Name: _____ **San Diego Mesa College** **Grade:** _____

Physical Geology 101 Laboratory
Topographic Map Lab – Topo Basics

Introduction & Purpose:

Topographic maps are extremely scaled-down, two-dimensional 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.

The purpose of this lab is to learn how to read, interpret, utilize, and create topographic maps and topographic map profiles. Learning how to create and read topographic maps can be difficult, especially for those people who are not 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 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 on contouring, topographic relief, and slope gradient in your lab manual – 9A; pages 168 through 184. Below are a set of contouring activities. Complete the following exercises found below, including using the below figures.

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

2. Place the correct contour value in empty box on map in Figure 9.18 below. 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".

3. Complete the topographic map in Figure 9.19 below 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.

4. 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. Do the calculation here: _____

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 steep hiking trails have "switchbacks"?

Figures for Part I: Questions #1 through #4

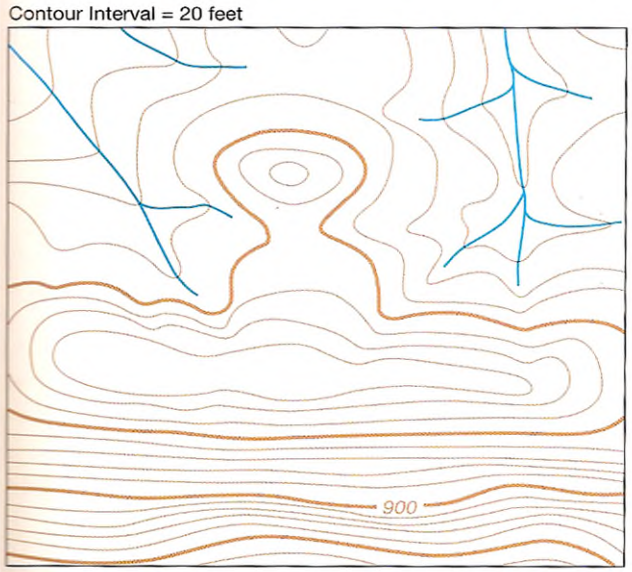


FIGURE 9.17 Topographic map interpretation. Use your pencil to lightly shade in the portion of this map that represents the highest elevation of land. Label a hill, "H." Label a ridge, "R." Label a saddle, "S." Use an arrow to label the lowest contour line in the map and label the arrow with the elevation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

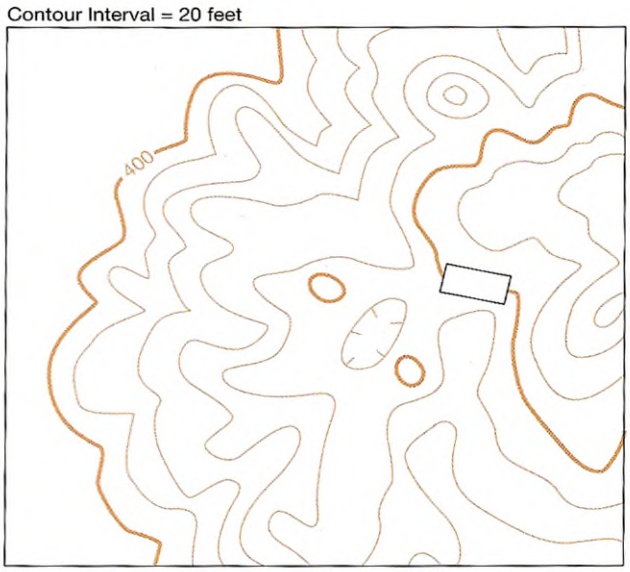


FIGURE 9.18 Topographic map interpretation. Use your pencil to lightly shade in the portion of this map that represents the lowest elevation. Label a closed depression, "CD." In the small box, write the elevation of the index contour on which it lies. (Refer to Figures 9.5–9.8 as needed.)

