INTERPRETING TOPOGRAPHIC MAPS *(MODIFIED FOR ADEED)*

Science Concept:

Topographic maps give information about the forces that shape the features of Earth.

Objectives:

The student will:

- identify land features from a topographical map;
- make inferences based on their knowledge of topographical maps; and
- write a letter describing and defending a route.

GLEs Addressed:

Science

[8] SD2.1 Students demonstrate an understanding of the forces that shape Earth by being able to interpret topographical maps to identify features (i.e., rivers, lakes, mountains, valleys, islands, and tundra).

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

Writing

[8] W3.2.2 The student writes for a variety of purposes and audiences by writing in a variety of nonfiction forms (e.g. letter, report, biography and/or autobiography) to inform or describe or persuade.

Vocabulary:

contour line – a line on a map joining points of equal height above or below sea level

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

island – an area of land, smaller than a continent , which is surrounded by water

lake – inland body of water, generally of considerable size and too deep to have rooted vegetation completely covering the surface

mountain – a large natural elevation of the earth's surface rising abruptly from the surrounding level

river – a large natural stream of water flowing in a channel to the sea, a lake, or another river

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

Materials:

- Objects of various size and shape, such as rocks, lego blocks, small fruit, etc. (5 per group)*
- Construction paper, 9" x 12" (one sheet per group)
- Craft foam, 9" x 6" x 5 millimeters thick (two to three sheets per group)
- Scissors (one per group)
- Glue (one per group)
- Modeling clay of different colors (optional)
- OVERHEAD: "Topographic Maps"
- OVERHEAD: "Multiple Routes"
- TEACHER INFORMATION SHEET: "Topographical Error Story"
- STUDENT INFORMATION SHEET: "Topographic Maps"
- STUDENT WORKSHEET: "Mapping"
- STUDENT WORKSHEET: "Mapping Routes"

*All objects combined should fit on the construction paper.

INTERPRETING TOPOGRAPHIC MAPS

Activity Preparation:

Collect objects for use in student mapping activity (five objects per group).

Activity Procedure:

Please refer to the assessment task and scoring rubric located at the end of these instructions. Discuss the assessment descriptors with the class before teaching this lesson.

Gear Up

Process Skills: predicting, describing, classifying, making generalizations, and communicating

1. Divide students into small groups (3-4). Distribute STUDENT WORKSHEET: "Mapping," a piece of construction paper, and a variety of objects to each group. Ask students to arrange the objects on the construction paper and map the objects onto the STUDENT WORKSHEET: "Mapping." Explain that groups should map their objects as detailed as they can without labeling the objects (no more than 3 minutes).
2. When each group is satisfied with their map, ask groups to exchange their maps with another group. Instruct students to examine the new map and determine a route for traveling from point A to point B. The route should be the easiest possible route, going over at least one of the features.
3. Ask groups to share routes and discuss other possible routes. Would it have been easier or harder to go over more objects? Why?
4. Ask the class if they have any problems navigating on the map they were given. What other information would have been helpful? Ask students if they have ever used a topographic map.
5. Read the TEACHER INFORMATION SHEET: "Topographic Error Story" to the class and discuss.
6. Display OVERHEAD: "Topographic Maps." Point out the contour lines, bodies of water, and any other features of the map that may be relevant to the remainder of the lesson.

Explore

Process Skills: predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating

7. Distribute the STUDENT INFORMATION SHEET: "Topographic Maps," craft foam, scissors, and glue to each group. Instruct groups to pick a map and cut the craft foam so that the pieces follow contour features of the map. Groups should use one piece of foam for each contour level. Groups will want to try and conserve their foam as much as possible. Next, they should glue their contour levels together to make the features shown on the map. When groups are finished they should be able to identify the features of their model they have made and relate them to the topographic map.
8. While students are working, ask them questions such as:
   a. What does it mean when the contour lines are close together/far apart?
   b. How would you use the contour lines to identify valleys and ridges, etc.?

Teacher's Note: If time and interest allows, students may also use clay to smooth the edges between the contour lines.

Generalize

Process Skills: making generalizations, inferring, and communicating

9. Ask students the following questions and discuss as a class.
   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 the contour lines look like for a volcano crater?
   e. What would it feel like to walk in an area where contour lines are far apart/close together?
   f. How can you tell the direction of stream flow?
   g. How might you know how fast a stream is flowing?

h. If you were blind folded and taken to a location on the map, where would you least want to be?
i. Can you find a spot on the map where would you be least likely get your feet wet?
j. If you were going to camp somewhere in the area depicted by the map, where you would want to put your tent? Why?
k. If someone went looking for wildlife, what might they find and where? Explain.
l. If you were to build a new park, where would you put it? Explain.
m. If you were to build a business of your choice, where would you put it? Explain.

