MiSP Topographic Maps Worksheet #1a L3

Name _____ Date _____

SLOPE AND TOPOGRAPHIC CONTOURS

Introduction:

Topographic contours are shown by lines of different widths. Each contour is a line of equal elevation; therefore, contours never cross. They show the general shape of the terrain. To help the user determine elevations, index contours are wider. Elevation values are printed in several places along these lines. The narrower intermediate and supplementary contours found between the index contours help show more details of the land surface shape. Contours that are very close together represent steep slopes. Widely spaced contours or an absence of contours means that the ground slope is relatively level. The elevation difference between adjacent contour lines, called the contour interval, is selected to best show the general shape of the terrain. A map of a relatively flat area may have a contour interval of 10 feet or less. Maps in mountainous areas may have contour intervals of 100 feet or more. The contour interval is printed in the margin of each U.S. Geological Survey (USGS) map. [This paragraph was excerpted from http://egsc.usgs.gov/isb/pubs/booklets/symbols/]

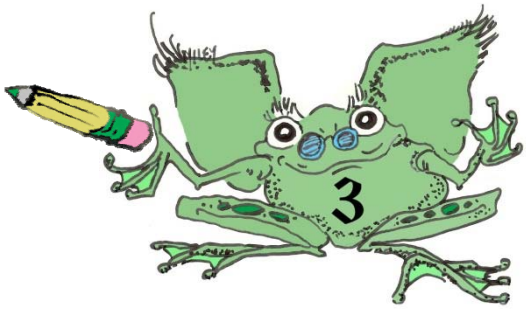
Materials:

- Topographic Maps Worksheet #1b
- Ruler

Procedure:

Check off each step as you complete it.

- ☐ Examine the simple map of Ellipse Island on Worksheet #1b. Note the key information.
- ☐ Two teams of hikers traveled to an elevation of 100 feet on the island. One group followed the path indicated by the line from A to B. The other group followed the line from C to D. Measure the horizontal map distance (to the nearest 0.25 inch) to each contour line that each group hiked across. Write the measurements on the chart on the next page.
- ☐ Convert the map distances to horizontal distance (distance relative to the ground) traveled by each team of hikers by multiplying the measured distance on the map (inches) times the scale distance: (measured map inches) x 0.5 mile/.25 inch.



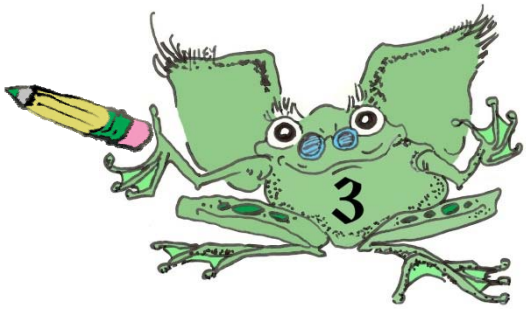
Record the data here:

A West to East Hikers (A to B) Total Distance Hiked to Contour Intervals:	B Map Distance to the nearest 0.25 inch	C Hiking Distance to the nearest 0.5 mile (COLUMN B) x 0.5 mile/.25 inch
20 feet		
40		
60		
80		
100		
West to East Hikers (C to D) Total Distance Hiked to Contour Intervals:	Map Distance to the nearest 0.25 inch	Hiking Distance to the nearest 0.5 mile (COLUMN B) x 0.5 mile/.25 inch
20 feet		
40		
60		
80		
100		

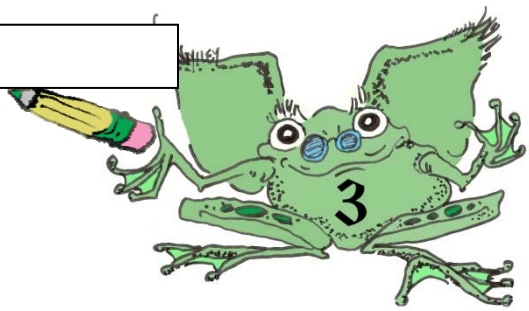
Graph the data:

Graph the data on the next page to show the relationship between the hiking distance (miles) for each group and the contour interval (elevation above sea level).

- Label the *x*-axis with hiking distance (miles).
- Label the *y*-axis with elevation (feet).
- Connect the data points for each group of hikers. Use two different colors and write a key for the graph.



Key
A–B distances and height:
C–D distances and height:



Discussion Questions:

1. We do not know what the highest elevation is on Ellipse Island but we do know it is less than 120 feet. How do we know it is less than 120 feet?

