

Isarithmic Mapping

- ▶ An Isarithmic maps is a type of thematic map that represents real or abstract three-dimensional surfaces by depicting continuous phenomena.
- ▶ There are two kinds of lines of equal value used to demarcate continuous surfaces on the map:
 - Isometric lines show distribution of values that can be referenced to points.
 - Isopleth lines show distribution of values that cannot be referenced to points."

▶ True point data

- Data is actually measured at the point location
 - e.g. The location of weather station for temperature map
- This kind of map is called isometric map

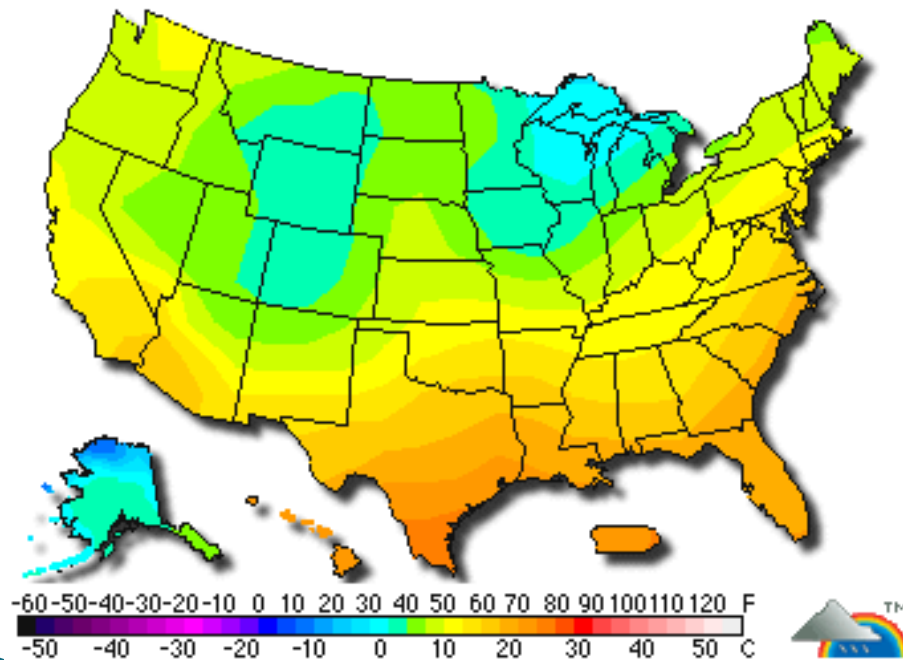
▶ Conceptual point data

- Data is collected over areas, and the map is constructed by interpolating given values at the centroid of areas
 - e.g. The location of census tract for murder rate map
- This kind of map is called isopleth map

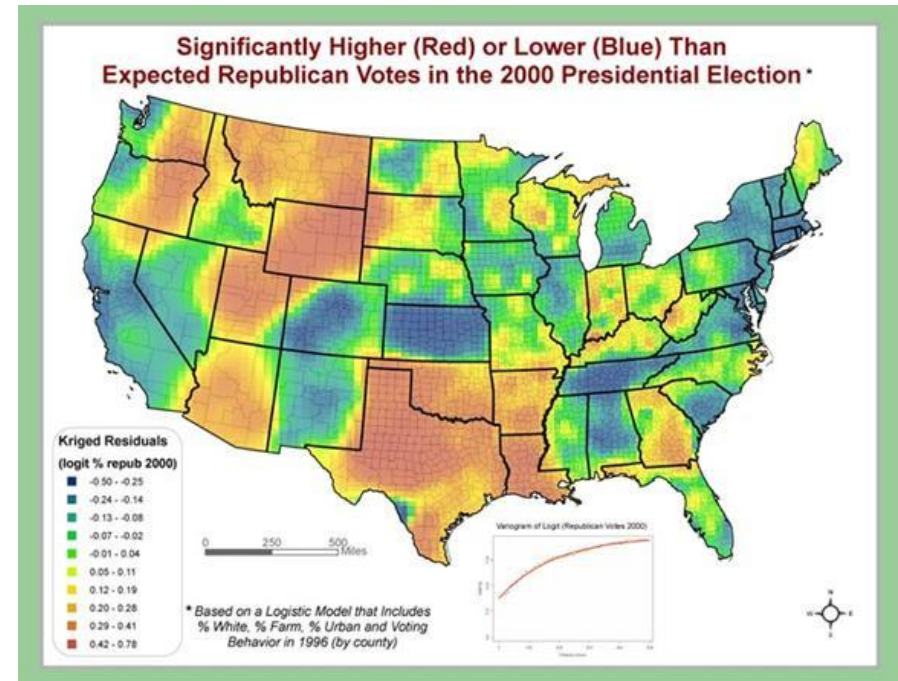
Isometric or isopleth map?

► Think how data is collected

Current temperature in the US



Voting behavior in the US



- ▶ Isarithmic mapping involves representing a real or conceptual three-dimensional geographical volume with quantitative line symbols.
- ▶ In isometric maps, the lines depict data values at specific points on a continuous distribution.
- ▶ In other words, the dataset provides data points that define the lines.
- ▶ In general, these maps are used to help visualize continuous data sets by utilizing color/hue, value, and shade.
- ▶ Topographic maps and temperature maps are good examples of data that are measured at specific locations.

- ▶ Isarithmic lines join all points of same value, whether measured or interpolated.
There are many different types of isarithmic lines.
- ▶ Some examples are:

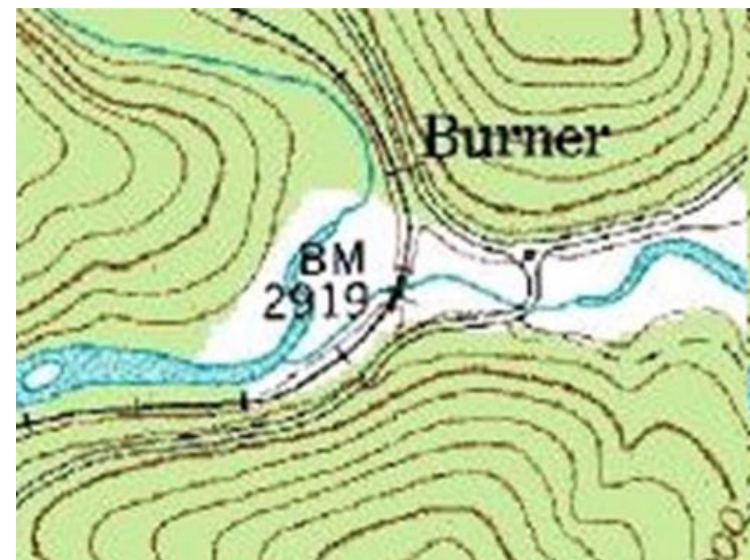
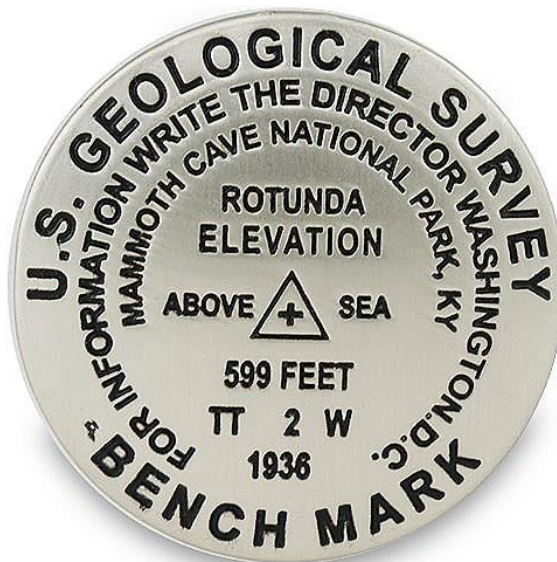


- ▶ Isolines, also called Countour lines, lines of equal elevation
- ▶ Isotherms, lines of equal temperature
- ▶ Isogeotherms, lines of equal annual mean temperature
- ▶ Isocheims, lines of equal mean winter temperature
- ▶ Isotheres, lines of equal mean summer temperature
- ▶ Isohels, lines of equal or constant solar radiation
- ▶ Isobars, lines of equal atmospheric pressure
- ▶ Isosteres, lines of equal atmospheric density
- ▶ Isodrosotherms, is a line of equal or constant dew point
- ▶ Isohyets, lines of equal rainfall



- ▶ Isohumes, lines of constant relative humidity
- ▶ Isonephhs, lines indicating equal cloud cover
- ▶ Isochalazs, lines constant frequency of hail storms
- ▶ Isobronts, lines at which a given phase of thunderstorm activity occurred simultaneously
- ▶ Isochrones, lines of equal travel time
- ▶ Isodapanes, lines of equal transport cost
- ▶ Isotachs, lines of equal wind speed
- ▶ Isogons, lines of equivalent angle (such as magnetic direction)
- ▶ Isobathytherms, lines showing depths of water with equal temperature
- ▶ Isohalines, lines of equal ocean salinity
- ▶ Isopycnals, are surfaces of equal water density

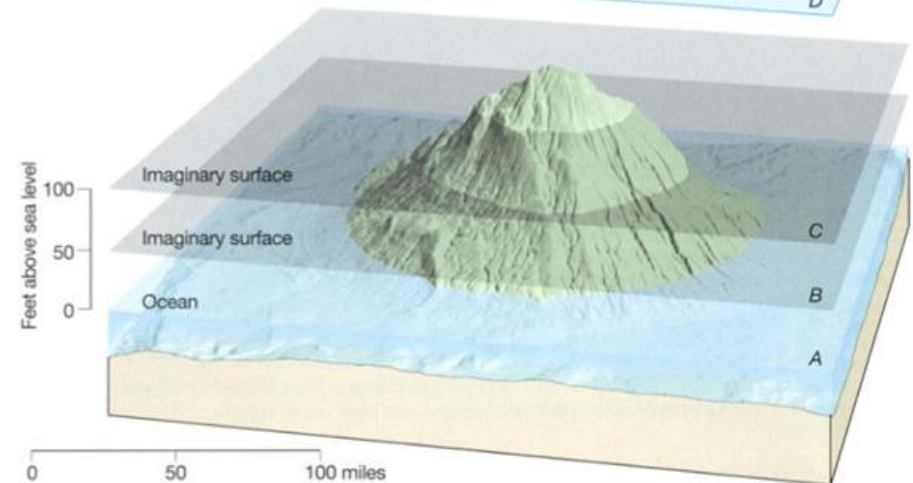
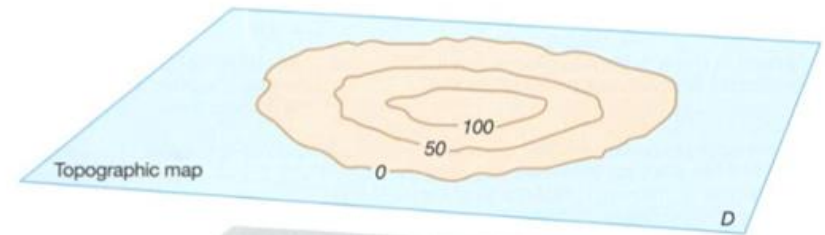
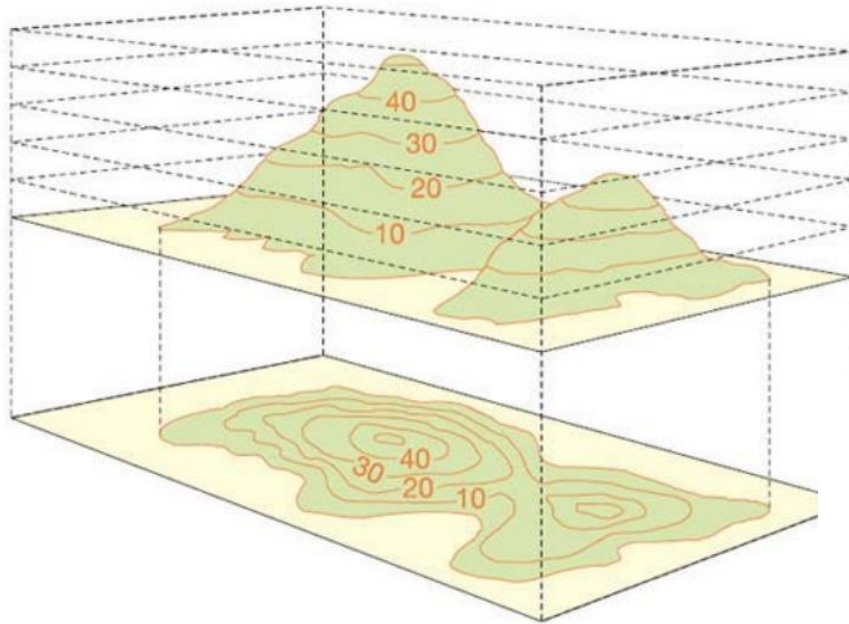
- ▶ An Isarithmic map uses isolines (**contour lines**) to show elevation.
- ▶ Contour lines connect points of equal elevation above a specified reference, usually as sea level.
- ▶ Benchmarks are locations where the elevation has been surveyed.
- ▶ Benchmarks are denoted on a map with the letters "BM", "X" or a triangle with the elevation printed beside