Apply

Process Skills: predicting, describing, classifying, making generalizations, inferring, and communicating

10. Display OVERHEAD: "Multiple Routes" Ask students to pick a route and explain their reasoning to the class. (NOTE: This should be an informal discussion of route choices.)
11. Distribute the STUDENT WORKSHEET: "Mapping Routes." Instruct students complete Part A of the worksheet by drawing a route they feel makes the most sense.
12. Ask students how scientists might use a topographic map to document coastal changes and discuss as a class. Ask if scientists could use a topographic map to document changes in permafrost and how that might be accomplishes. Explain that scientists can compare topographic maps from the past to the current landscape to document rates of change along the coast, as well as compare a topographic map to current aerial photos or satellite images to document changes in size and distribution of thaw lakes.
13. Each student writes a letter describing their journey from point A to point B. Students should including a description of at least five topographic features they will encounter on their route (i.e. rivers, lakes, mountains, valleys, and islands). Students need to defend why they chose their route.

INTERPRETING TOPOGRAPHIC MAPS

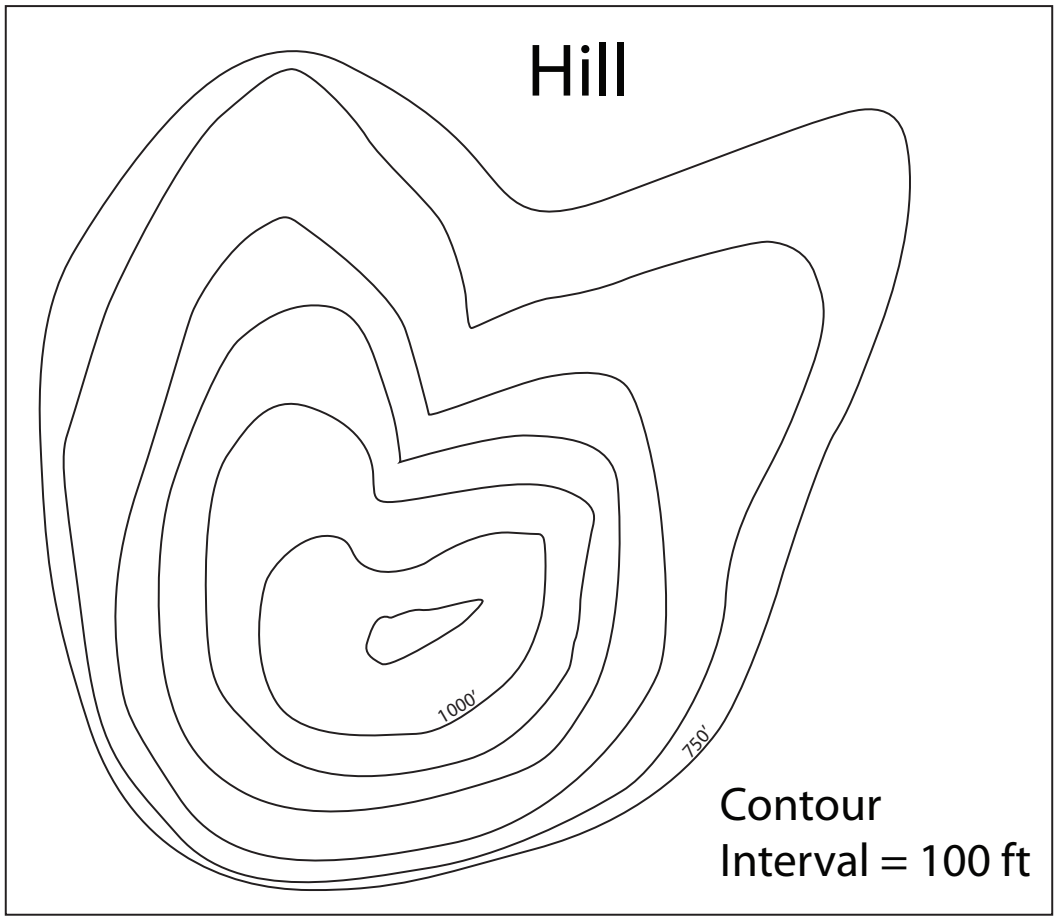
RUBRIC

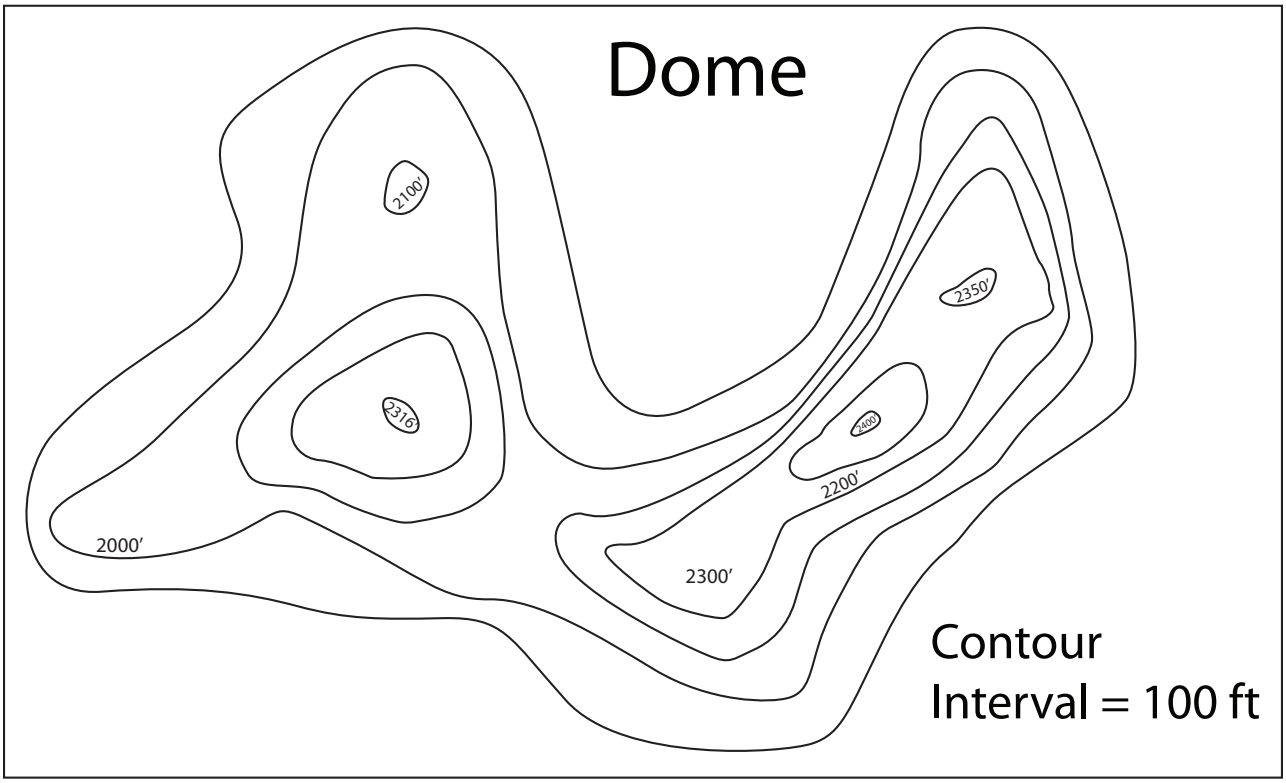
Assessment Task

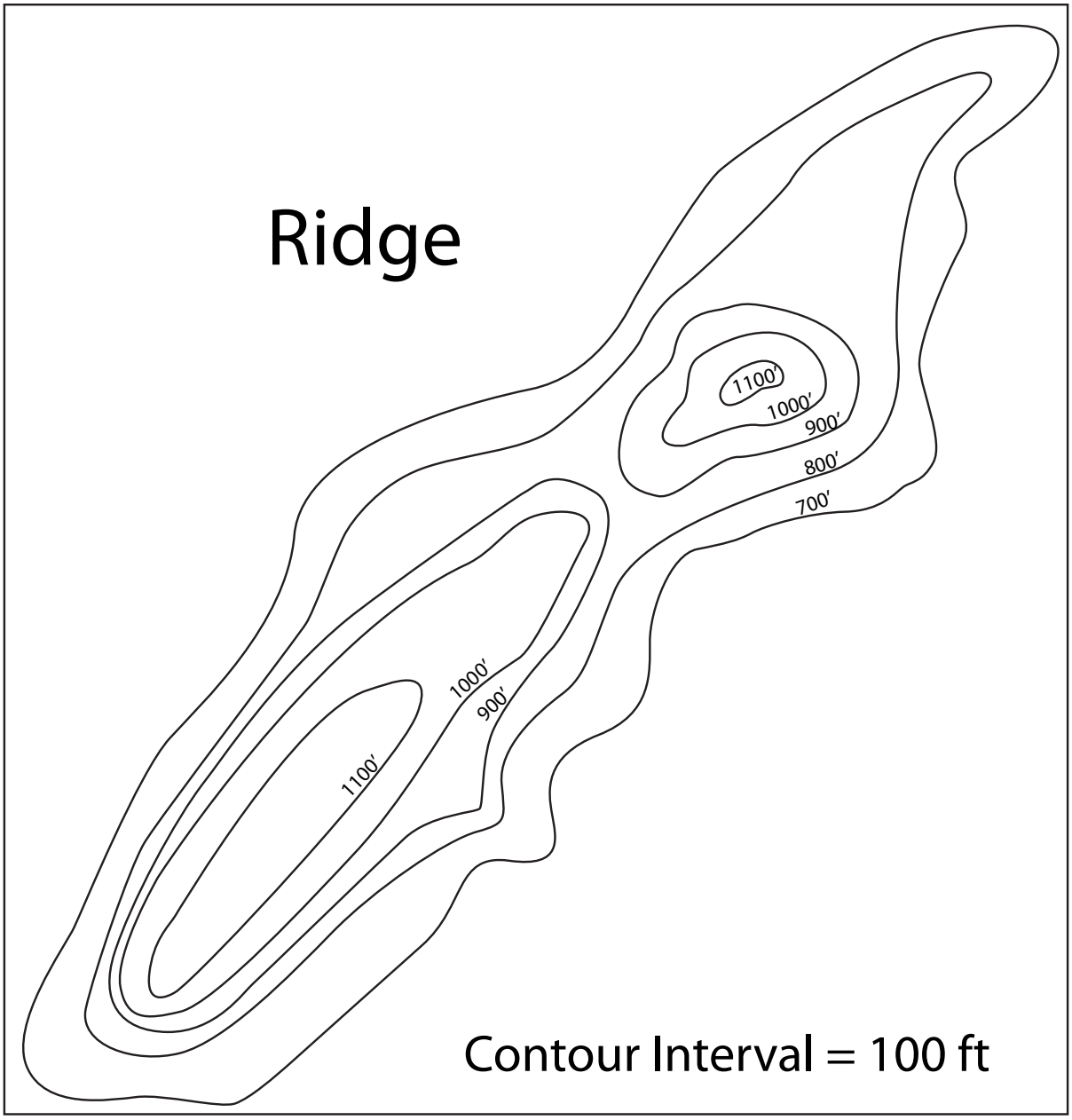
Each student writes a letter describing their journey from point A to point B. Students should include a description of at least five topographic features they will encounter on their route (i.e. rivers, lakes, mountains, valleys, and islands). Students need to defend why they chose their route.

