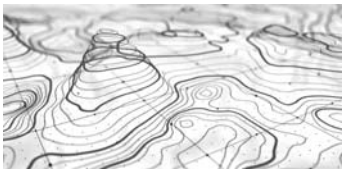
Topographic Survey

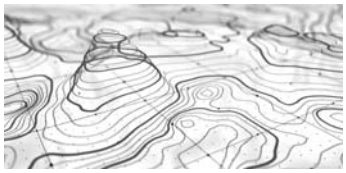
- ***Topography*** is the study of the shape and features of land surfaces.



- Topography is a field of geoscience and planetary science and is concerned with local detail in general, including not only relief but also natural and artificial features, and even local history and culture.

Topographic Survey

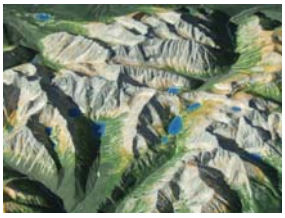
- ***Topography*** is the study of the shape and features of land surfaces.



- This meaning is less common in the United States, where topographic maps with elevation contours have made "topography" synonymous with relief.

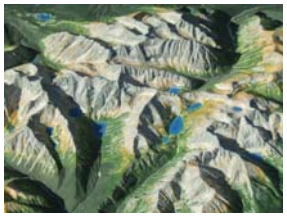
Topographic Survey

- ***Topography*** - defined as the shape or configuration or relief or three-dimensional quality of a surface
- Topography maps are very useful for engineers when planning and locating a faciltiy



Topographic Survey

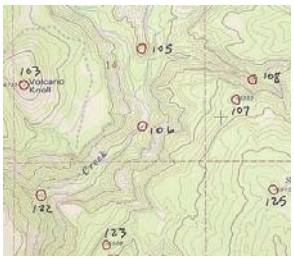
- U.S. Geological Survey (USGS) has developed maps for a large part of the US
- Napoleon Bonaparte received his first promotion because of ability to make and use maps



Topographic Survey

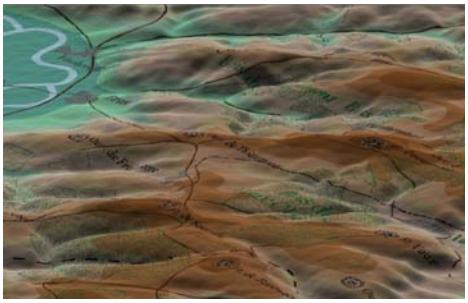
USGS Topographic Map of Mt. Shasta, CA - 1883

Typical USGS Topographic Map



Topographic Survey

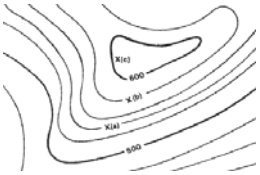
Topographic Survey



Topographic Survey

Contours

The most common method of representing the topography of an area is to use ***contour lines***



A ***contour line*** is an imaginary level line that connects points of equal elevation

Topographic Survey

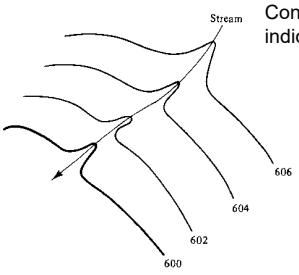
Contours

There are several rules to note when viewing topographic maps:

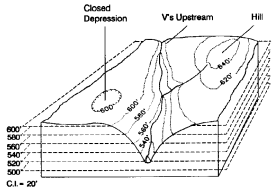
- **The rule of Vs:** sharp-pointed V usually are in stream valleys, with the drainage channel passing through the point of the V, with the V pointing upstream.
- **The rule of Os:** closed loops are normally uphill on the inside and downhill on the outside, and the innermost loop is the highest area.
- **Spacing of contours:** close contours indicate a steep slope; distant contours a shallow slope. Two or more contour lines merging indicates a cliff.

