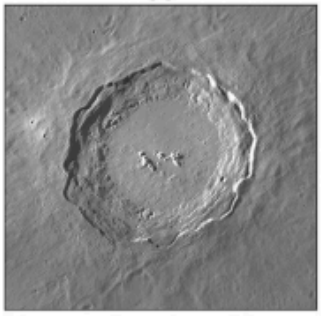
WARM UP

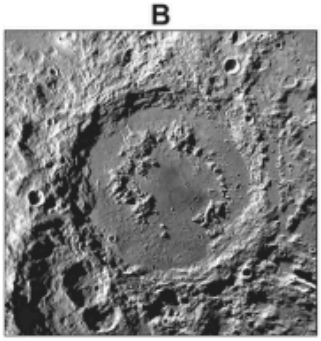
The Late Heavy Bombardment is a period of time when Earth, the Moon, and the other inner planets experienced intense impact activity from asteroids and comets. Information about the Moon's early history can be obtained from observations of craters on the Moon's surface. The photographs below show four different impact craters.

A



Uneven rim edge with shallow middle depression in crater bottom.

B

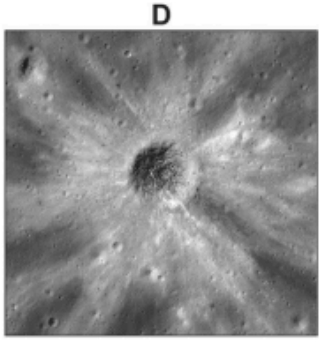


Smaller craters visible on weathered, less-distinct rim edge.

C

Missing parts of rim edge with multiple smaller craters inside crater bottom.

D



Distinct rim of crater surrounded by ejected material with deep middle depression.

1. Which table identifies the correct relative ages of two craters and a piece of evidence that supports the hypothesis for the Late Heavy Bombardment?

(1)

Oldest Crater	Youngest Crater	Evidence for the Late Heavy Bombardment
B	A	Craters of all ages cover most of the Moon's surface.

(2)

Oldest Crater	Youngest Crater	Evidence for the Late Heavy Bombardment
B	D	Multiple smaller craters are found inside the bottoms of larger craters.

(3)

Oldest Crater	Youngest Crater	Evidence for the Late Heavy Bombardment
C	A	The rims of the smaller craters are surrounded by younger ejecta materials.

(4)

Oldest Crater	Youngest Crater	Evidence for the Late Heavy Bombardment
C	D	A large proportion of craters were determined to have formed over a short period of time.

OBJECTIVE

SWBAT calculate the gradient between two points on a topographic map.
SWBAT determine the direction of stream flow on a topographic map based on the shape of the contour lines.

Criteria For Success (CFS)

Students will receive a minimum score of an 80% on the exit ticket.

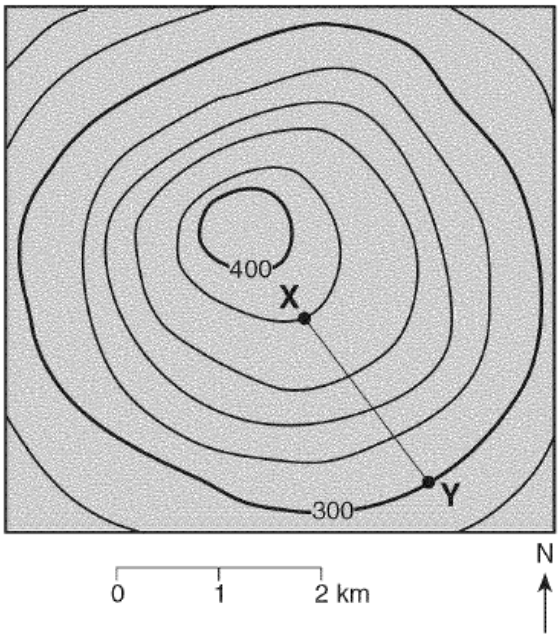
Calculating Gradient In Topographic Profiles:

$$\text{Gradient} = \frac{\text{change in field value}}{\text{distance}}$$

Calculating the gradient, or slope, in a topographic map profile, involves determining both the horizontal distance (usually measured in kilometers or **km**), and finding the change in elevation, which is calculated by finding the contour interval and determining the change in elevation. For an example, look at the Regents problem below:

Example I:

The topographic map below shows a hill. Points *X* and *Y* represent locations on the hill's surface. Elevations are shown in meters.