Rubric:

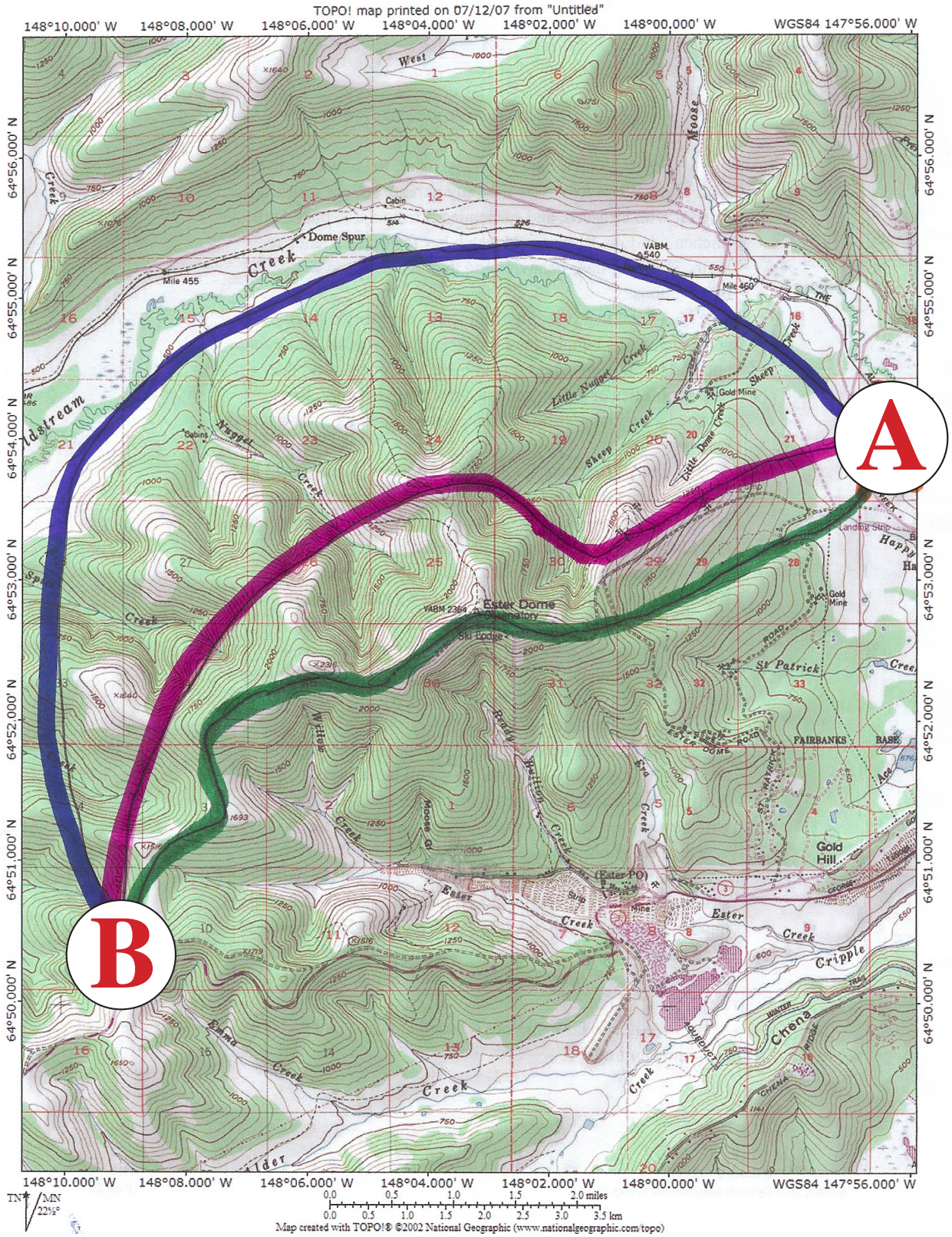
Objectives	GLEs	Below Proficient	Proficient	Above Proficient
The student identifies land features from a topographic map.	[8] SD2.1	The student identifies 3 or 4 features from a topographic map.	The student identifies 5 features from a topographic map (i.e., rivers, lakes, mountains, valleys, and islands).	The student identifies 5 or more features from a topographic map and infers what ecosystems might be associated with those features.
The student makes inferences based on their knowledge of topographical maps.	[8] SA1.1	The student does not make an inference based on qualitative observations that are supported by their understanding of the features found on a topographic map (i.e. student does not avoid a hazard).	The student makes an inference based on qualitative observations that are supported by their understanding of the features found on a topographic map (i.e. route avoids all hazards such as a cliff).	The student makes more than one inference based on qualitative observations that are supported by their understanding of the features found on a topographic map (route avoids all hazards and is the shortest route possible).
The student writes a letter describing and defending a route.	[8] W3.2.2	The student writes a letter that does not clearly or accurately describes and defend their route.	The student writes a letter that clearly and accurately describes and defends their route.	The student writes a letter that clearly and accurately describes and defends their route and is persuasive.