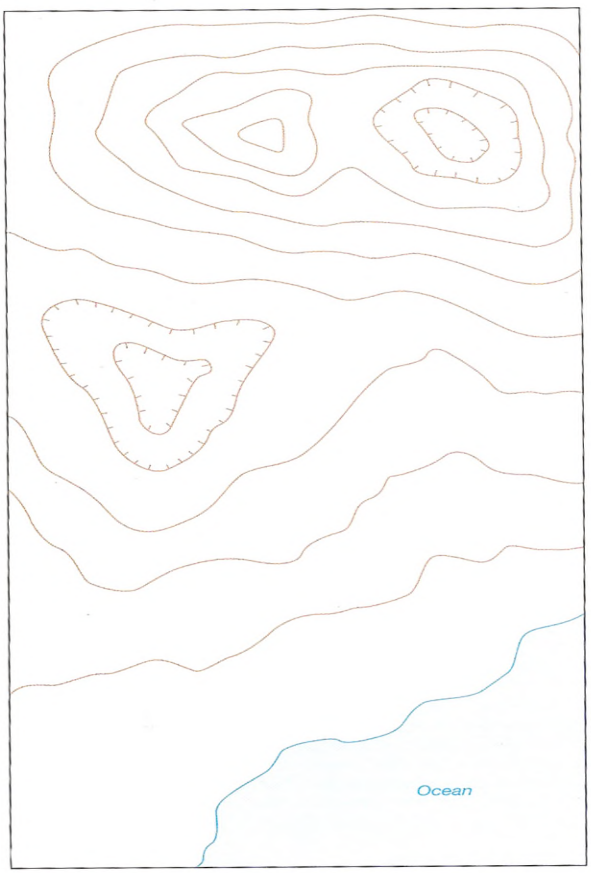
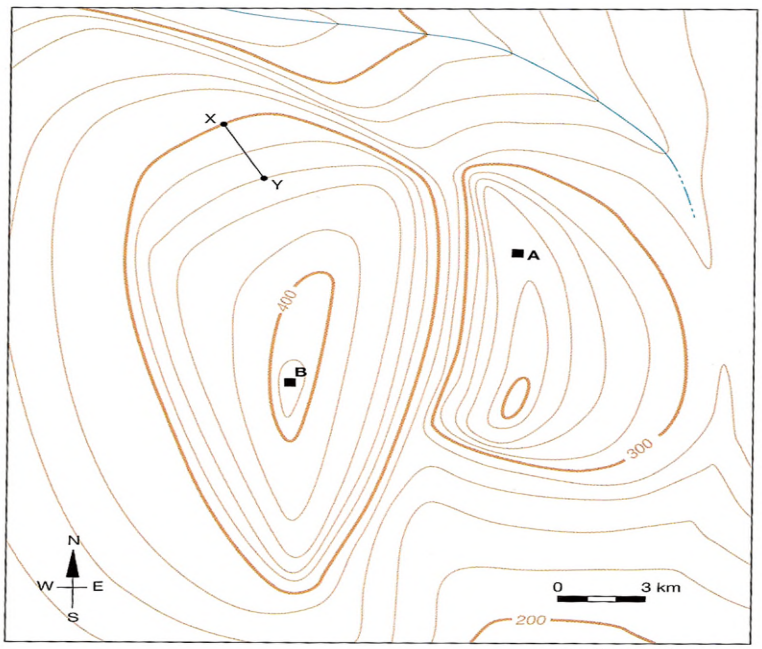


FIGURE 9.19 Complete this topographic map. Use a contour interval of 10 ft and label the elevation of every contour on the map. (*Hint*: Start at sea level and refer to Figures 9.8 and 9.9.)

