

TOPOGRAPHY

Overview:

In this lesson students will learn about contour lines and how to identify features on a topographic map, then work with Elders to learn local place names.

Objectives:

The student will:

- identify features found on a topographic map by examining a U.S. Geological Survey contour map;
- create a 3-dimensional model from a simple topographic map template; and
- interview Elders to learn local place names.

Targeted Alaska Grade Level Expectations:

Science

[7-8] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating.

[8] SD2.1 The student demonstrates an understanding of the forces that shape Earth by interpreting topographical maps to identify features (i.e., rivers, lakes, mountains, valleys, islands, and tundra).

Vocabulary:

contour line – line on a map connecting points of the same elevation

contour map – map that shows elevations and surface features of the land by means of contour lines

elevation – the vertical distance between a standard reference point, such as sea level, and the top of an object or point on Earth, such as a mountain; the summit of Mount Everest is the highest elevation on Earth

feature – a prominent or conspicuous part or characteristic

glacier – a slowly moving mass or river of ice formed by the accumulation and compaction of snow on mountains or near the poles

gradient – the degree to which something inclines; a slope

island – a piece of land completely surrounded by water

lake – a large inland body of standing fresh or salt water

mountain – generally massive, usually steep-sided, raised portion of Earth's surface; can occur as single peaks or as part of a long chain; can form through volcanic activity, by erosion, or by the collision of tectonic plates

river – a large, natural stream of fresh water that flows into an ocean, a lake or other body of water, usually fed by smaller streams that flow into it

slope – to have or take an inclined or oblique direction or angle considered with reference to a vertical or horizontal plane; slant

topographic map – a map showing topographic features, usually by means of contour lines

topography – the shape, height, and depth of the land surface in a place or region; physical features that make up the topography of an area include mountains, valleys, plains, and bodies of water; man-made features such as roads, railroads, and landfills are also often considered part of a region's topography; detailed description or drawing of the physical features of a place or region

valley – a low area of land between hills or mountains, typically with a river or stream flowing through it

Whole Picture:

Knowledge of the land and its topography is interwoven in the language of the Athabascan people. Gaa'al taji njik means "where-game-usually-passes-along-a-trail," and Jak ddhaa means "blueberries mountain" known for abundant blueberries. Kihtr'uu choh means "big bare-topped mountain," and Vineeteiidii van means, "it-floods-over-lake," a lake known to overflow in the winter.

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Richard Nelson, in his book "Make Prayers to the Raven," says it best.

To most outsiders, the vast expanse of forest, tundra, and mountains in the Koyukon homeland constitutes a wilderness in the absolute sense of the word. For the Western mind, it is wilderness because it is essentially unaltered and lacks visible signs of human activity, and it must therefore be unutilized. But in fact the Koyukon homeland is not a wilderness, nor has it been for millennia.

This apparently untrodden forest and tundra country is thoroughly known by a people whose entire lives and cultural ancestry are inextricably associated with it. The lakes, the hills, river bends, sloughs, and creeks are named and imbued with personal or cultural meanings. Indeed, to the Koyukon these lands are no more a wilderness than are farmlands to a farmer or streets to a city dweller. At best we can call them wildland. (246)

Modern topographic maps differ from other maps in that they have lines that connect points of equal elevations. These lines are called contour lines and show the height above sea level. Topography is one of several factors that influence climate. The primary ways in which topography influences climate are temperature and precipitation.

Materials:

- Sticky note flags
- Topographic map of Alaska, Tyonek Quadrant (one per group)
- Craft foam, approx. 9"x6", as thick as possible (three+ sheets per group)
- Scissors
- Glue
- Modeling clay (optional)
- TEACHER INFORMATION SHEET: "USGS Topographic Map Symbols"
- STUDENT INFORMATION SHEET: "Topographic Examples"
- STUDENT WORKSHEET: "Topo Map Checklist"
- STUDENT WORKSHEET: "Mapping Routes"

Activity Preparation:

1. Review TEACHER INFORMATION SHEET: "USGS Topographic Map Symbols" for information about how to read a topographic map.
2. Make extra copies of STUDENT INFORMATION SHEET: "Topographic Examples" for Activity Procedure 4.
3. The topographic map used in the lesson was chosen because it highlights such a wide variety of features. If possible, obtain a topographic map of your area for Activity Procedure 8. Invite an Elder to visit and talk about the local place names, including the reasons people chose to settle in the area.