PRINCIPAL CHARACTERISTICS OF CONTOUR LINE

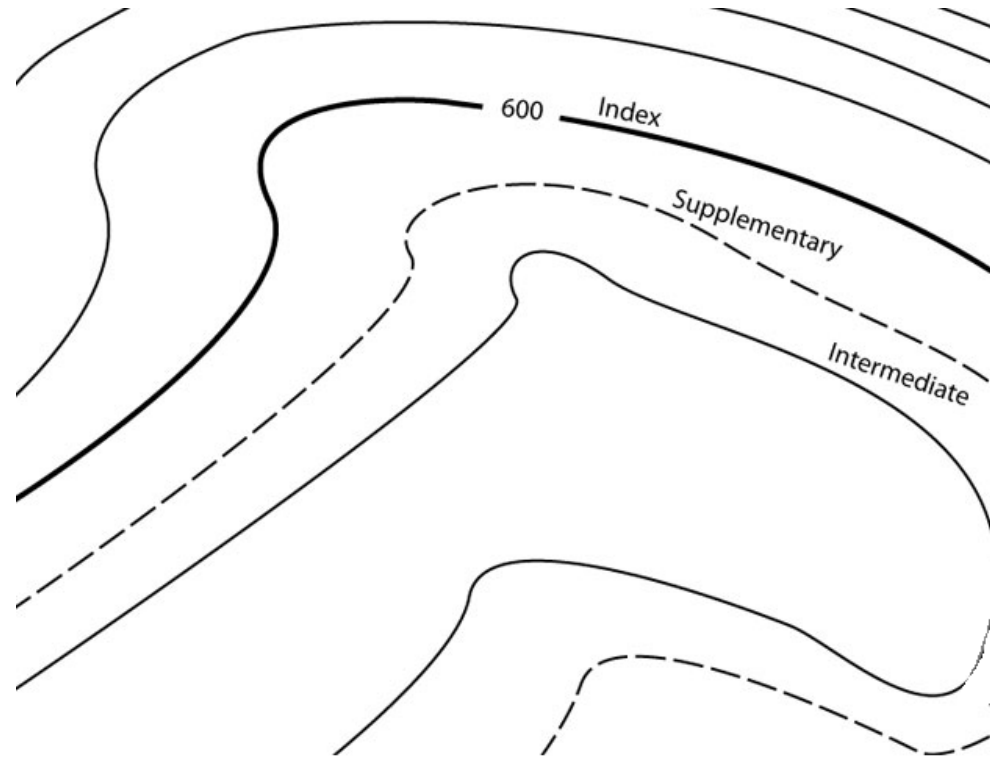
- ▶ A contour may be defined as a line of intersection of a level surface with the surface of the ground.
- ▶ This means every point on the contour line has the same altitude as that of the assumed intersecting surface.
- ▶ Contour lines are a method of depicting the 3-dimensional character of the terrain on a 2-dimensional map.
- ▶ Understanding contours is a very useful navigation skill because you can identify the lay of the land and landscape features as they appear on the ground.

View of contours in 3D and 2D



Types of Contour Lines

- ▶ Index Contour Lines
- ▶ Intermediate Contours
- ▶ Supplementary Contours
- ▶ Depression Contours





- ▶ To make the contour map easier to read and follow, the contour lines are labeled periodically.
- ▶ In order to develop visual levels, these labeled index contours are also made noticeably thicker than other intermediate contours.
- ▶ Index labels should be easy to read, but not so large as to dominate the map.
- ▶ Do not place labels upside down.
- ▶ Each label should be placed consistent with flow of the line to which it is associated.

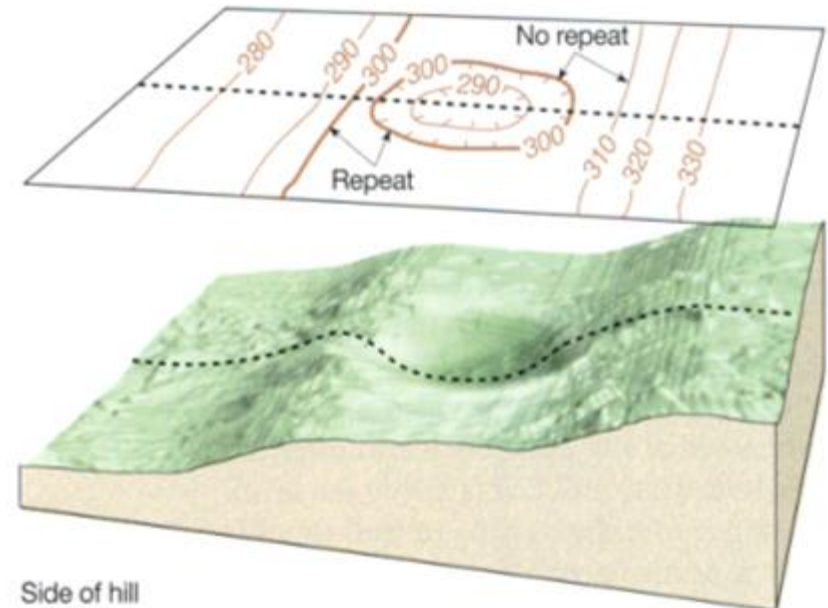
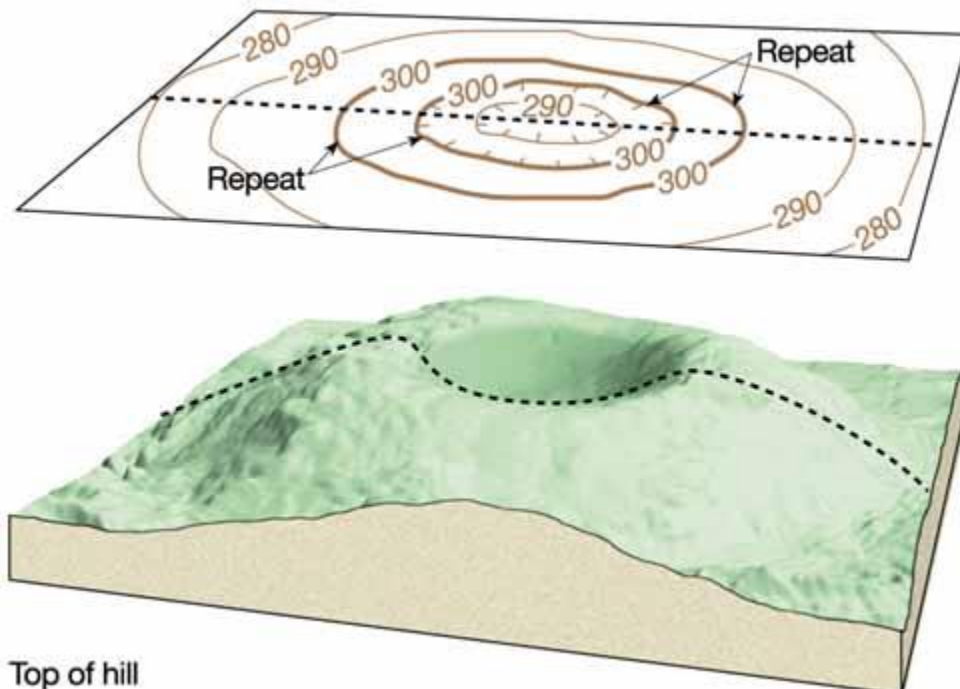