_____

_____

2a. A map is two-dimensional but the trails these hikers were on are three-dimensional. The distance each group walked from A to B or C to D was longer than it would have been if they had been walking on a flat island. Look at the graph. Which group traveled the greatest horizontal distance in miles (horizontal distance = distance traveled from A to B or C to D) if there was no change in elevation?

_____

_____

2b. Which group traveled the greatest TOTAL distance (distance along the slope) in miles? How do you know that?

_____

_____

2c. Look again at the graph. Which group had the steepest climb? How do you know that?

_____

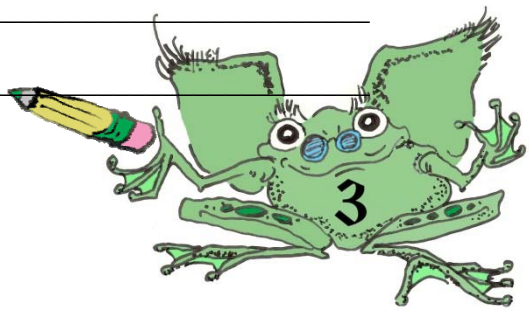
_____

3. One of the hikers in the group traveling the A to B path broke off from the group and hiked for 4 miles around the island, using a GPS devise to stay at an elevation of 40 feet (his path took him along the 40' contour line). What would a graph of his distance traveled versus elevation look like?

_____

_____

_____



4. Using the graph, determine the elevation of each group after they've hiked 2.25 miles relative to the ground:

   A to B hiking group after 2.25 miles — elevation = _____ feet

   C to D hiking group after 2.25 miles — elevation = _____ feet

5. Look at the graph you drew. You will compare the average grade (steepness) of the hike for the two groups by calculating the unit rate of change (slope) of each line.

   Unit Rate of Change = $\frac{\Delta \text{ Elevation (feet)}}{\Delta \text{ Hiking Distance (miles)}} = \frac{\Delta y}{\Delta x} = \frac{(y_2 - y_1)}{(x_2 - x_1)}$

Graphed data	Ordered Pair (x_1, y_1) (x_2, y_2)	Δ Elevation (feet) Δy	Δ Hiking Distance (miles) Δx	**Unit Rate of Change (slope)** $\Delta y / \Delta x$
A to B hikers				
C to D hikers				

6. How do the unit rates of change (slopes) of the graphed data for the two routes compare? Discuss numerical value and sign (positive/+ or negative/-).

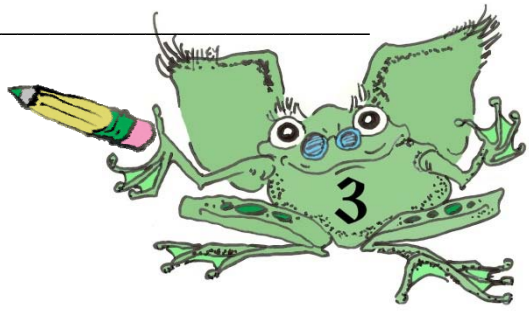
   _____

   _____

7. What would be different about the unit rates of change (slopes) if we graphed the hikers going down the hills (B to A and D to C)?

   _____

   _____



8. The graphed lines for both hiking teams have a *y*-intercept of 0 (zero). That indicates that when each hiking team started (their mileage was 0), their elevation was _____ feet.

9. Based on the unit rates of change (slopes) that you calculated above and the *y*-intercepts, write an equation for the distance/elevation graph for each hiking group. Remember that the equation for a line is $\boldsymbol{y = mx + b}$ and *m* is the unit rate of change (slope) and *b* is the *y*-intercept.

Equation — A to B hikers	Equation — C to D hikers

10. Using each equation above, calculate the predicted elevation in feet for the total hiking distance indicated. Show your work.

Total Hiking Distance	A to B Group	C to D Group
x = .3 mile	y = _____ ft	y = _____ ft
x = 2.1 miles	y = _____ ft	y = _____ ft
x = 4.7 miles	y = _____ ft	XXXXXXXXXXXXXXX

11a. Why is the C to D group's 4.7-mile box blocked out?

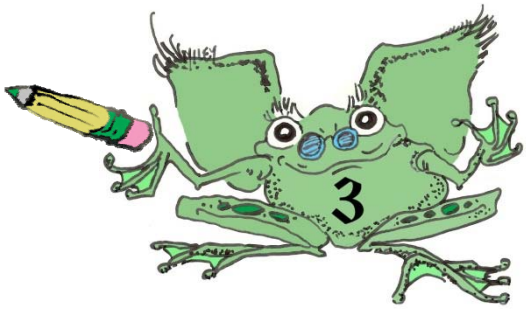
_____

_____

11b. Why is each calculated elevation an <u>estimate</u>?

_____

_____



Extension:

What is the total distance hiked by each of the hiking teams? Show your work.