Activity Procedure:

1. Divide students into groups. Hand out a copy of the topographic map of Alaska, Tyonek Quadrant. Allow students to explore the map for a few minutes then ask students to make some observations about the lines and symbols on the map. How many different kinds of features can they see?
2. Hand out STUDENT WORKSHEET: "Topo Map Checklist." Ask students to complete the worksheet. Students should use sticky note flags to mark found items and should not mark on the maps.
3. Discuss the worksheet with students. "If there were no labels on the map, how would you be able to tell where there was a mountain? A lake? A glacier? A river?" Introduce related vocabulary words: contour line, elevation, topography, etc. Ask students to point to the highest elevation on a mountain. Circulate to check for understanding.
4. Divide students into groups. Distribute STUDENT INFORMATION SHEET: "Topographic Examples," craft foam, scissors and glue. Ask each group to pick one of the maps to model. Ask students to cut out one piece of foam for each contour level. Next, ask students to glue their contour levels together to make the feature shown on the original map.

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NOTE: Students can use extra copies of the map sheets to cut along contour lines and trace around them on the foam.

5. If time allows, hand out modeling clay and ask students to smooth the edges between the contour lines.
6. Allow students to compare models with classmates. Ask the following questions:
 - a. What is a contour line?
 - b. What does a river, lake, mountain, valley, island, etc. look like on a topographic map?
 - c. How would you construct the contour lines on a topographic map to show a cliff?
 - d. What would it feel like to walk in an area where the contour lines are far apart? Close together?
7. Hand out STUDENT WORKSHEET: "Mapping Routes." Explain the directions and tell students to be prepared to explain their reasoning regarding the route they chose. Allow students time to complete.
8. Invite an Elder to visit and talk about the local place names. If available, label a map of your area (topographic or other map type) with Athabascan place names. Do a profile of the region. Find out why the Native people chose this spot to settle. What were the appealing topographic features?

Language Links:

Ask a local Native language speaker to provide the words in the local dialect for the topography words listed in the chart below. The local dialect for these words may differ from the examples provided. Share the words with students to build fluency in local terms related to the land. Include local words in songs, stories and games when possible.

English	Gwich'in	Denaakk'e	Lower Tanana	Deg Xinag	Your Language
Land	Nan	Nen'	Nen'	Ngan	
River	Han	No'	Nik'a	Xin	
Valley	Nihtak	Taayee	Tok'a		
Hill	Taih	Teyh	Teyh		
Mountain	Ddhah	Dleł	Ddheł	Deloy	
Lake	Van	Benh	Ben	Vinq'it	
Glacier	Git	Loo	Łu		
Ocean	Chuu choo	Daagheyukk kk'e	Tth'itu'bogha		

Answers:

STUDENT WORKSHEET: "Topo Map Checklist"

Part One

Answers will be flagged on student maps.

Part Two

1. airplane
2. U.S. Geological Survey (USGS)
3. 200 feet
4. Hayes River
5. The person at point B

STUDENT WORKSHEET: "Mapping Routes"

Answers will vary.



Topographic Map Symbols

What is a Topographic Map?

A map is a representation of the Earth, or part of it. The distinctive characteristic of a topographic map is that the shape of the Earth's surface is shown by contour lines. Contours are imaginary lines that join points of equal elevation on the surface of the land above or below a reference surface, such as mean sea level. Contours make it possible to measure the height of mountains, depths of the ocean bottom, and steepness of slopes.

A topographic map shows more than contours. The map includes symbols that represent such features as streets, buildings, streams, and vegetation. These symbols are constantly refined to better relate to the features they represent, improve the appearance or readability of the map, or reduce production cost.

Consequently, within the same series, maps may have slightly different symbols for the same feature. Examples of symbols that have changed include built-up areas, roads, intermittent drainage, and some lettering styles. On one type of large-scale topographic map, called provisional, some symbols and lettering are hand-drawn.

Reading Topographic Maps

Interpreting the colored lines, areas, and other symbols is the first step in using topographic maps. Features are shown as points, lines, or areas, depending on their size and extent. For example, individual houses may be shown as small black squares. For larger buildings, the actual shapes are mapped. In densely built-up areas, most individual buildings are omitted and an area tint is shown. On some maps, post offices, churches, city halls, and other landmark buildings are shown within the tinted area.