- ▶ The intermediate regular contours are between the index contours
- ▶ Drawn with a finer line weight with solid color.

- ▶ Supplementary contours are appropriate in the areas of flat terrain, where contours drawn at the basic interval would be spaced relatively far apart.
- ▶ They are usually are drawn as **dashed** or **dotted** lines to distinguish them from contours drawn at the basic interval.

Depression Contours

- ▶ When an area lies at a lower elevation than all of the surrounding terrain, it forms a depression.
- ▶ A depression on the land surface is often mapped with depression contours.
- ▶ Short ticks are drawn at right angle to the contour lines.
- ▶ The ticks point downslope toward the bottom of the depression.



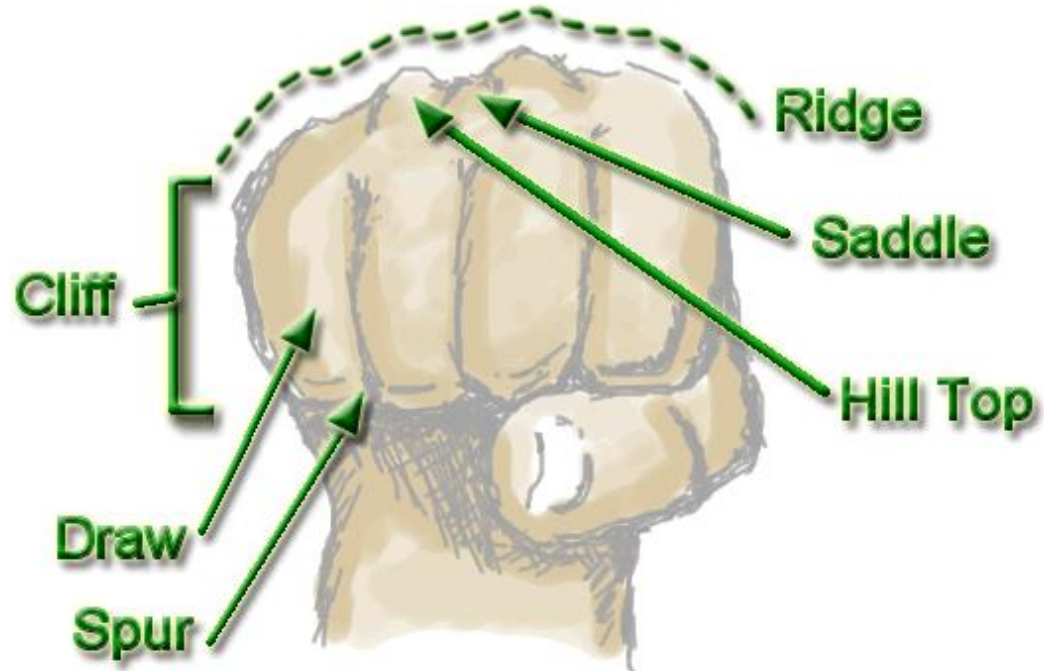
- ▶ Steep slopes: contours are closely spaced
- ▶ Gentle slopes: contours are less closely spaced
- ▶ Valleys: contours form a V-shape pointing up the hill – these V's are always an indication of a drainage path which could also be a stream or river.
- ▶ Ridges : contours form a V-shape pointing down the hill
- ▶ Summits: contours forming circles
- ▶ Depressions : are indicated by circular contour with lines radiating to the center.

▶ Major-Five

- Hill
- Ridge
- Valley
- Saddle
- Depression

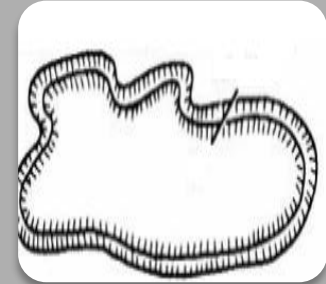
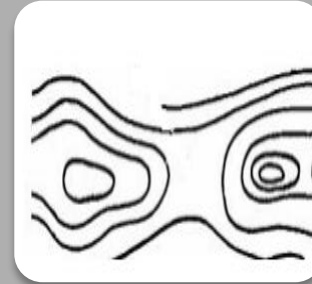
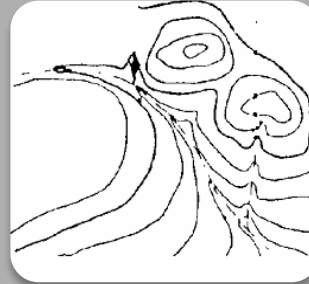
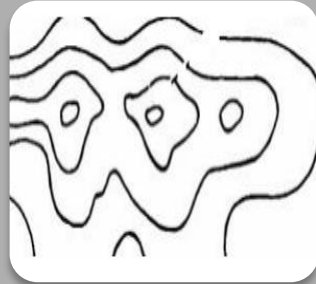
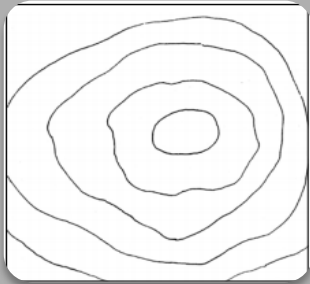
▶ Minor-Three

