

Earth Systems

Unit 5

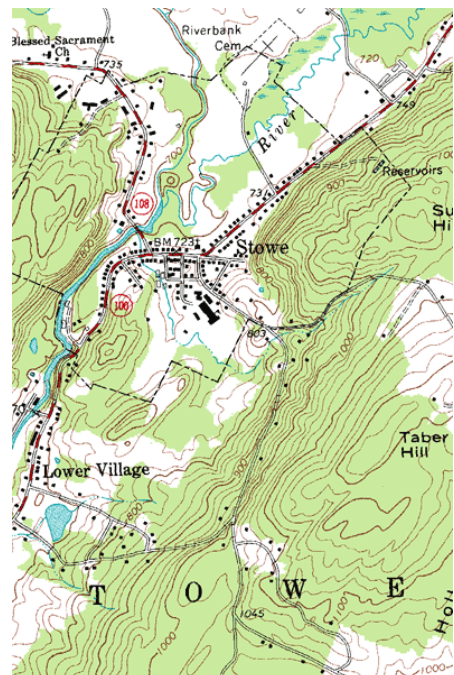
Part 1

Topographic and Geologic Maps

Topographic Maps

A topographic map represents the Earth's three-dimensional surface in two dimensions. Topography is the shape of the land: hills, mountains, valleys, canyons, etc.

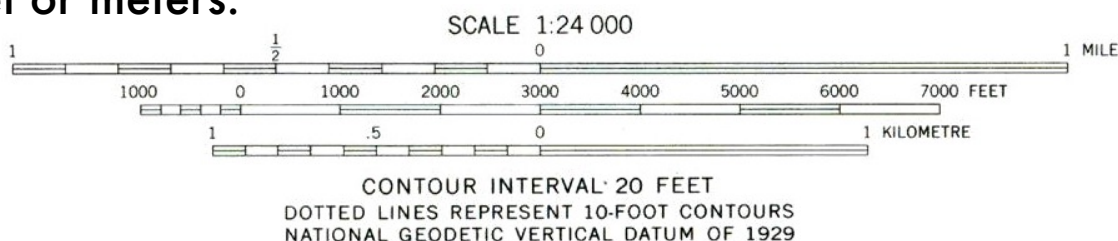
Topographic maps show elevation above mean sea level using contour lines. An isoline is any line on a scientific map where every point on the map is the same number value (isotherms: equal temperature, isobars: equal pressure, etc.). A contour line is a line of equal elevation. Because of this, contour lines run parallel to each other, but never cross each other.



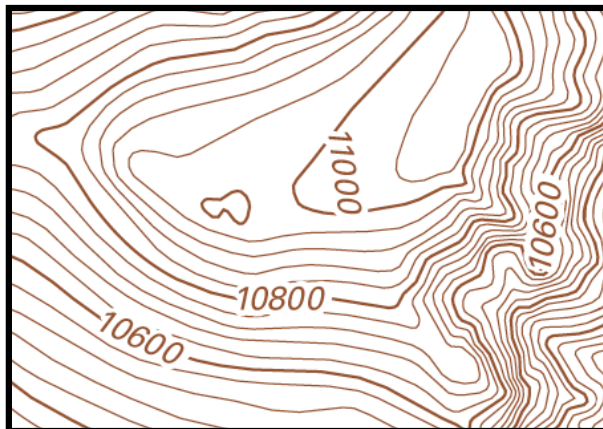
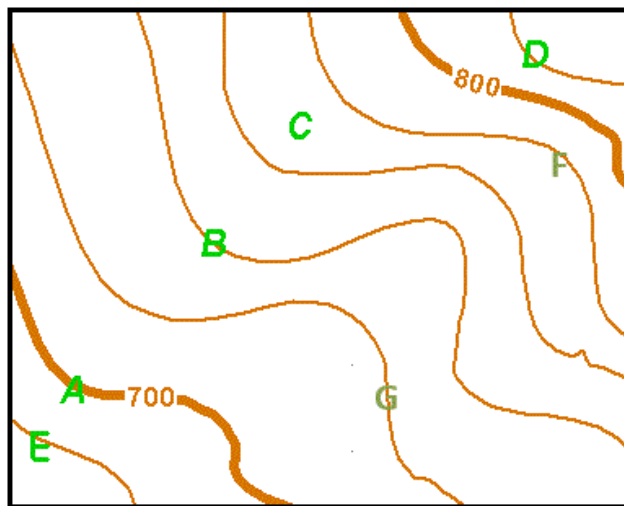
The map scale shows the ratio of map distances to real distances. For example, 1:24,000 means 1 cm on the map is 24,000 cm (0.24 km) in real life, and 1 inch equals 24,000 inches (2000 feet) in real life.