What is the gradient between points X and Y?

a.) 40 m/km
b.) 80 m/km
c.) 100 m/km
d.) 120 m/km

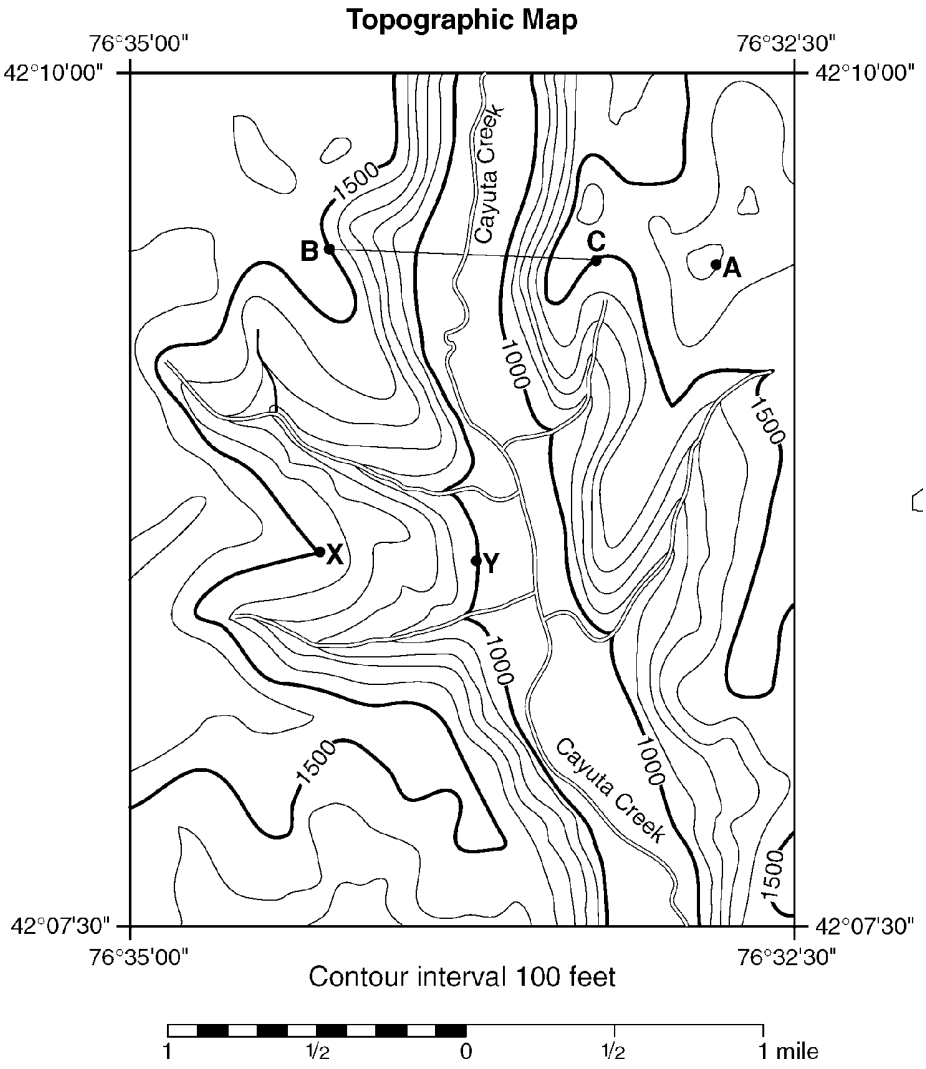
Example II:

A stream has a source at an elevation of 1,000 meters. It ends at a lake that has an elevation of 300 meters. If the lake is 200 kilometers away from the source, what is the average gradient of the stream?