- Draw
- Spur
- Cliff



Using a Fist to Explain Terrain Features

Five Major Terrain Features



Hill

Ridge

Valley

Saddle

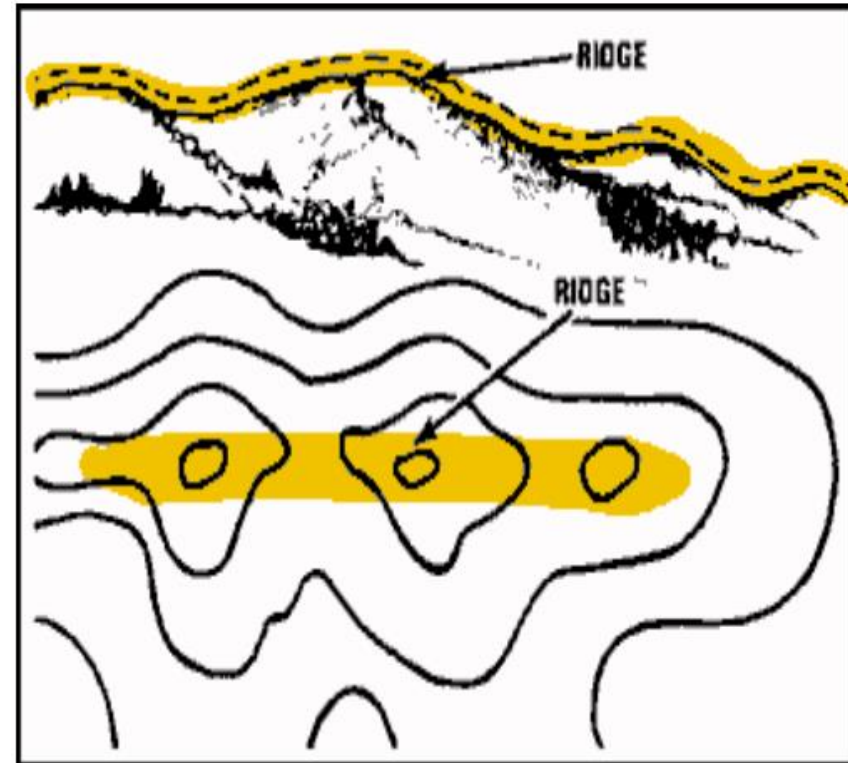
Depression

- ▶ A hill is a point or small area of high ground.
- ▶ When you are on a hilltop, the ground slopes down in all directions.
- ▶ The height and slope of a hill are represented on a map by the number of concentric contour rings and the distance between the rings.



Ridge

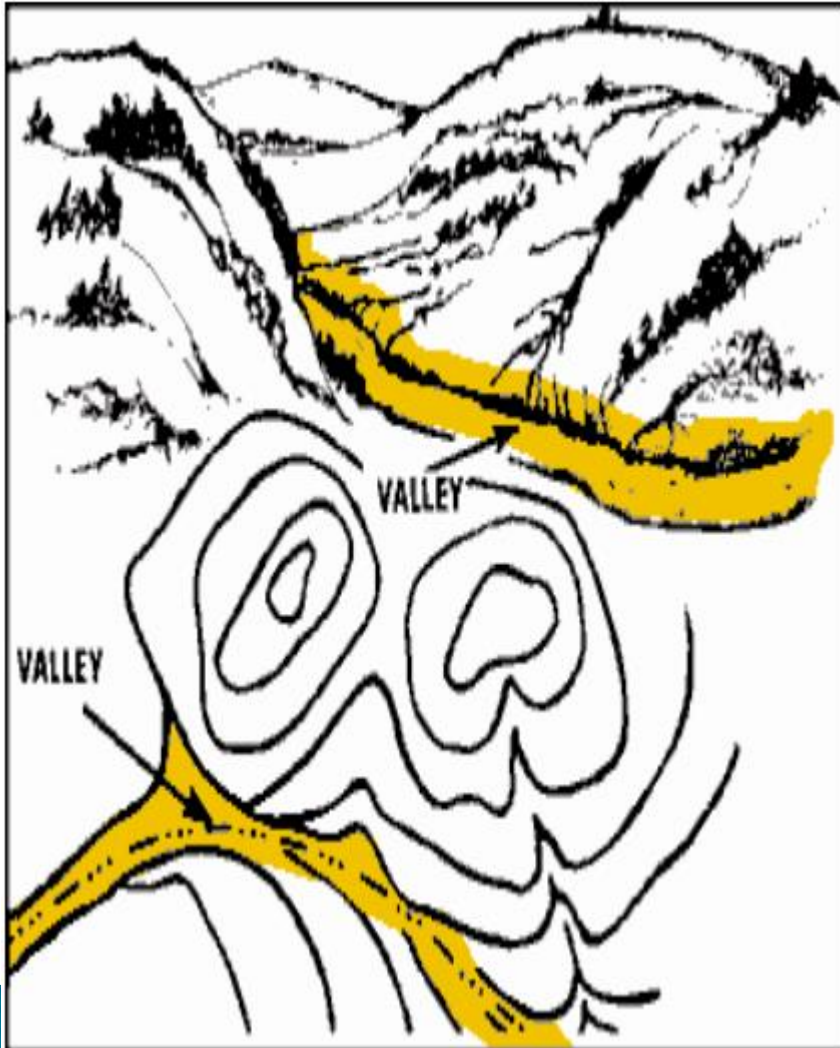
- ▶ A ridge is a line of high ground with height variations along its crest.
- ▶ A ridge is not simply a line of hills. All of the points of the ridge crest are higher than the ground on both sides of the ridge.
- ▶ You can identify a ridge on a map by looking for contour lines forming a U or V.
- ▶ The closed end of the U or V points away from high ground.