Hill
1000'
750'
Contour
Interval = 100 ft


Dome
2100'
2350'
2316
2400
2200'
2000'
2300'
Contour
Interval = 100 ft


Ridge
1100'
1000'
900'
800'
700'
1000'
900'
1100'
Contour Interval = 100 ft

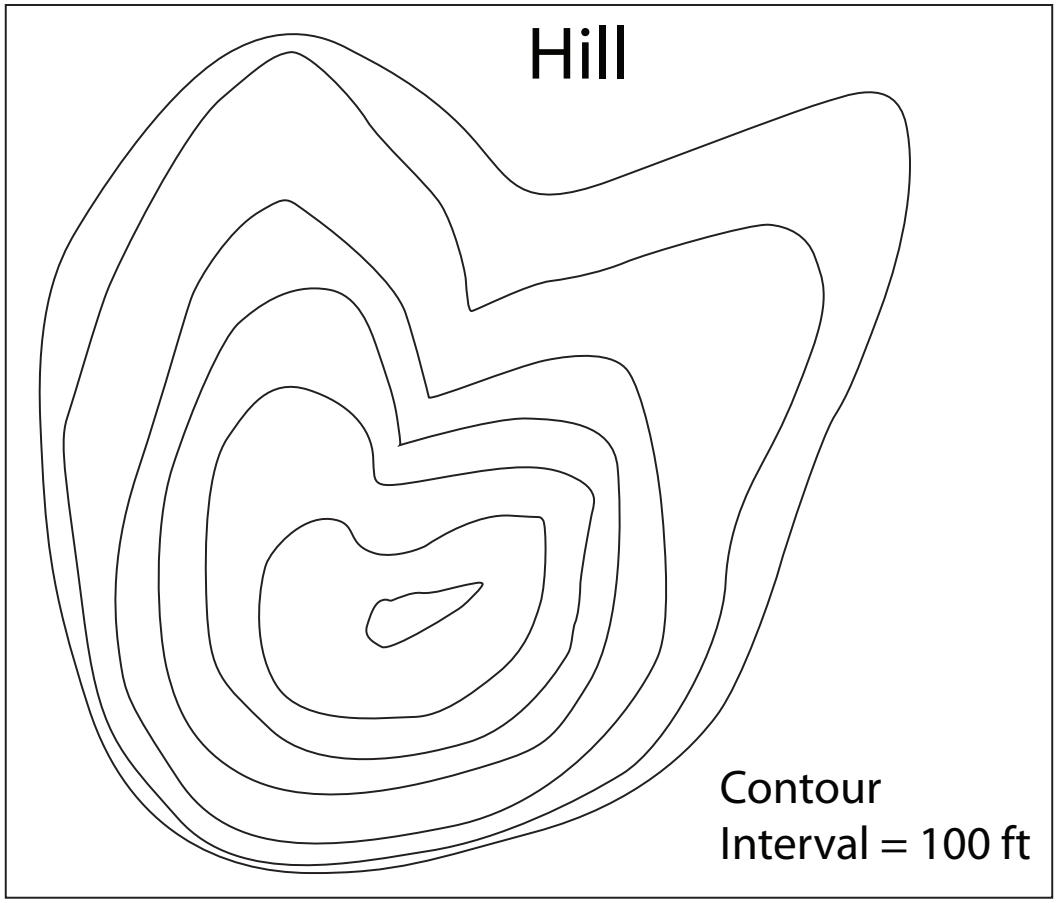
ESTER DOME

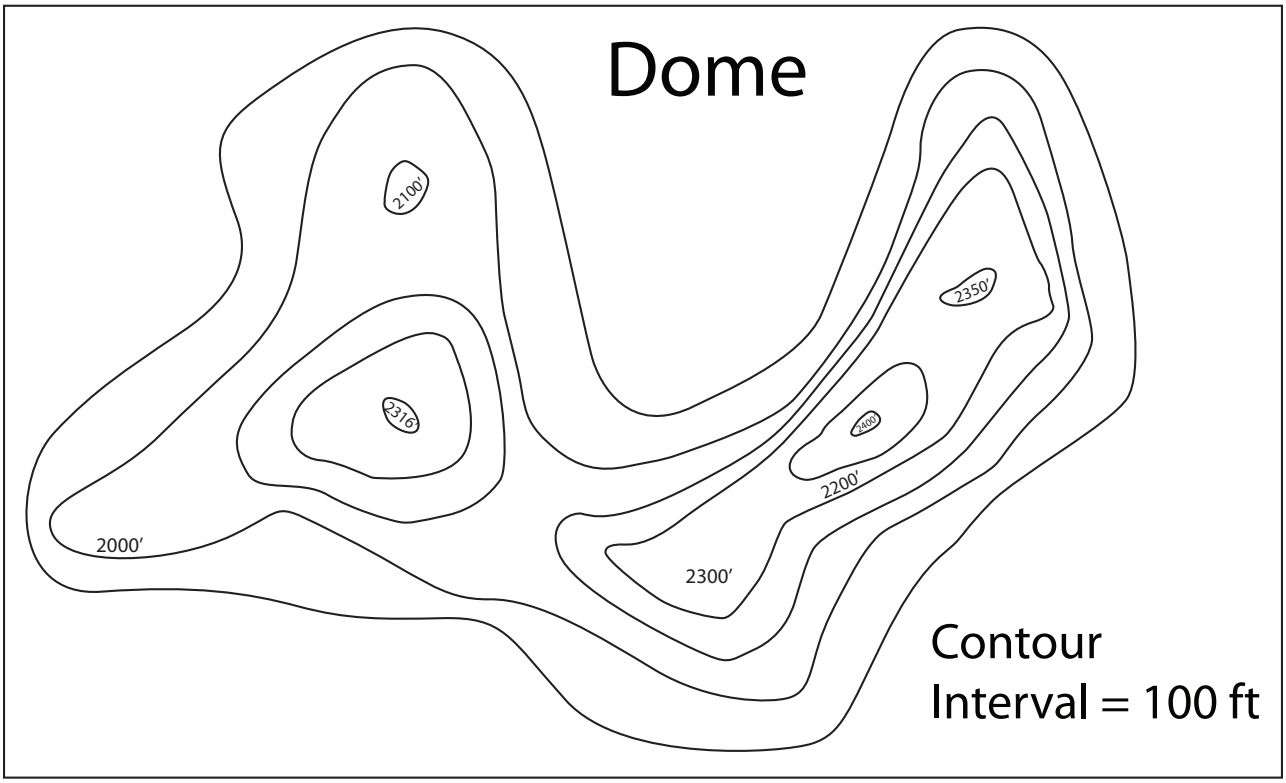

TOPO! map printed on 07/12/07 from "Untitled"
148°10.000' W
148°08.000' W
148°06.000' W
148°04.000' W
148°02.000' W
148°00.000' W
WGS84 147°56.000' W
64°56.000' N
64°55.000' N
64°54.000' N
64°53.000' N
64°52.000' N
64°51.000' N
64°50.000' N
Dome Spur
Mile 455
Mile 460
VABM 4540
Ester Dome
Ski Lodge
Gold Mine
Gold Hill
(Ester PO)
FAIRBANKS BASE
St Patrick
Ester Creek
Cripple Creek
Chena
A
B
TN
MN
22½°
0.0 0.5 1.0 1.5 2.0 miles
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 km
Map created with TOPO!® ©2002 National Geographic (www.nationalgeographic.com/topo)

The Gorge

One late winter, Vance, a new teacher on Kodiak Island, decided to hike into a remote valley to do some wintertime ptarmigan hunting with some friends. Vance consulted a topographic map to familiarize himself with the new area where he would be hiking. He determined that he would hike upstream in one valley, follow it to its headwaters, cross over a ridge into an adjacent valley, hike downstream, cross the stream at the bottom of the valley, and walk to a friend's house (with a pack full of ptarmigan for dinner). After a hearty dinner, the group would catch a ride back to their vehicles parked back in the valley where they started.