Topographic Survey

Contours

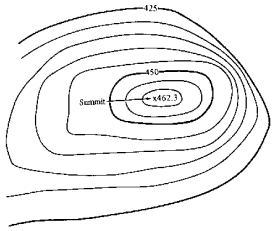


Contours that point up hill can indicate a valley or stream



Topographic Survey

Contours

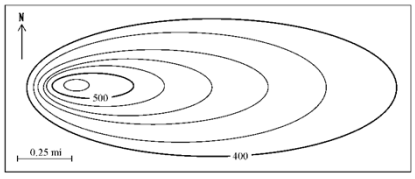


Imagine a hill that has its top sliced off with a really big knife

Topographic Survey

Contours

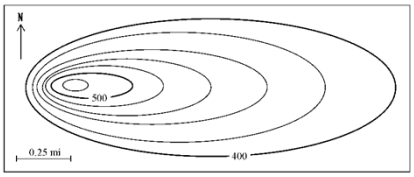
When is the steepest part of this terrain?



Topographic Survey

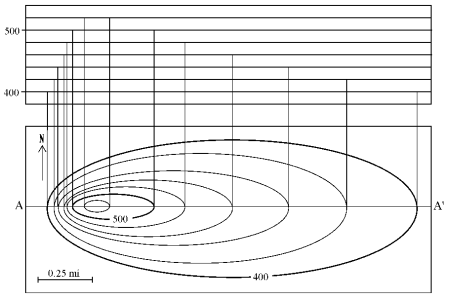
Contours

What is the shallowest part?



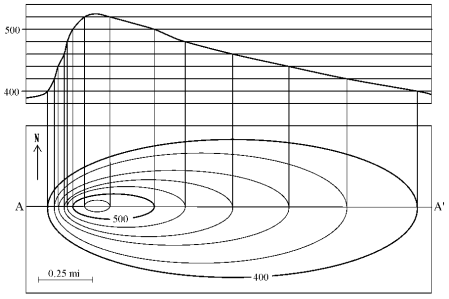
Topographic Survey

Contours



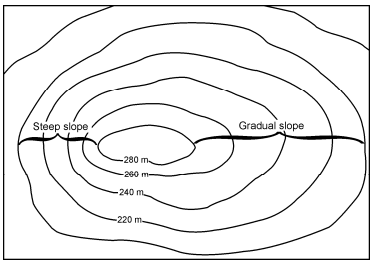
Topographic Survey

Contours



Topographic Survey

Contours



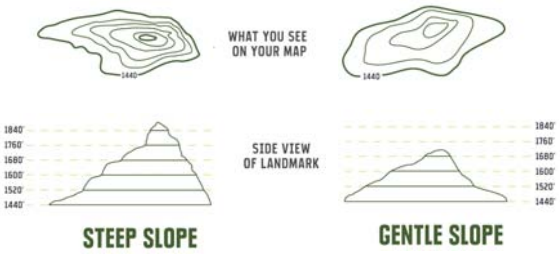
Topographic Survey

Contours

- The selection of the contour is important
- The contour interval should be small enough to give the desired topographic detail while remaining economic
- Usually every fifth contour line is shown in a heavy, wider line, this is called a ***index line***