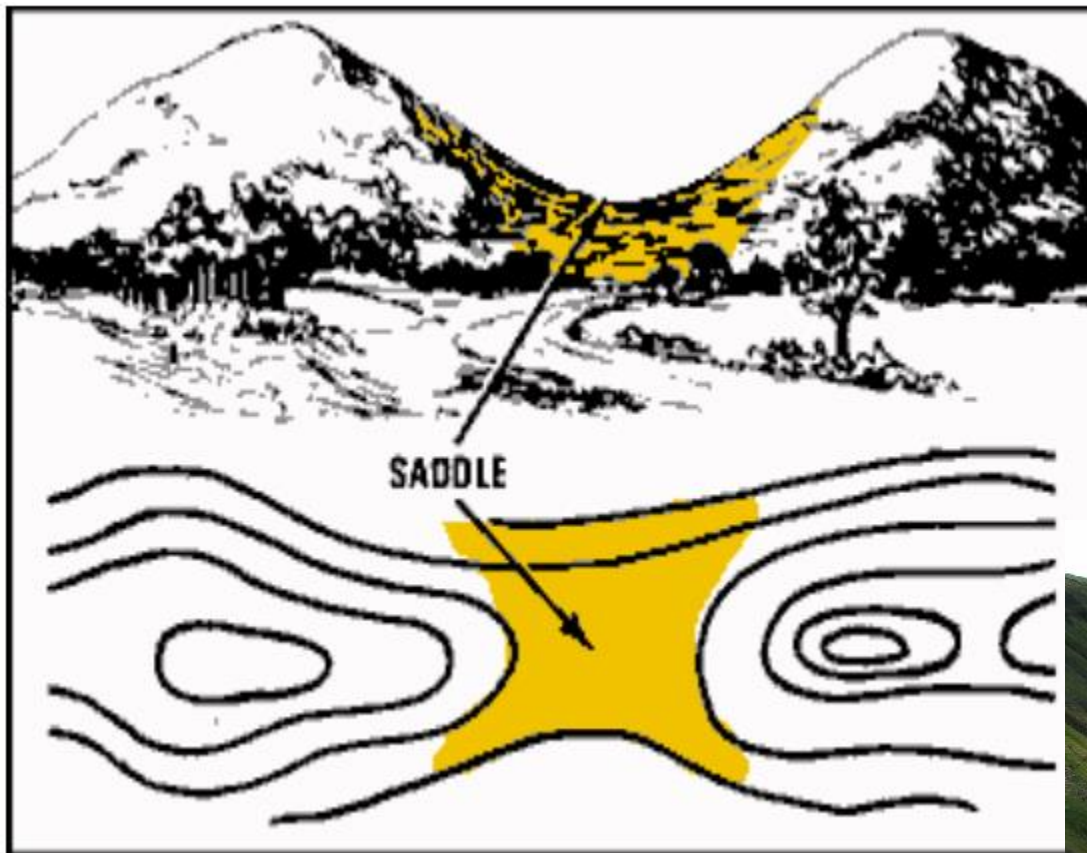
- ▶ A valley is a reasonably level ground bordered on the sides by higher ground. It generally has room to maneuver within it.
- ▶ A valley may or may not contain a stream course running through it. Contour lines indicating a valley are Ushaped and are usually a dotted or broken line.
- ▶ “Arrows” that point upstream are valleys

Valley



- ▶ A saddle is a dip or low point along the crest of a ridge. A saddle is not necessarily the lower ground between two hilltops.
- ▶ It may also be a break along an otherwise level ridge crest.
- ▶ A saddle is normally represented as an hourglass shape on a map.
- ▶ The hourglass is made by contour lines narrowing between two groups of concentric circles that indicate hilltops or points of raised ground.

