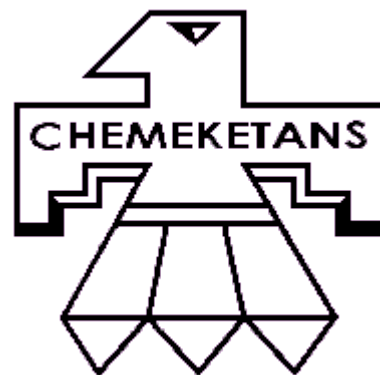


The Chemeketans



Topo Map Basics



Participant Handout

Prepared by Steve Dougherty

Welcome

My name is Steve Dougherty. I am a member of the Chemeketans and have served as a mountain climbing leader in the club since 1998. I developed a three-part Route Finding School in the fall of 2003. The school is staffed by volunteer club members as a service to the Salem community. Today's 90 minute class, *Topo Map Basics*, covers just a small part of the content covered in the Chemeketan Route Finding School.

Course Materials

- 11x17 Portion of the Three Fingered Jack USGS 7.5 Minute Quadrangle
- Pencil
- USGS Index of Topographic Map Symbols

Route Finding School

If you find the Topo Map Basics class useful you may wish to enroll yourself in the three-part Chemeketan Route Finding School. The Chemeketan Route Finding School will teach you useful back country navigation skills. The school is divided into three parts. Part one "Using Maps" is very similar to today's training and focuses on map reading. Part two "Map and Compass" will teach you how to use a compass with your map. Part three "GPS" will teach you how to set waypoints and navigate to those waypoints in the field. Parts two and three have fun field session exercises, so you can get some hands on practice at Salem's Riverfront Park. A \$20 fee is charged to cover the cost of the participant workbook and materials and space is limited to 50 participants. For more information please visit my website at www.cascadeadventures.net.

Chemeketan Membership Information

Membership Information: For more information about membership contact the Membership Secretary: The Chemeketans, Membership Secretary, PO Box 864, Salem OR 97308 or visit the Chemeketan website at www.chemeketans.org.

Topographic Maps

Topographic maps are drawn from aerial photographs and use contour lines to show elevation. Each contour line represents a specific elevation above sea level. Since each contour line represents a different elevation they do not intersect or cross. From the shape and interval of contour lines, ridges, peaks, canyons, and other landforms can be identified.

Types of Topo Maps

USFS Maps

USGS 7.5-Minute Quadrangle

USGS 15-Minute Quadrangle

Wilderness Maps

USFS Fire Maps

USGS 7.5-Minute Quadrangles

There are over 54,000 quadrangles (map sheets) that cover every inch of the United States. The USGS primary scale for mapping topographic maps is 1:24,000. These quadrangles are called 7.5-minute quadrangles because they show an area that is 7.5 minutes of longitude wide by 7.5 minutes of latitude high.

How is a USGS Map Made?

1. USGS maps are created from aerial photographs. Airplanes fly a north-south direction along carefully determined flight lines at a consistent altitude above the terrain. Photographs must be taken when in the proper season when the sky is clear and with the Sun at the proper angle for the type of ground being photographed. The specialized camera can cost more than \$250,000.
2. A cartographer draws the map by viewing a pair of aerial photographs through a stereoscope, which produces a three-dimensional view of the terrain. It takes 10 precisely positioned aerial photographs to provide the stereoscopic coverage needed for each 7.5-minute quadrangle.
3. After aerial photographs are obtained, field survey work may be required to establish and measure the map's basic control points and to identify objects that need visual verification. Survey measurements are taken carefully to establish the control points that become the framework on which map detail is compiled. Two types of control points are needed to position map features accurately. Horizontal control points identify the latitude and longitude of selected features within the area being mapped. They establish correct scale and map orientation and allow accurate positioning of the map's features. Vertical control points determine the elevation of selected points for the correct placement of a topographic map's contours.

Map Legend

The legend and margins of USGS topographic quadrangles contain a variety of useful information. The major features are:

Road Legend	Map Name
Year of Production and Revision	General Location in State
Next Adjacent Quadrangle Map	Map Scale
Distance Scale	Contour Interval
Magnetic Declination	Latitude and Longitude
Vertical Datum	Horizontal Datum

Map Scale

The scale of the map is determined by the amount of real-world area covered by the map. For example, USGS 7.5-minute topographic quadrangles have a scale of 1:24,000. 1:24,000 is a simple ratio, meaning that one-inch on the map is equal to 24,000 inches in the field. If you do the math, this means that one inch on a USGS map represents 2000 feet. Common topographic map scales are:

- 1:24,000 (7.5 minute quadrangle)
- 1:62,500 (15 minute quadrangle)
- 1:100,000 (1° sheet)
- 1: 250,000 (2° sheet)



Key Point – One inch on a 1:24,000 USGS 7.5 Minute Quadrangle is 2,000 feet.