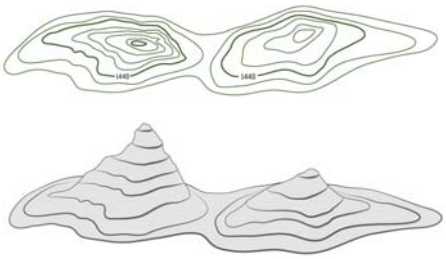
Topographic Survey

Contours



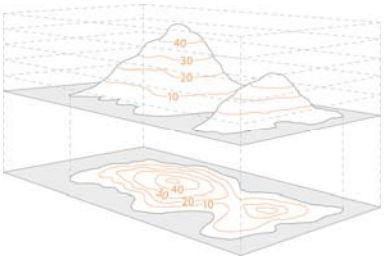
Topographic Survey

Contours



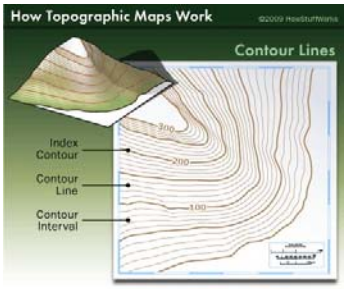
Topographic Survey

Contours



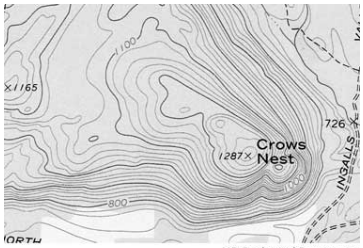
Topographic Survey

Contours



Topographic Survey

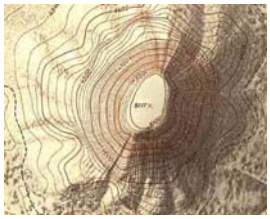
Contours



US Geological Survey map

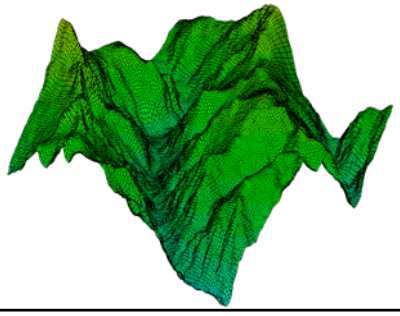
Topographic Survey

Contours



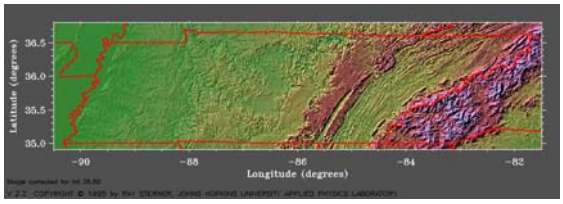
Topographic Survey

Contours



Topographic Survey

Contours



Topographic Survey

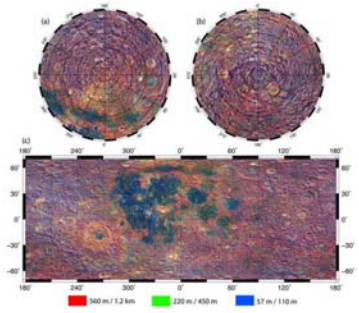
Contours

Topographic Survey

Contours

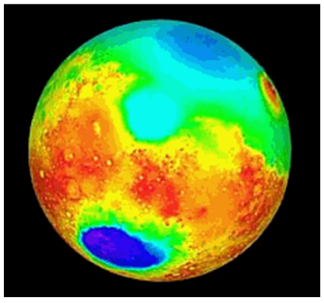
Topographic Survey

Contours



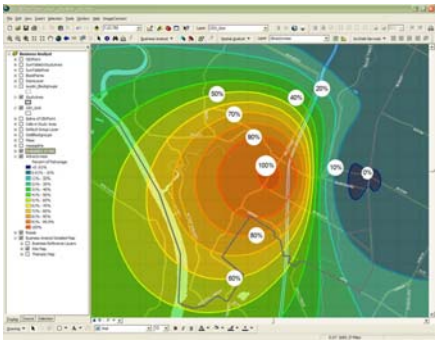
Topographic Survey

Contours



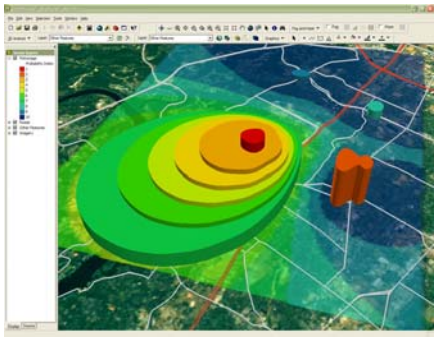
Topographic Survey

Contours



Topographic Survey

Contours



Topographic Survey

Characteristics of Contours

- Closely spaced contours indicate steep slopes
- Widely spaced contours indicate moderate slopes
- Contours should be labeled to the elevation value
- Contours are not shown going through buildings
- Contour line do not cross

Topographic Survey

Characteristics of Contours

- Depression and hill look the same; note the contour value to distinguish the terrain
- Important points can be further defined by including a “spot” elevation
- Contour lines tend to parallel each other on uniform slopes

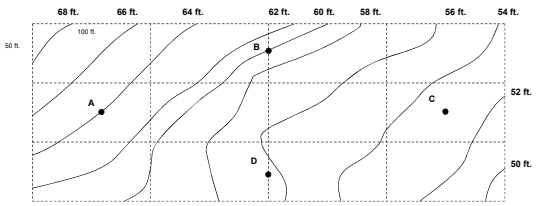
Topographic Survey

Construction of Contours

- The first step in developing a contour map is measuring the elevations of a group of points
- It will be easier for us to establish a rectangular grid of points (marked with flags) and measure the elevation
- The location of the flag points can be established by taping and checked by pacing or the odometer

