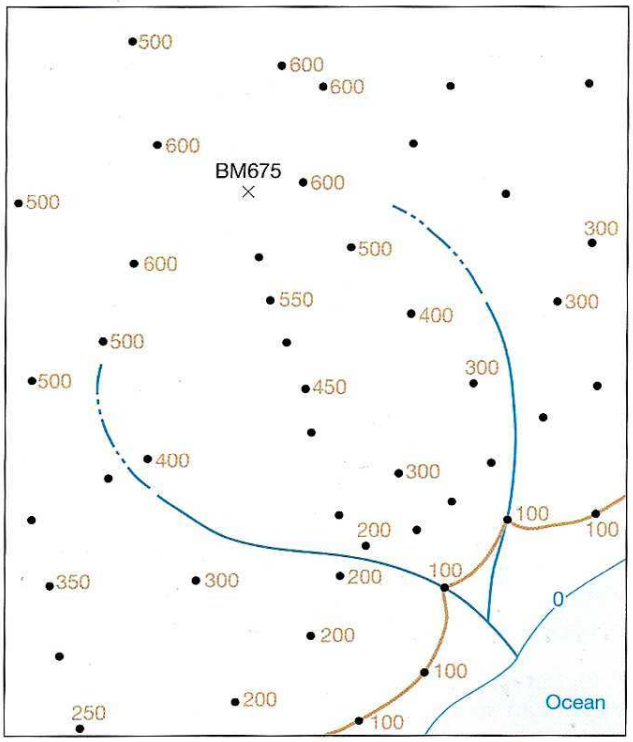



**FIGURE 9.15** Use interpolation and extrapolation to estimate elevations of points that are not labeled (see Figure 9.6). Then add contour lines with a 100-foot contour interval. Note how the 0-foot and 100-foot contour lines have already been drawn.

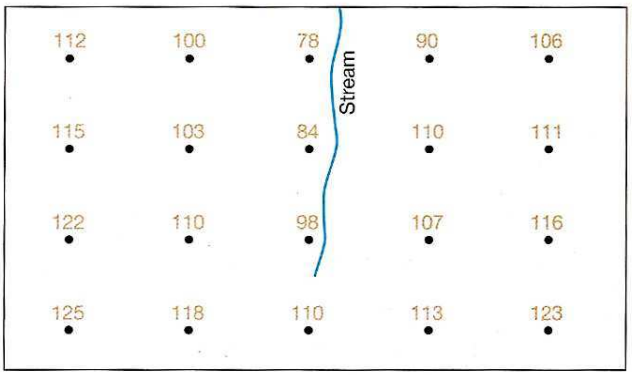



**FIGURE 9.16** Construct a topographic map by contouring these elevations. Use a contour interval of 10 feet. (Refer to Figure 9.5 as needed.)

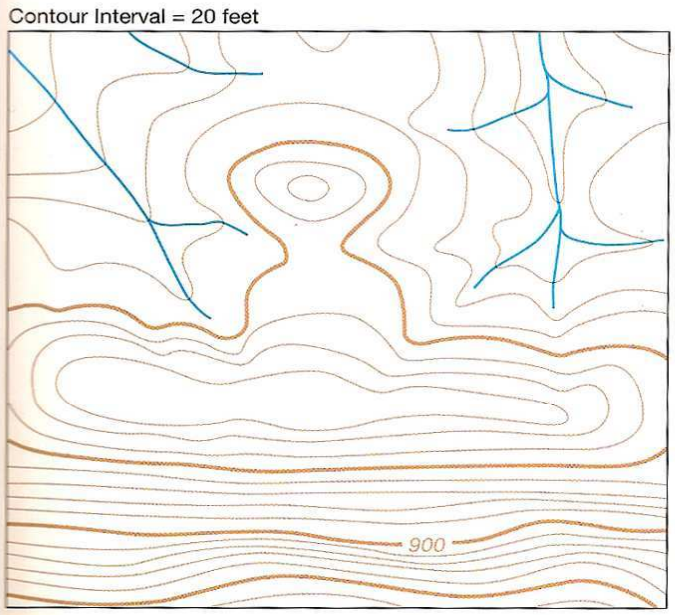



**FIGURE 9.17** Topographic map interpretation. Use your pencil to lightly shade in the portion of this map that represents the highest elevation of land. Label a hill, "H." Label a ridge, "R." Label a saddle, "S." Use an arrow to label the lowest contour line in the map and label the arrow with the elevation of the contour. (Refer to Figures 9.5–9.8 as needed.)