Scale bars show horizontal distance in different units, usually miles, feet, and kilometers. Fractions are shown on the left part of the bar (to the left of zero).

The contour interval of a map shows the difference in elevation between each contour line. On most maps, every fifth line is bold and is labeled with the elevation in feet or meters.



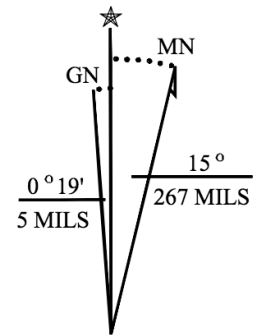
These bold index lines are labeled with the elevation above sea level. There are thinner contour lines in between the index values. What is the contour interval and the elevations of points A-E?



Contour lines give you information on the steepness of the land, too. Lines that are close together indicate steep slopes. Lines that are far apart show more gentle slopes. Closed loops show hills.

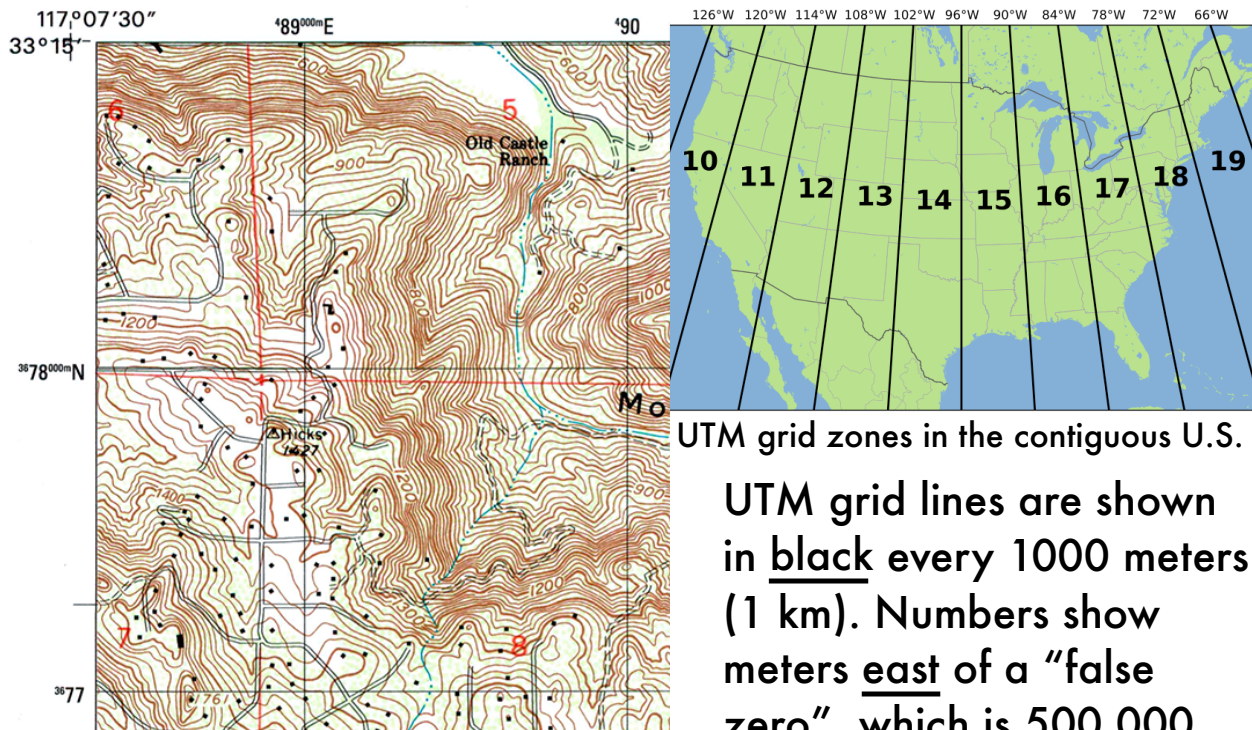
Large scale fractions such as 1:24,000 (large scale maps) show smaller and more up close areas. Other common but smaller scales in the U.S. are 1:100,000 and 1:250,000 topographic maps.