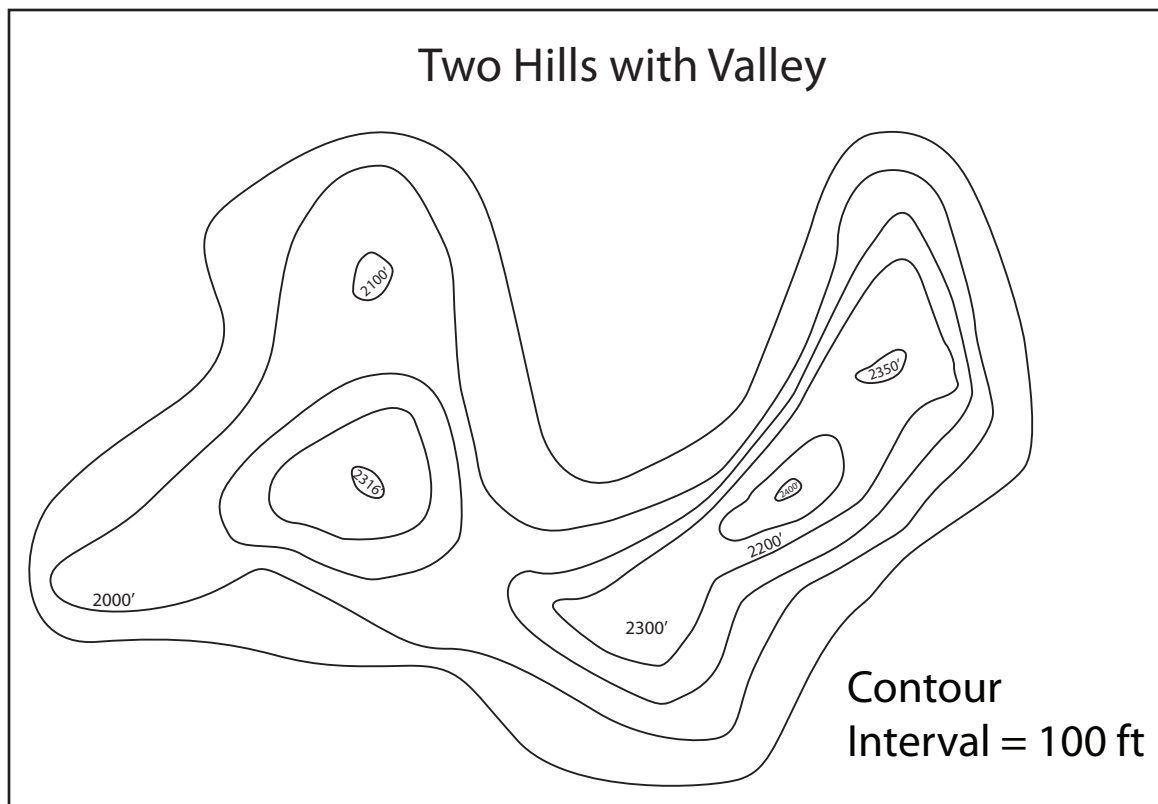
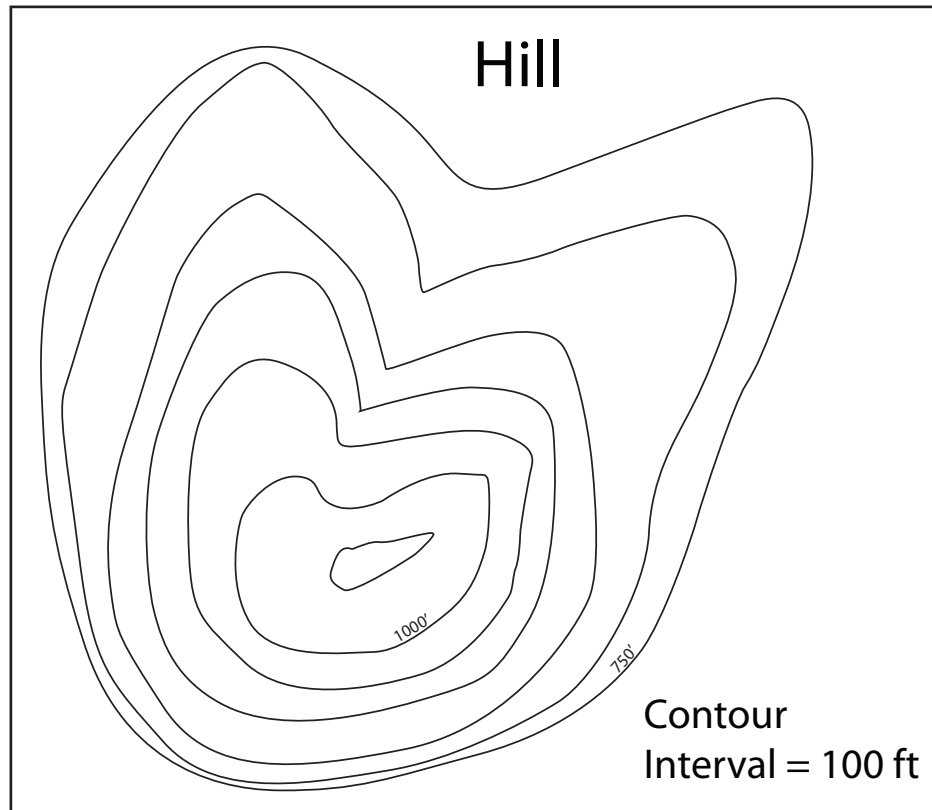
The first features usually noticed on a topographic map are the area features, such as vegetation (green), water (blue), and densely built-up areas (gray or red).