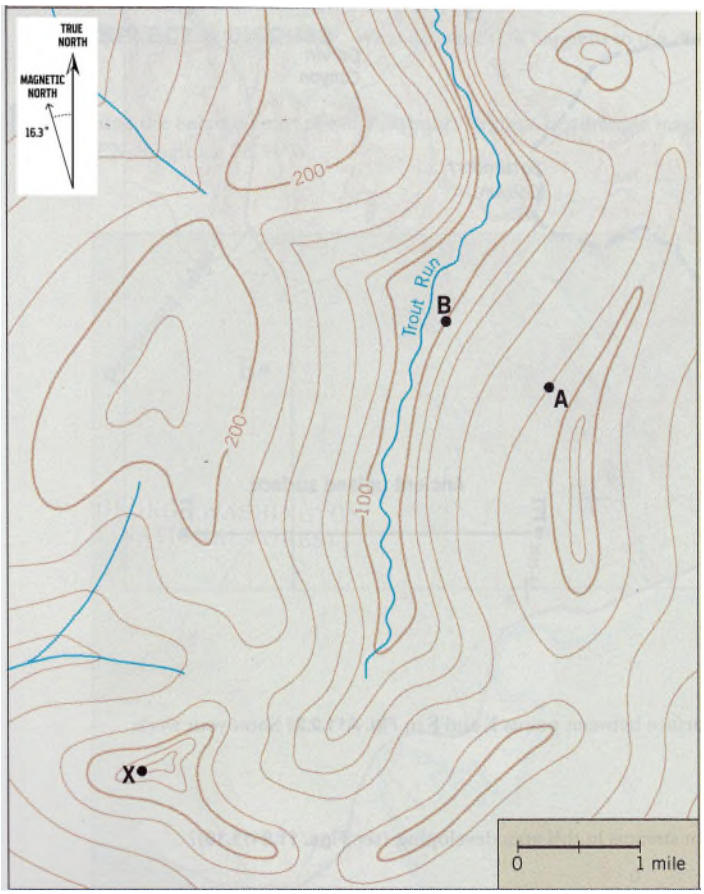


Elevations are in meters.

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 Simple Topographic Map

Instructions: Answer the following questions for the Trout Run topographic map illustrated below



1) The dimensions of the map is _____ miles by _____ miles.

2) What is the verbal scale of this map?

1 inch of map = _____ miles of real ground

3) What is the contour interval? _____feet

4) What's the **index** contour interval? _____ feet

5) What is the total (maximum) relief of the map? (Subtract lowest elevation from highest)

Total relief = _____ feet

6) What is the elevation of Point B? _____ feet

7) What is the elevation of Point X? _____ feet

8) Which direction does water flow in Trout Run creek? North or South? _____

9) What is the magnitude (degrees) and direction (W or E) of magnetic declination? _____ ___

10) Very tightly-spaced set of parallel contour lines represent what type of geographic features?

Answer:_____

11) Very broadly-spaced set of parallel contour lines represent what type of geographic features?

Answer:_____

12) Sets of contour lines that form "V"-shaped pattern that *points to higher elevations* represent what sort of general geographic feature? (hint: choose either stream valley or ridge line)

Answer:_____

13) Sets of contour lines that form "V"-shaped pattern that *points to lower elevations* represent what sort of geographic feature? (hint: choose either stream valley or ridge line)

Answer:_____

14) What is the horizontal distance from point "A" to point "B"? (in miles). _____ miles

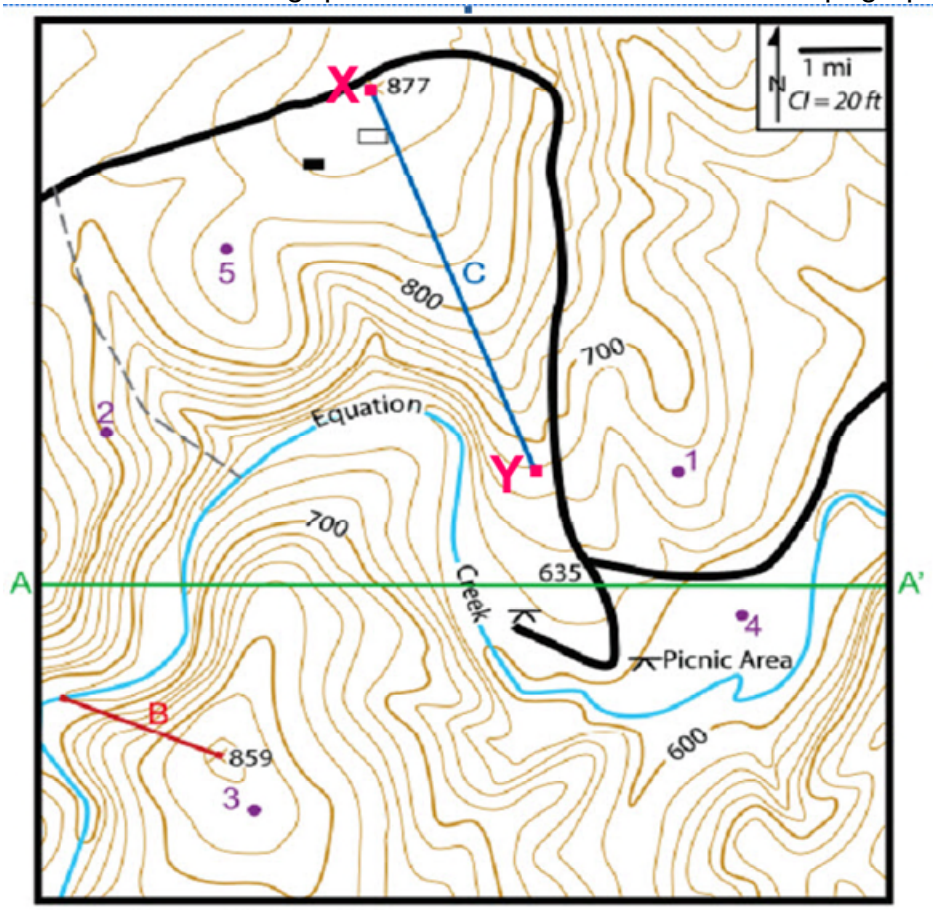
15) What is the elevation difference between points "A" and "B" (in feet)? _____ feet