Topographic Survey

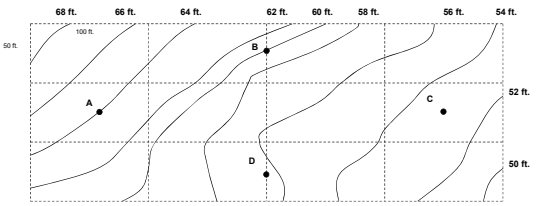
Group Work



What is the elevation of point A?

Topographic Survey

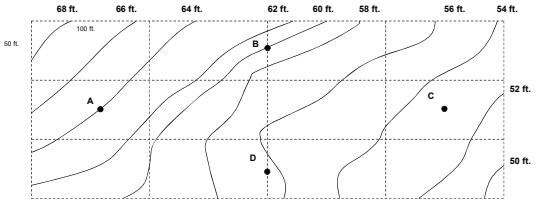
Group Work



What is the elevation of point C?

Topographic Survey

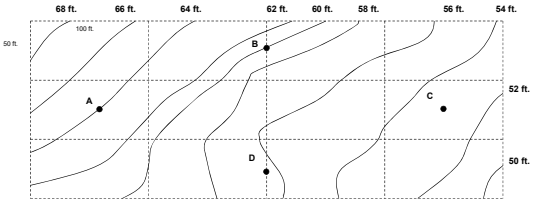
Group Work



What is the approximate slope between points A and C?

Topographic Survey

Group Work

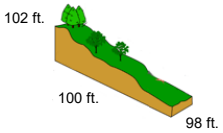


$$slope = \frac{\Delta elevation}{length} = \frac{53\,\text{ft.} - 64\,\text{ft.}}{300\,\text{ft.}} = -0.037 = -3.7\%$$

Topographic Survey

Construction of Contours

- For our project, the spacing of the grid is established by requiring that **no more than 1-foot contour elevation** change in each grid cell.
- To compute that spacing consider the slope along each edge of your site:



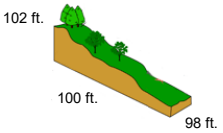
$$slope = \frac{\Delta elevation}{length} = \frac{102 - 98}{100}$$

$$grid\ spacing = \frac{1}{slope} = \frac{100}{4} = 25\,\text{ft.}$$

Topographic Survey

Construction of Contours

- Repeat this calculation for each side of your site and use the smallest value for you grid spacing
- If the grid spacing value is problematic to use or set-up, round down to a convenient value - probably a multiple of 10 would be convenient.



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Topographic Survey

Construction of Contours

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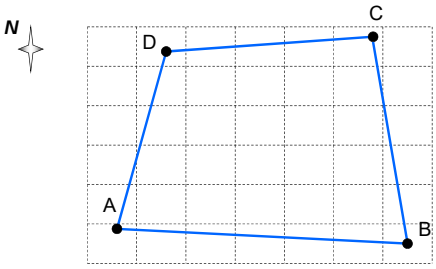
Side	Length (ft.)	ΔElevation	Grid Spacing
AB			
BC			
CD			
DA			

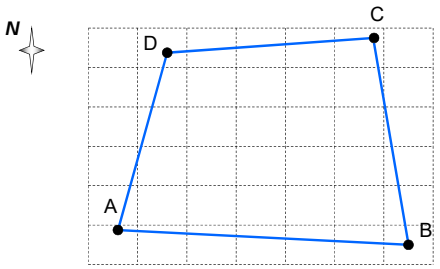
Topographic Survey

Construction of Contours

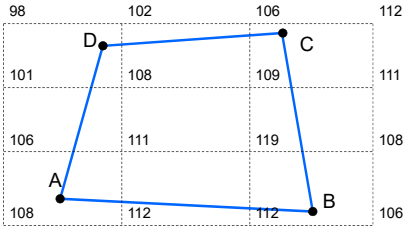


Topographic Survey

Once your contour grid is established, measure the elevation of each grid point



Topographic Survey



- We want a contour map on 5 ft. intervals
- The grid is rectangular, the dimensions of the sides are 80 ft. (north) and 100 ft. (east)