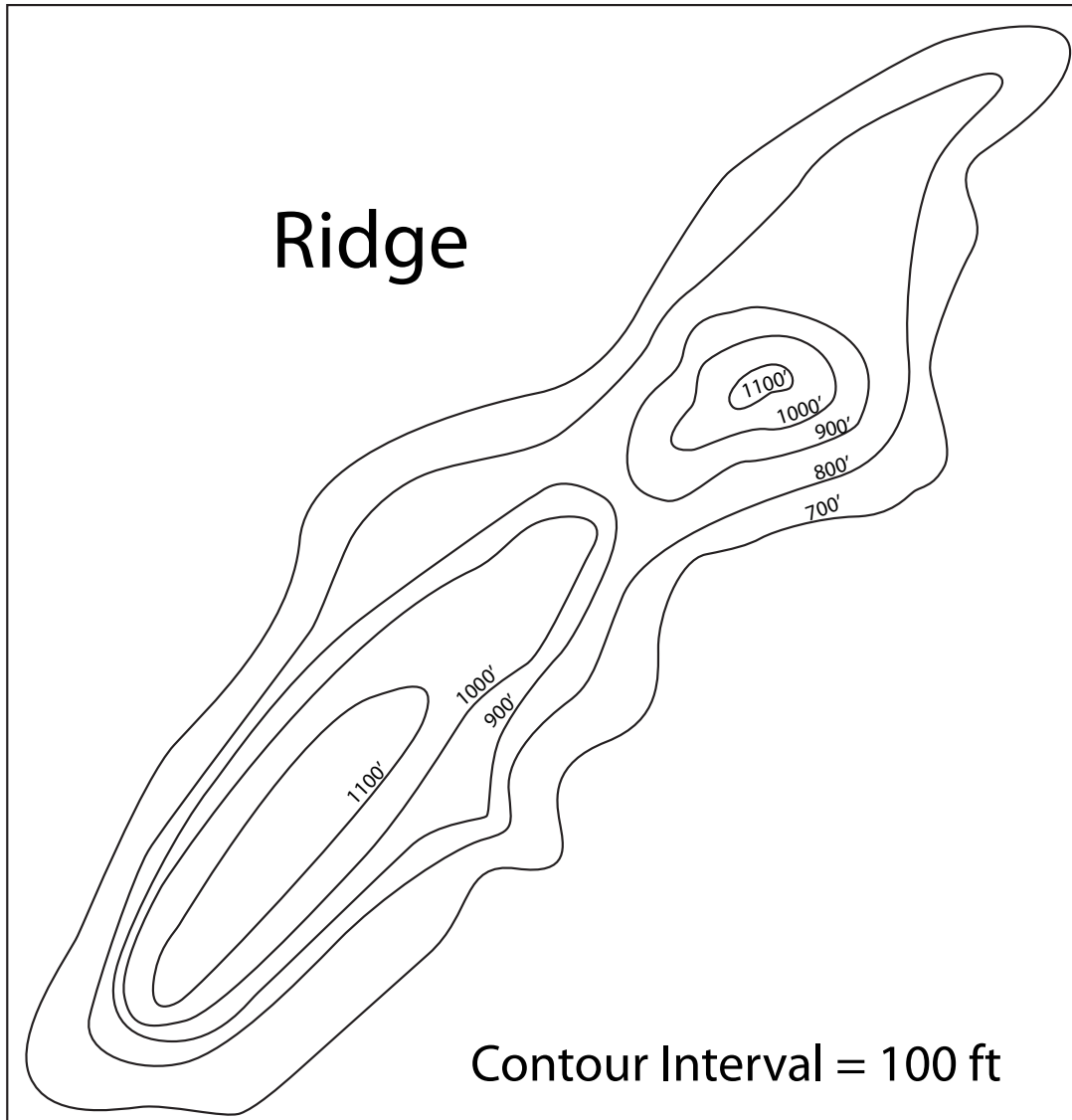
Many features are shown by lines that may be straight, curved, solid, dashed, dotted, or in any combination. The colors of the lines usually indicate similar classes of information: topographic contours (brown); lakes, streams, irrigation ditches, and other hydrographic features (blue); land grids and important roads (red); and other roads and trails, railroads, boundaries, and other cultural features (black). At one time, purple was used as a revision color to show all feature changes. Currently, purple is not used in our revision program, but purple features are still present on many existing maps.