The morning started out sunny and cold so the snow was hard and easy to walk on. It did not take long for the group to get into good ptarmigan habitat above the tree line, and start seeing ptarmigan. By the time the group had reached a high enough elevation to cross over into the next valley the snow had started to get soft which made walking much more difficult. They were glad that the rest of the hike would be mostly downhill. Eventually, they reached the stream they planned to cross to get to their friend's house, but there was something wrong. The stream was at the bottom of a deep gorge with very steep sides that would make climbing down to the stream too dangerous. Even though they were less than a mile from their friend's house and near the end of the hike. They were forced to walk all the way back to where they parked their cars along a route much longer than they had planned. This took several more hours, and they did not get back to their cars until after dark. When Vance got back home he realized that he had hastily looked at the map and missed an important feature. What do you think that he missed that would have let him know the stream was at the bottom of a steep gorge?


Hill
Contour
Interval = 100 ft


Dome
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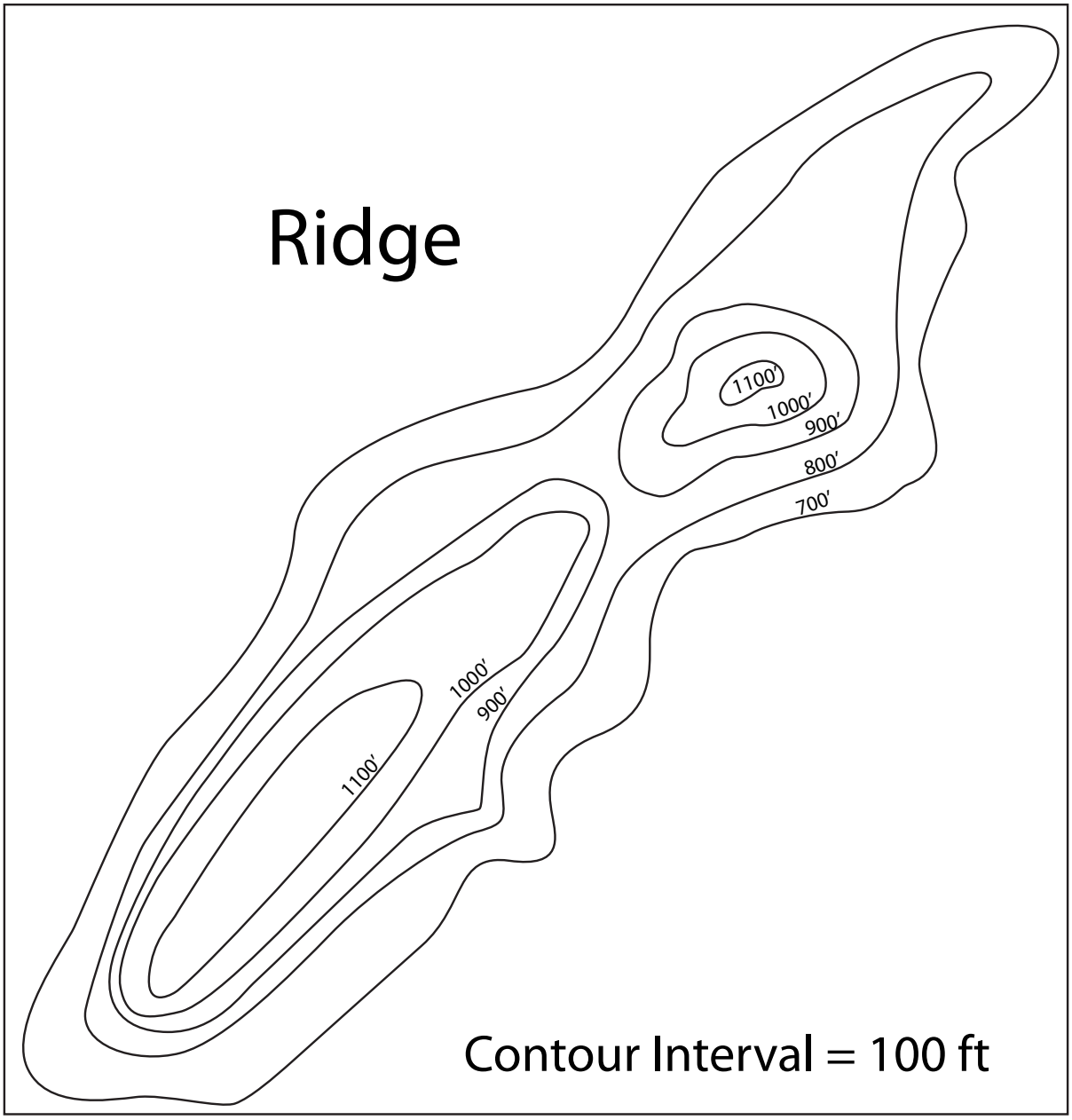
2000'
2300'
Contour
Interval = 100 ft


Ridge
1100'
1000'
900'
800'
700'
1000'
900'
1100'
Contour Interval = 100 ft

NAME: _____ STUDENT WORKSHEET

MAPPING

Directions:

Map the objects provided by the teacher. After all objects are mapped, exchange your map with another group. Navigate from point A to point B via the easier route possible, going over at least one object. Mark your route with a pencil.