The difference between magnetic north, where a compass points, and true north (the direction to the north pole) is shown with the magnetic declination symbol. The angle is shown is degrees and milliradians (MILS) ($360^\circ = 2000\pi$ milliradians).



UTM GRID AND 1968 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

Besides latitude and longitude, topographic maps also have a grid for finding locations. The international grid is the UTM (Universal Transverse Mercator) grid. This is shown as a grid (or grid marks) every 1000 meters (1 km).



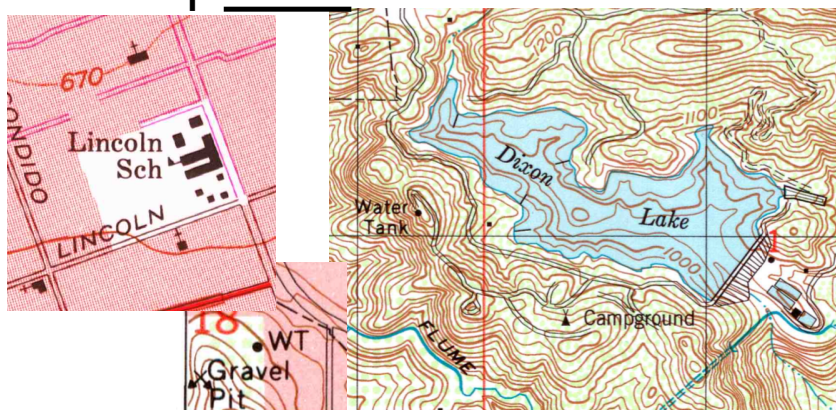
UTM grid zones in the contiguous U.S.

Latitude and longitude are shown on the map's corners. The UTM grid shows thousands of meters as large numbers. Hundred thousand and million meters are shown as small numbers in the front. The last three zeros are usually not shown.

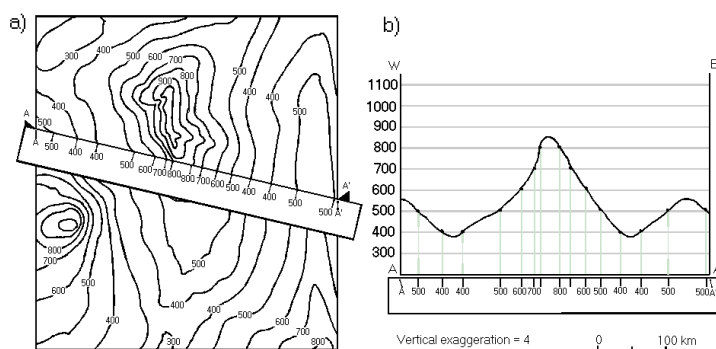
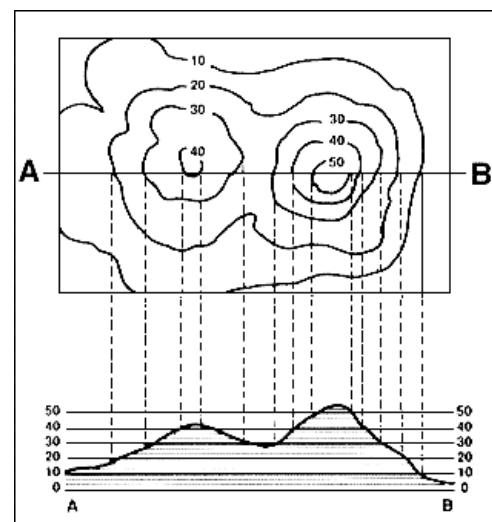
UTM grid lines are shown in black every 1000 meters (1 km). Numbers show meters east of a "false zero", which is 500,000 meters west of the zone's center, and meters north of the equator.