Various point symbols are used to depict features such as buildings, campgrounds, springs, water tanks, mines, survey control points, and wells. Names of places and features are shown in a color corresponding to the type of feature. Many features are identified by labels, such as "Substation" or "Golf Course."

Topographic contours are shown in brown 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 to 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.

Bathymetric contours are shown in blue or black, depending on their location. They show the shape and slope of the ocean bottom surface. The bathymetric contour interval may vary on each map and is explained in the map margin.





NAME: _____

TOPO MAP CHECKLIST

PART ONE

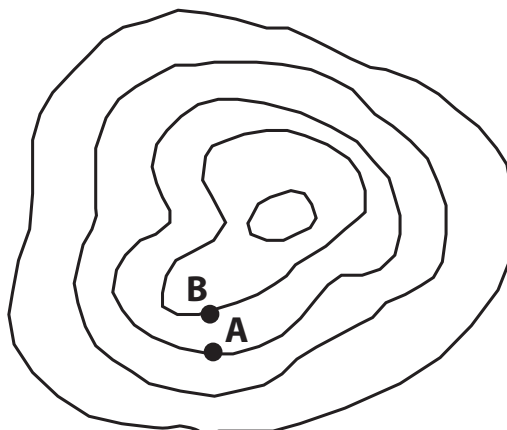
Directions: Find the following on the USGS topographic map and mark each one with a sticky note flag.

- | | |
|---|---|
| _____ Beluga Mountain | _____ Tyonek |
| _____ Chakachamna Lake | _____ Susitna Flats |
| _____ Shamrock Glacier | _____ Neacola Mountains |
| _____ Cook Inlet | _____ Porcupine Butte |
| _____ Mount Susitna | _____ Skwentna River |
| _____ Fire Island | _____ Parks Highway |
| _____ The Iditarod Trail | _____ Border for Lake Clark National Park |
| _____ Border separating the Matanuska-Sustina Borough and the Kenai Peninsula Borough | |

PART TWO

Directions: Refer to the USGS topographic map to answer the following questions.

1. What is the symbol for a landing strip? _____
2. Who published the map? _____
3. How far apart are the contour intervals? _____
4. What river is fed by Hayes Glacier? _____
5. Refer to the figure below. One person is standing at point A, another at point B. Which person is standing at a higher elevation? _____



NAME: _____
MAPPING ROUTES

Directions: Draw a route between point A and point B on the topographic map below. Your route should be the one that makes the most sense to travel. There is no single correct route, however, you should use the features of the map to help make your choice.