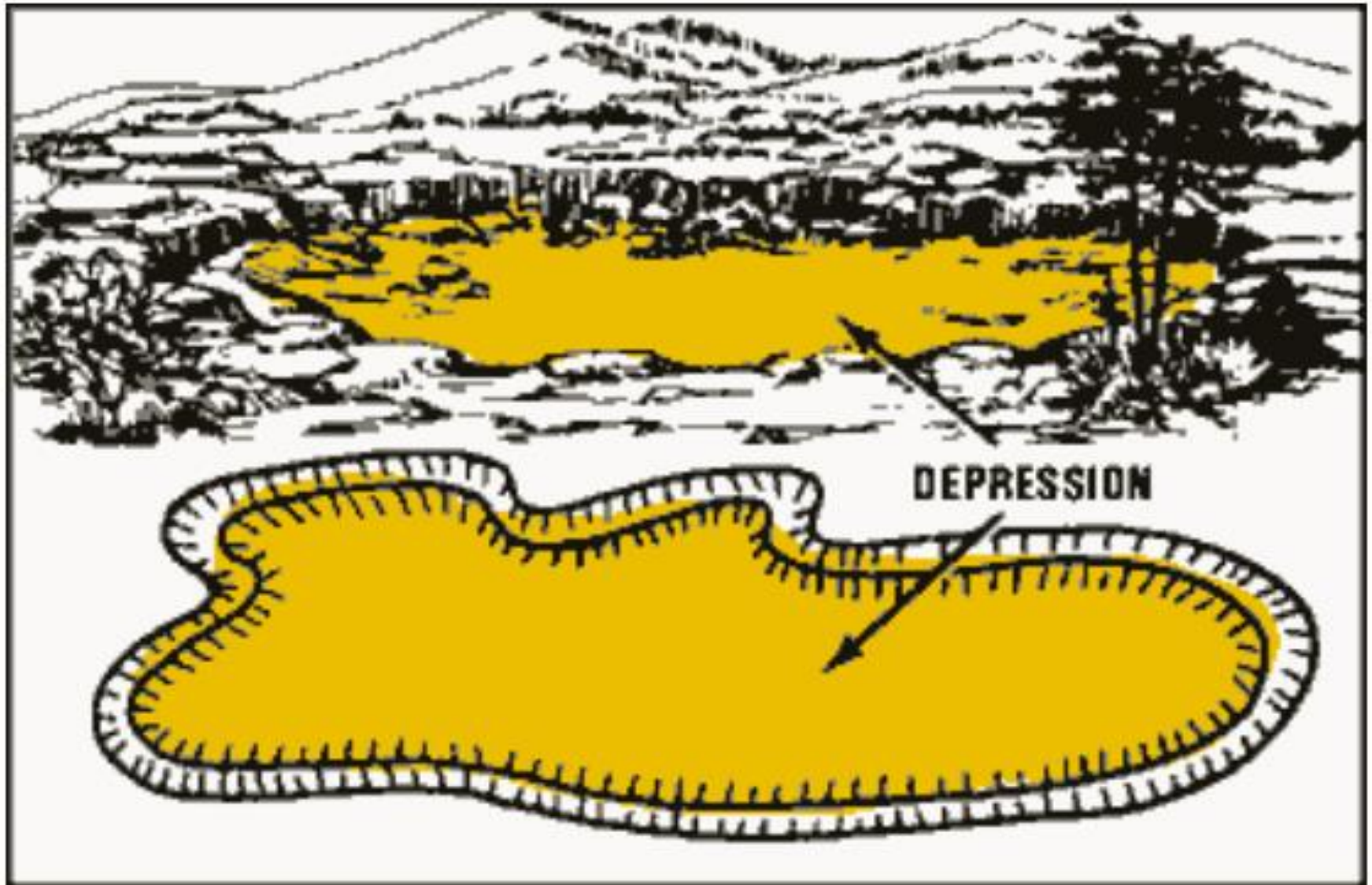
Saddle

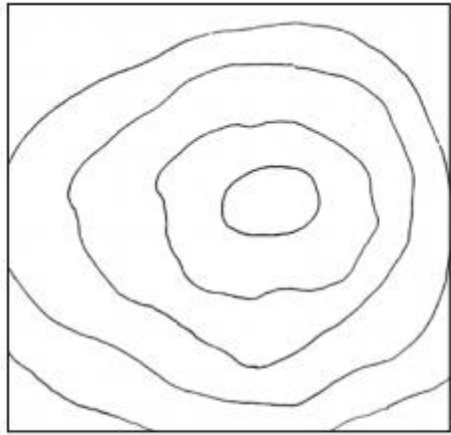




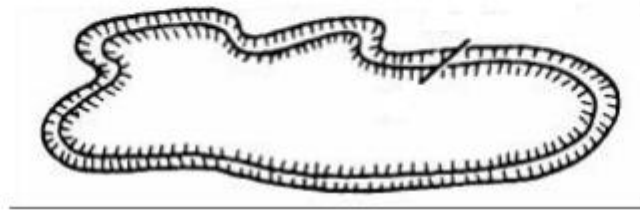
- ▶ A depression is a low point or hole in the ground that is also surrounded on all sides by higher ground.
- ▶ A depression generally has no or little room to maneuver within it.
- ▶ The map symbol that represents a depression is closed contour lines that have tick marks. The tick marks point toward the low ground or down slope