Map Symbols and Colors

The USGS produces an index of all symbols used on the topographic maps they publish. This index is located in the rear pocket of your notebook. Additional copies can be ordered from the USGS.

USGS topographic maps use the following colors to designate different features:

- **Black** - man-made features such as roads, buildings, etc.
- **Blue** - water, lakes, rivers, streams, etc.
- **Brown** - contour lines
- **Green** - areas with substantial vegetation (could be forest, scrub, etc.)
- **White** - areas with little or no vegetation; white is also used to depict permanent snowfields and glaciers
- **Red** - major highways; boundaries of public land areas; section lines
- **Purple** - features added to the map since the original survey. These features are based on aerial photographs but have not been checked on land.

There are many other features (buildings, swamps, mines, etc.) that are designated on topographic maps, but which are not described in the map legend. See the *Index of USGS Topographic Map Symbols* in the rear pocket of this notebook.



Check for Understanding: Map Symbols

Identify three symbols used on the 11x17 USGS map for which you do NOT know the meaning. Then look up the symbols in the USGS Index of Topographic Map Symbols and define the meaning of the symbols.

Unknown Symbol	Definition

Contour Lines

Contour lines drawn on the map represent altitude above sea level. Contour lines are brown on USGS maps. The map legend will indicate the contour interval between each contour line. Every fifth contour line is an index contour and is labeled with an elevation.



Check for Understanding: Reading Contour Lines #1

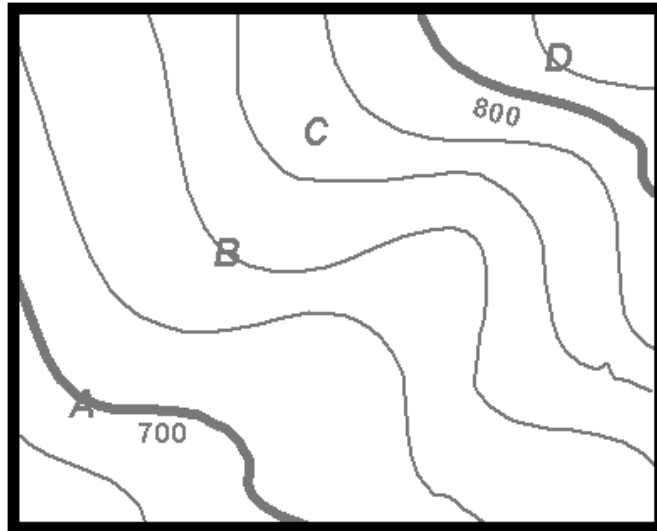
Determine the elevations for:

A: _____

B: _____

C: _____

D: _____

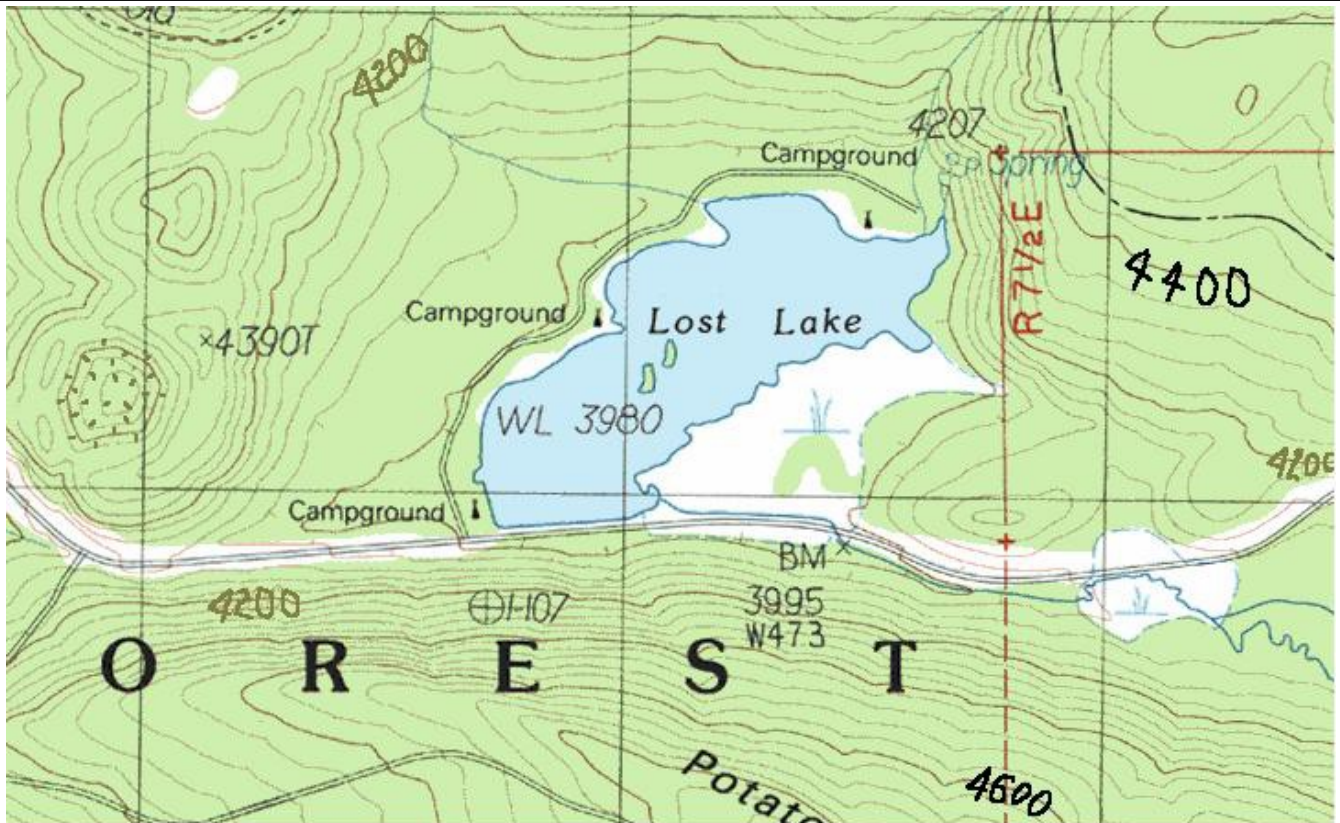


Surface Features can be identified from contour lines:

- **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 that could also be a stream or river.
- **Ridges** - contours are usually more rounded and don't have a stream running down the middle
- **Summits** - contours form circles
- **Depressions** - circular contours but with lines radiating to the center



Check for Understanding: Reading Contour Lines #2



Using the map above, identify the elevations of these map features:

1. Lost Lake.....
2. Any Campground at Lost Lake.....
3. Section Corner NE of Lost Lake.....
4. Highest Point North of the Highway.....
5. Most Westerly Road Junction.....
6. Depression west of Lost Lake.....

Measuring Distances

There are a number of ways to measure trail distance on a map.

- **Paper Method** – Use a piece of paper and mark tick marks along its edge. Make a mark wherever the trail bends. Use the map scale to measure the total length between the tick marks.
- **Ruler Method** – Most compasses have a ruler along the edge of the baseplate. Use this ruler to convert a distance measured on the map with the map scale.
- **Topo Map Software Method** – Most topographical map software products have a feature, which can measure straight-line or curved-line distance measurements.
- **Section Line Method** – One of the easiest ways to calculate a rough distance is to use the section lines because in most cases they are one mile apart. Section lines are red.

Calculating Travel Time

Most of us know about how fast we travel when hiking. Hikers normally travel between two and three miles per hour (three mph is quite fast). If you include short rest breaks one should calculate an average pace of about two miles per hour on flat ground. Without rest breaks I figure it will take me 6 minutes to travel a quarter mile (2.5 mph). Going uphill will slow you down considerably. As a basic rule of thumb, you should add an additional hour to the travel time for every 1,000 feet of elevation you gain.



Steve's Recommended Practice – When backpacking, figure on a two-mile per hour pace (this includes brief rest breaks) and add an hour for every 1,000 feet of elevation you gain.

Orienting a Map

When one “orients” a map, the map is turned until it corresponds with the surroundings. You don’t need a compass to orient a map if you can identify landmarks in your area. One should always make it a habit to view a map so that it is oriented with one’s surroundings. Once the map is oriented you can use your thumb as a “You are here” reference.

The Art of Staying Found

1. Check your position regularly by carrying a pocket-size laminated map of your route. Carry this in your hand or a front pocket and refer to it often. Anticipate features along your route so that when you pass them you will know your exact position.
2. Keep track of your start time and your hiking pace. This information can be used to calculate how far you have traveled. This may not tell you exactly where you are, but it will put you in the ballpark.
3. Look back often, especially at critical turns and make mental notes about features along the route that will help you recognize them on your return. Share these mental notes with other members of your party. This will help you remember and will keep members of your party on track should they become separated.
4. Use all the information available to you for fixing your position (compass heading, features along the trail, elevation, travel time). All of these clues should be telling you the same thing. If something doesn’t add up, like you are heading downhill instead of uphill, stop and resolve the discrepancy before proceeding.

***Check for Understanding: USGS Quad Maps***

Use the 11x17 USGS Quad to answer the following questions:

1. What is the name of the quadrangle?
2. What is the name of the adjacent quadrangle that is due east?
3. What year was the quadrangle originally field checked?
4. Has the quadrangle been revised? If yes, when was the revision field checked?
5. What horizontal datum was used to create the map?
6. What is the contour interval?
7. Are there supplemental contours? If yes, what are the supplementary contours?
8. How many different types of roads are on the quadrangle?
9. What is the highest point?
10. What is the lowest point?