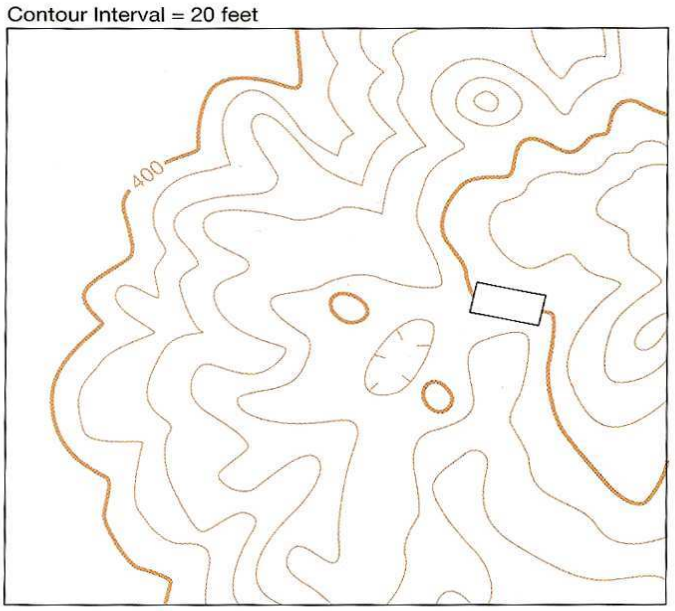



**FIGURE 9.18** Topographic map interpretation. Use your pencil to lightly shade in the portion of this map that represents the lowest elevation. Label a closed depression, "CD." In the small box, write the elevation of the index contour on which it lies. (Refer to Figures 9.5–9.8 as needed.)

## Work Sheet for Part I. - Questions #5 and #6

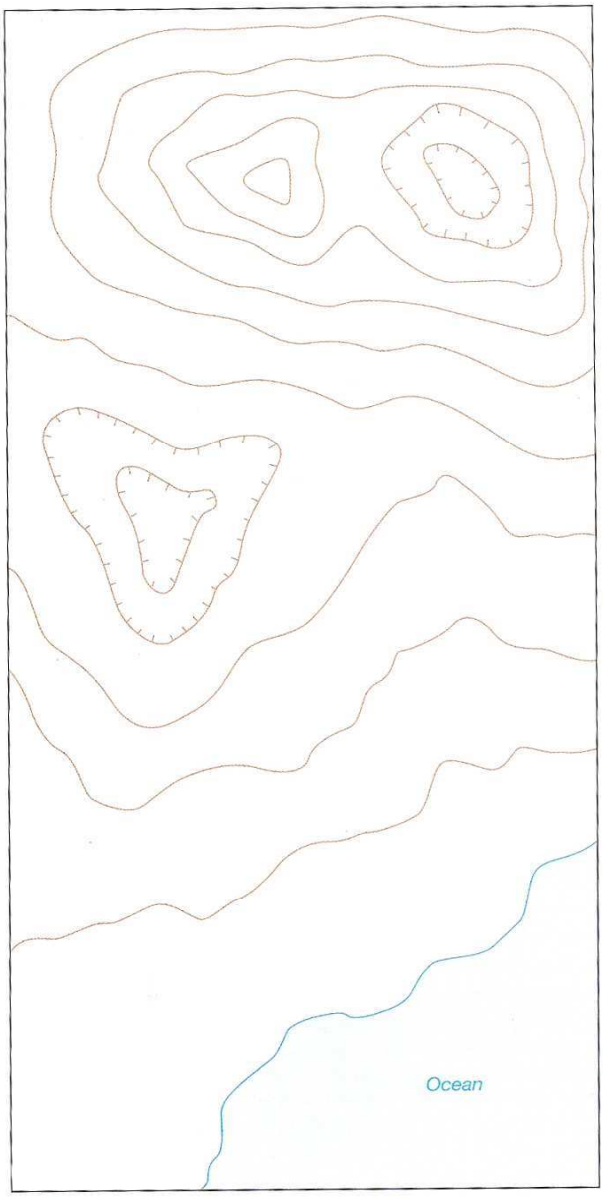
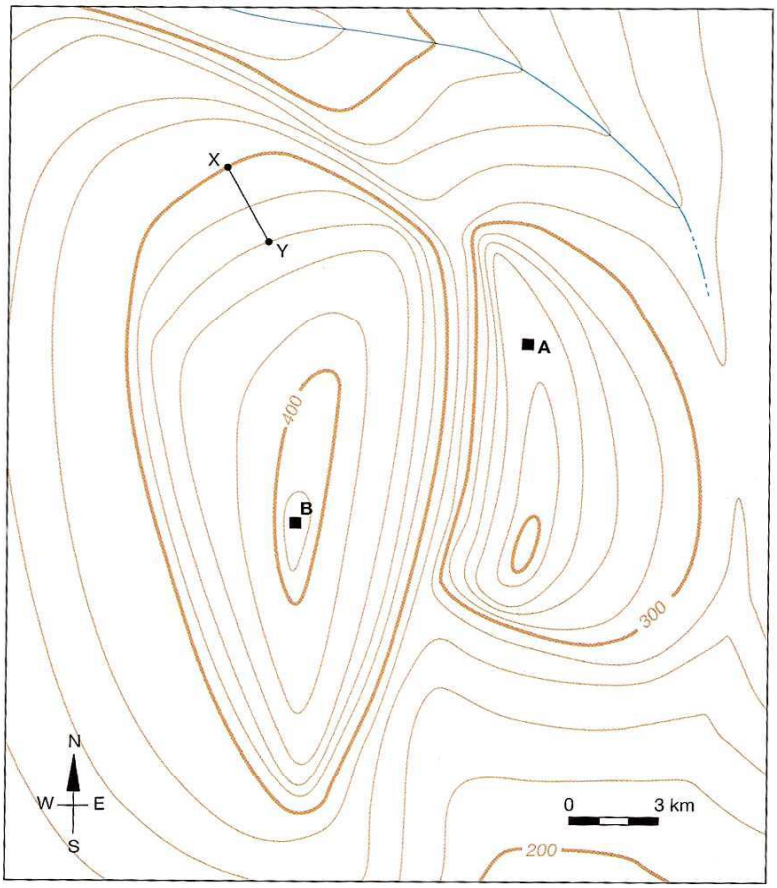