Colors on topographic maps have specific meanings. Contour lines and other land features, such as sand dunes, are shown in **brown**. Water features, such as ponds, lakes, streams, and swamps are shown in **blue**. **Green** shows areas covered in vegetation. White areas usually have only sparse vegetation. Black is used for cultural or human-made features. Primary and secondary roads are colored **red**. The U.S. Land Survey lines are also **red**. **Pink** or **light gray** indicates built up urban areas.

Map symbols are consistent across all maps, and show schools, churches, water tanks, gravel pits, etc.



A profile line is a line across the map from which a terrain profile can be drawn. The profile is a side view of the land along the profile line. Sometimes profiles are **not** at the same scale as the map, but are **exaggerated vertically**.



To draw a profile, the elevation of every contour line crossing the profile line is marked and noted, then transferred to the vertical profile graph.

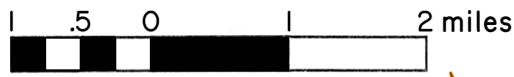
Figure 3. Illustration of how to draw a topographic profile from a contour map

A gradient measurement can be calculated for a stream or slope by dividing the difference in elevation between two points by the distance between them in the same units.

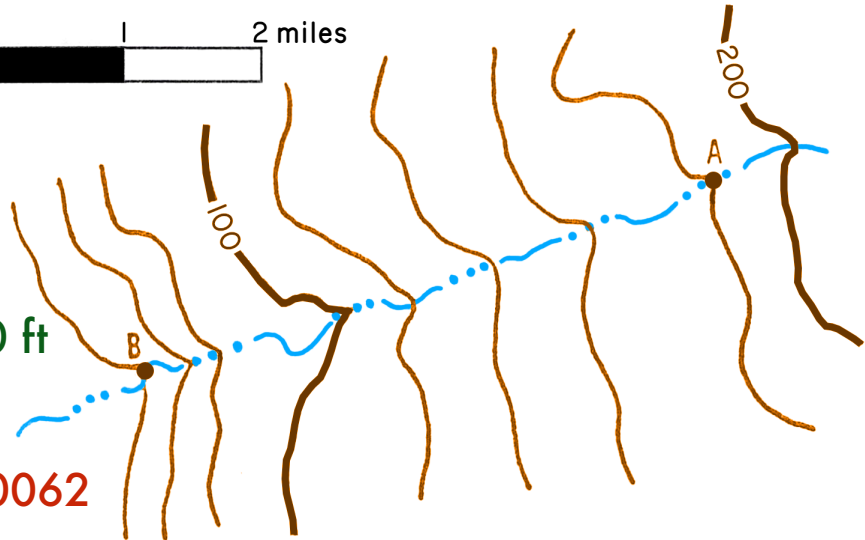
Find the stream gradient between A and B.