A

B

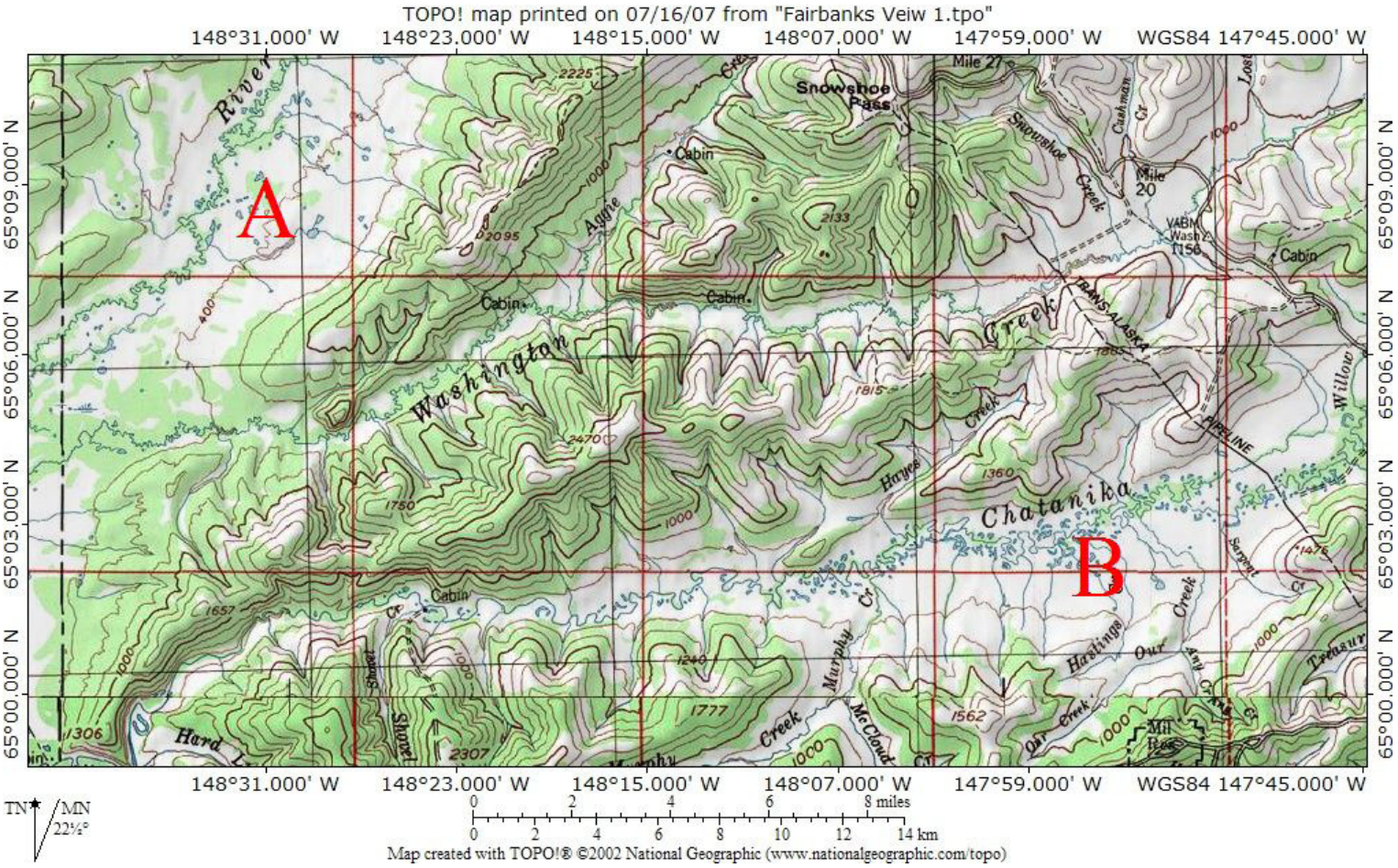
NAME: _____

MAPPING ROUTES

STUDENT WORKSHEET
(page 1 of 2)

Directions:

Part A: 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.



NAME: _____

MAPPING ROUTES

Part B: Write a letter describing your journey from point A to point B. Include a description of at least five topographic features you encountered on the route (i.e. rivers, lakes, mountains, valleys, and islands). Defend why you chose this route.