**FIGURE 9.19** Complete this topographic map. Use a contour interval of 10 ft and label the elevation of every contour on the map. (*Hint*: Start at sea level and refer to Figures 9.8 and 9.9.)




Elevations are in meters.

**FIGURE 9.20** *Gradient* is a measure of the steepness of a slope, expressed in feet per mile or meters per kilometer. To determine the gradient of a slope, divide the *relief* (difference in elevation between two points on a map) by the distance measured between the two points. This is sometimes called *rise over run*. For example, this topographic map is contoured in meters. Can you determine the contour interval? Can you determine the gradient from point **X** to point **Y**? Can you plot a path from point **A** to point **B** that does not cross any slopes with a gradient above 20 meters per kilometer? Explain your reasoning.

## Part II. Analysis of a Standard 7 ½ Minute Quadrangle USGS Topographic Map

**Instructions:** Complete the following map analysis activities for a standard 7 ½ quadrangle topographic map supplied by your instructor.

1. The size of the map is _____ minutes by _____ minutes
2. The ratio scale is _____
3. The verbal scale is _____
4. The contour interval is _____

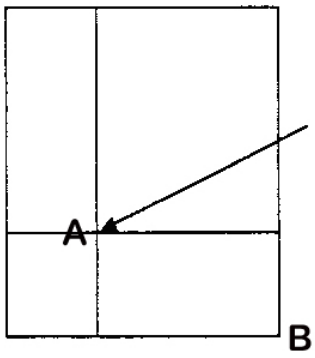
5. The adjacent quadrangle to the south is _____

6. What is the maximum relief of the map? _____

7. When was this map last updated? _____

8. What is the amount and direction of magnetic declination? _____

9. What is the exact latitude and longitude of a point 1/3 of the way up from the bottom and 1/3 of the way over from the left edge of the map?




Lat. _____

Long. _____

10. Locate that same point by UTM northing and easting coordinates:

Zone _____ _____N _____E

11. Is this point visible to a person standing due west at the edge of the map? _____

12. Calculate the slope gradient between that point and the nearest hilltop in feet per mile.

_____ feet per mile

13. What is the distance from point A to point B on the map? _____feet; _____miles

14 What is the bearing from Point A to Point B on the map? Azimuth: _____ Quad: _____

15. What is the bearing from Point B to Point A on the map? Azimuth _____ Quad: _____

## Part III. Topographic Map Laboratory Reflection

**Directions:** Write a 120 word minimum reflection of the lab activity, explaining its purpose, the methods used, the results obtained, and a brief personal reflection of what you enjoyed and learned about doing this lab (*3 points possible*). Answer the following 3-point question reflection set on a separate sheet of paper:

**1)** *What was the purpose of this lab? What did you actually discover and learn during this lab?*

**2)** *What did you enjoy most about this lab? Also, what was challenging or thought-provoking?*

**3)** *What are your constructive comments about the design and execution of this lab? What's good? What's bad? Offer suggestions for making the lab better.*