elevation of point A: 180 ft difference in elevation: 140 ft

elevation of point B: 40 ft distance: 4.25 miles

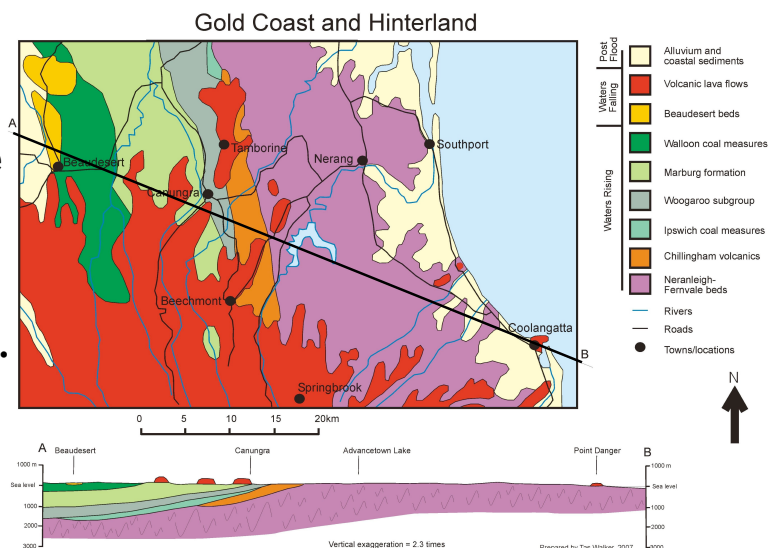


1 mile = 5280 ft
 4.25 miles = 22440 ft
 gradient:
 $140 \div 22440 = 0.0062$




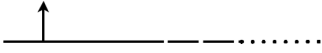








Geologic Maps

Geologic maps show a region's rocks and sediments. An area where one predominant rock exists is called a geologic unit. It will be given one particular color on the map. The line between geologic units is the contact. Sometimes the contact line is along a fault. Faults are shown with thicker black lines. The strike (direction) and dip (downward angle) of faults and joints is also shown.



Sample geologic map with a cross section line A-B. The actual cross section is shown below.

MAP SYMBOLS

	Contact between map units. Solid where accurately located, dotted where concealed.		
	Fault- solid where accurately located. Dashed where approximately located or inferred; dotted where concealed. Arrow and number indicate direction and angle of dip of fault plane.		
	Strike and dip of inclined sedimentary beds.		Horizontal beds
	Strike and dip of inclined igneous joints.		Strike of vertical sedimentary beds
	Strike of vertical igneous joints.		Strike and dip of overturned beds
	Strike and dip of inclined igneous foliation.		Anticline Syncline

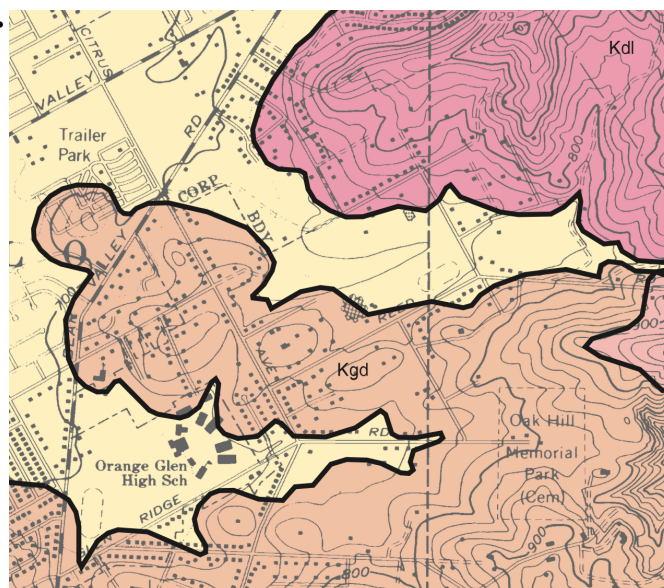
Contact lines and faults are dotted when they go under sediments or other rock layers. The estimated position of a fault is shown as a dashed line.

Folds, joints, and the strike and dip of sedimentary layers, and other geologic features are shown as symbols on the map.

In addition to a special color, geologic units also have a letter symbol. Capital letters represent the geologic period, if known. Small letters represent the name of the unit if there is one, or the types



For example, Kdl is the symbol for the Cretaceous (K) granite of Dixon Lake (dl), a fine grain intrusive igneous rock. Kgd is the symbol for the Cretaceous (K) granodiorite (gd) rocks that surround Orange Glen.



Granodiorite undivided (Cretaceous) - Mostly hornblende-biotite granodiorite, coarse to medium grained.