16) What is the slope gradient from "A" to "B"? (in feet per mile). Do the calculation below

Calculation: Answer: _____ feet per mile

Part III. Analysis of Another Simple Topographic Map

Instructions: Answer the following questions for the Math State Park topographic map below



Topographic Map of Math State Park

1) The dimensions of the map are _____ miles by _____ miles.

2) What is the verbal scale of this map? 1 inch of map = _____ miles of real ground

3) What is the contour interval? _____feet **4)** What is the **index** contour interval? ____ feet

4) Which of these locations (points 1 through 5) has a **lowest** elevation? _____

5) Which of these locations (points 1 through 5) has a **highest** elevation? _____

6) The elevation of Picnic Area is _____ feet. Estimate the elevation of Point 5. _____ feet.

7) What is the total (maximum) relief of the entire map? Total relief = _____ feet

8) What is the distance of from point "X" to point "Y" (in miles)? _____ miles.

9) What is the bearing (direction) from point "X" to point "Y"? Azimuth: _____ Quad: _____

10) What is the slope gradient for Line "B"? (in feet per mile). Do the calculation below.

Calculation: Answer: _____ feet per mile

11) Which direction does Equation Creek flow? East or West? _____

Part II. Analysis of Poway 7 ½ Minute Quadrangle USGS Topographic Map

Instructions: Complete the following map analysis activities for the Poway 7 ½ or 15 minute quadrangle topographic map supplied by your instructor.

1) What is the name of your map? _____

2) What type of map projection was used to make this map? _____

3) The size of the map is _____ minutes (latitude) by _____ minutes (longitude)

4) What is the fractional ratio scale of this map? _____

5) What is the verbal scale of this map? 1 inch of map = _____ miles of real ground

6) What is the contour interval? _____feet What's the **index** contour interval? _____ feet

7) What's the name of the adjacent quadrangle to the <u>northeast</u> of this map? _____

8) What is the total (maximum) relief of the map? (Subtract lowest map elevation from highest)

Total relief = _____ feet

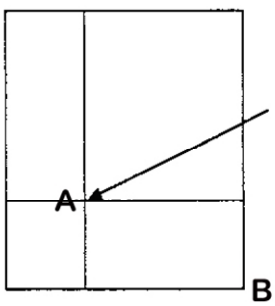
9) How many square miles does this map cover? (Multiply map length miles by map width miles)

Total area of map = _____square miles

10) What year was this map last updated? _____

11) What is the amount (degrees) and direction (W or E) of magnetic declination? _____ ___

12) 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 <u>left</u> edge of the map? (Location point "A" on map)



Lat. _____

Long. _____

13) Determine point "A" location by UTM zone, northing, and easting coordinates:

Zone _____ _____N _____E

14) Determine the Township, Range, Section, section quarter and quarter-quarter for location "A"

____ ¼ of the _____ ¼ of Section _____ of Township: _T____ Range: _R_____

15) What is the distance from point A to point B on the map? _____feet; _____miles

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

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

18) What is the type of ground cover for the immediate region around point "A"? _____

19) Which direction does water flow in Beeler Canyon? _____

20) Calculate slope gradient between top of Black Mountain and Hilltop Community Park.

Calculation here: *Answer:* _____ feet per mile

Part V. Topographic Map Laboratory Reflection

Directions: Write a 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

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.*

_____

_____

_____

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