Depression





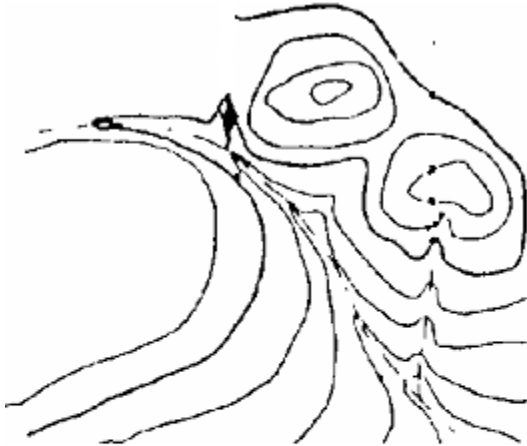
Hill



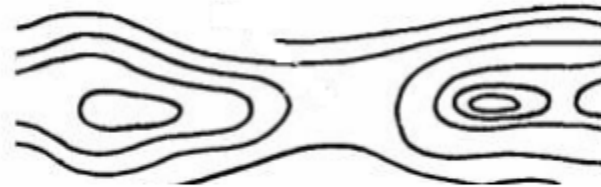
Depression



Ridge



Valley



Saddle

Three Minor Terrain Features



Draw

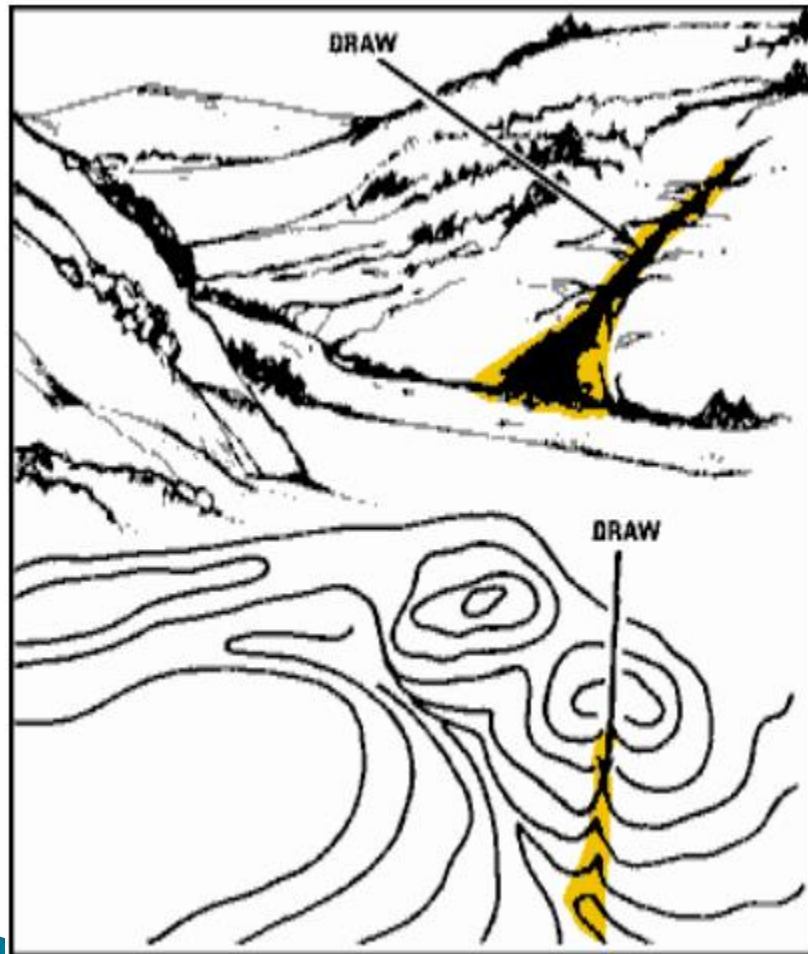


Spur

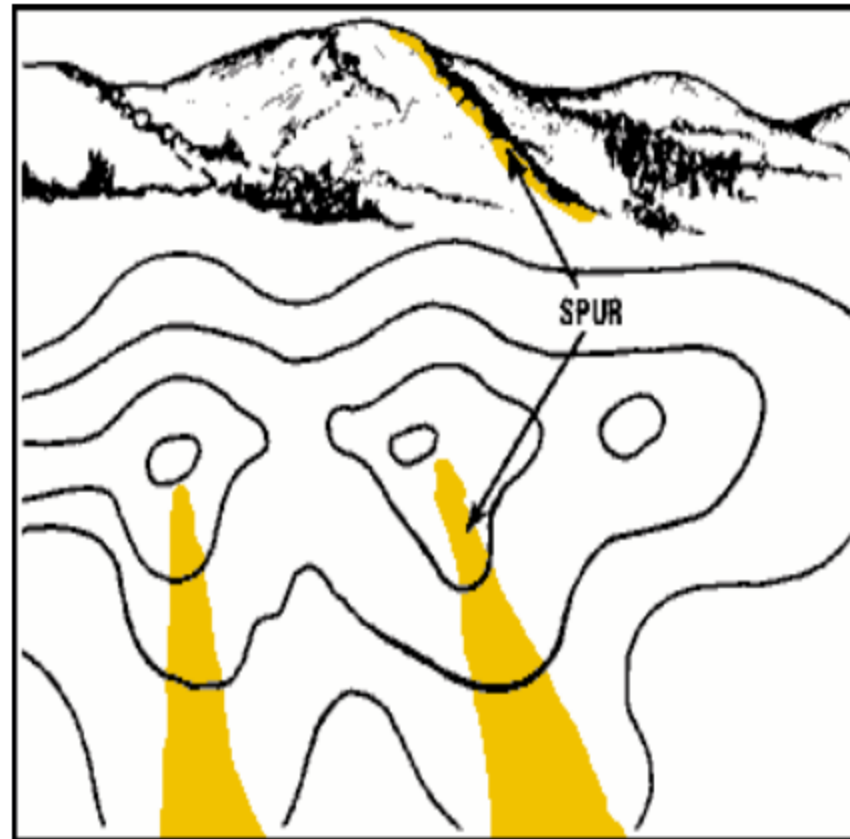


Cliff

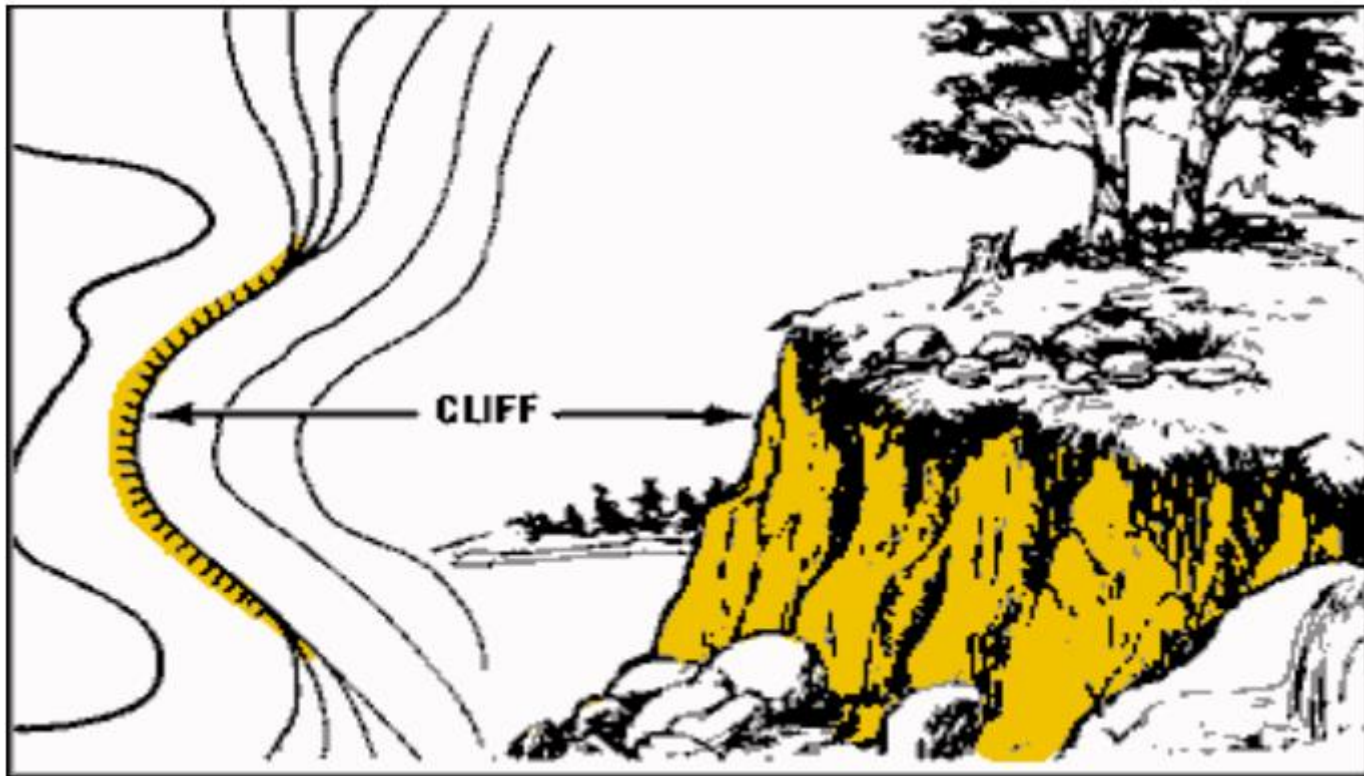
- ▶ A draw is similar to a valley except it usually has a less developed course.
- ▶ There is generally no level ground and, therefore, little or no room to maneuver.
- ▶ The ground slopes upward on each side and toward the head of the draw.
- ▶ Draws are caused by flash floods and can be found on flat terrain but are more often found along the sides of ridges. Contour lines indicating a draw are shaped like a V with the point of the V pointing toward the head of the draw.



- ▶ A spur is usually a short, continuously sloping line of higher ground, normally jutting out from the side of a ridge.
- ▶ A spur is often formed by two very parallel streams cutting gullies or draws down the side of a ridge.
- ▶ You can spot a spur on a map when the contour lines form a U or V shape that points away from the higher ground.



- ▶ A cliff is a vertical or near-vertical slope.
- ▶ A cliff may be shown on a map by contour lines that are very close together.
- ▶ A cliff is also shown as a ticked contour line with the tick marks pointing towards the lower ground.



- ▶ What terrain feature is a vertical or near vertical slope?
 - CLIFF
- ▶ What terrain feature is represented by contour lines are V-shaped with the point of the V toward the head of the high ground?
 - DRAW
- ▶ What terrain feature is represented by short, continuously sloping line of higher ground jutting out the side of a ridge?
 - SPUR