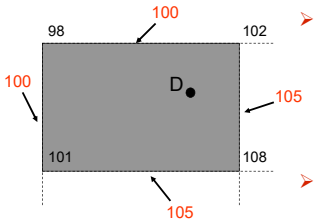
Topographic Survey

Construction of Contours

- The basic method for estimating contour is applied to each grid cell individually
- Use ***linear interpolation*** to find the location of the desired contour interval
- Let consider the cell in the upper left–hand corner - remember the contour interval is 5 ft.

Topographic Survey

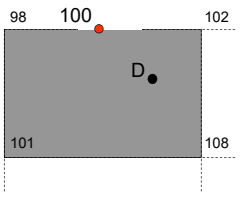
Construction of Contours

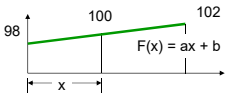


- First see if a contour interval exist between nodes of the grid cell; if so, estimate where along the side the contour interval would be located
- Apply simple linear interpolation to each side to locate the contour interval

Topographic Survey

Let's look at the top edge of the grid cell





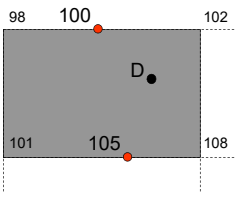
$$a = slope = \frac{102-98}{100}$$

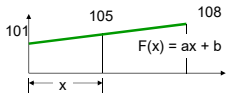
$$b = \text{intercept} = 98$$

$$x = \frac{2(100)}{4} = \boxed{50\,\text{ft.}} \quad \Leftarrow \quad 100 = \frac{4}{100}x + 98$$

Topographic Survey

Let's look at the bottom edge of the grid cell





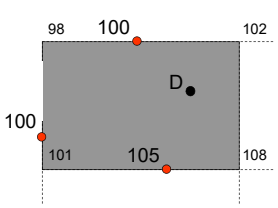
$$a = slope = \frac{108-101}{100}$$

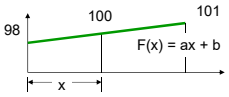
$$b = \text{intercept} = 101$$

$$x = \frac{4(100)}{7} = \boxed{57\,\text{ft.}} \quad \Leftarrow \quad 105 = \frac{7}{100}x + 101$$

Topographic Survey

Let's look at the left edge of the grid cell





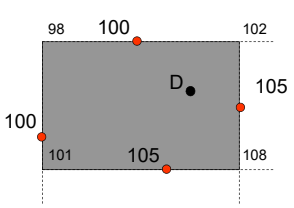
$a = slope = \frac{101-98}{80}$

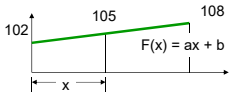
$b = \text{intercept} = 98$

$x = \frac{2(80)}{3} = \boxed{53\,\text{ft.}}$ ⟵ $100 = \frac{3}{80}x + 98$

Topographic Survey

Let's look at the right edge of the grid cell





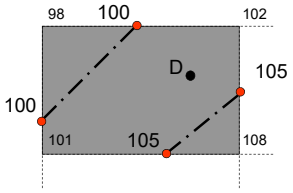
$a = slope = \frac{108-102}{80}$

$b = \text{intercept} = 102$

$x = \frac{3(80)}{6} = \boxed{40\,\text{ft.}}$ ⟵ $105 = \frac{6}{80}x + 102$

Topographic Survey

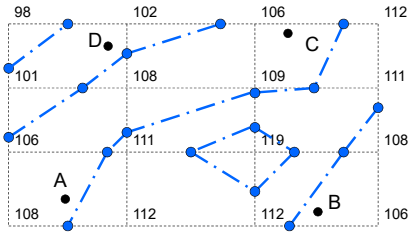
Locate the contour intervals locations on the grid cell



- Next, simply connect points of equal contour intervals
- One grid cell down, eight to go . . .

Topographic Survey

Repeating the linear interpolation for each of the remaining grid cell gives:



Topographic Survey

TopHat Questions

Topographic Survey

End of Topographic Surveying