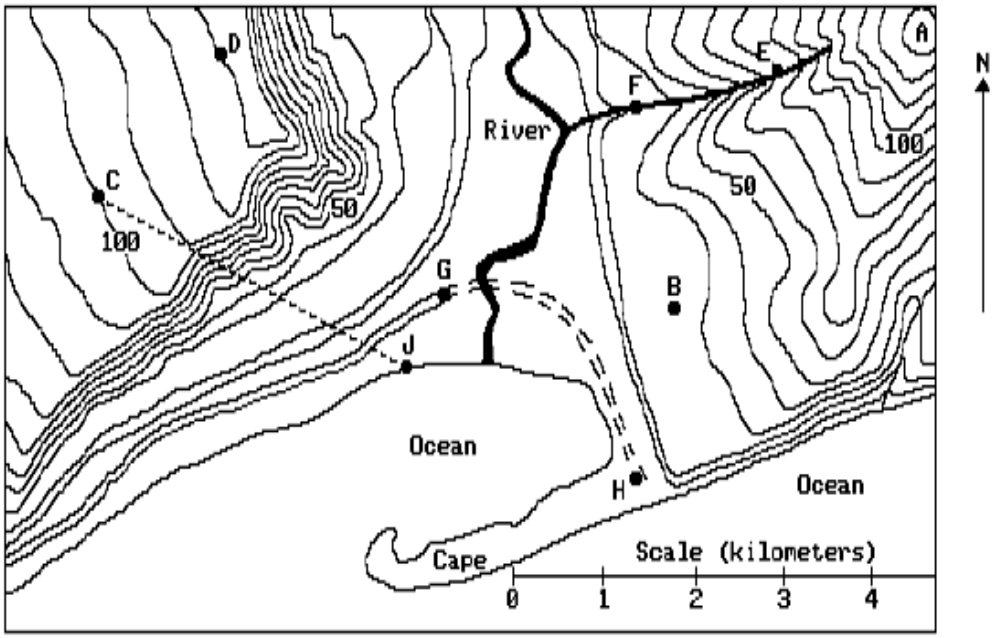
Draw a picture:	Change in field value = _____ Distance = _____ Gradient = _____	a.) 15 m/km b.) 10 m/km c.) 3.5 m/km d.) 1.5 m/km

Gradient Practice:

1.) What is the approximate gradient between point *X* and point *Y*?
   a.) 100 ft/mi
   b.) 250 ft/mi
   c.) 500 ft/mi
   d.) 1,000 ft/mi

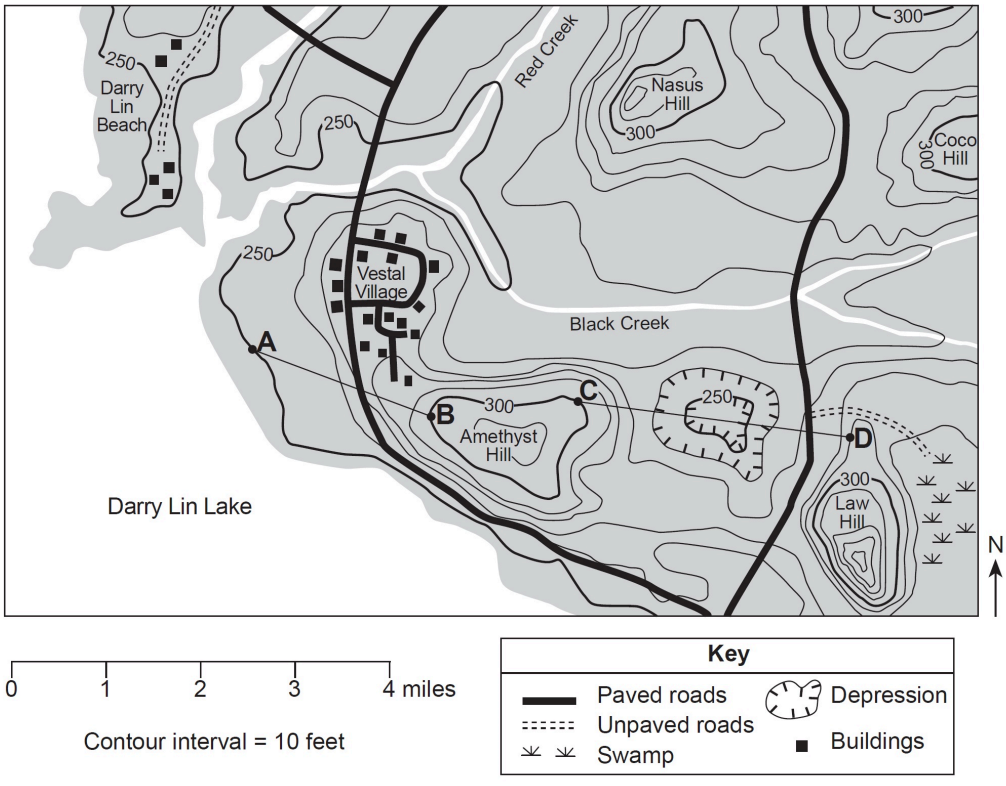


The topographic map below represents a coastal landscape. The contour lines show the elevation in meters.



2.) What is the rate of change in elevation (gradient) of the land from point *C* to point *D*?

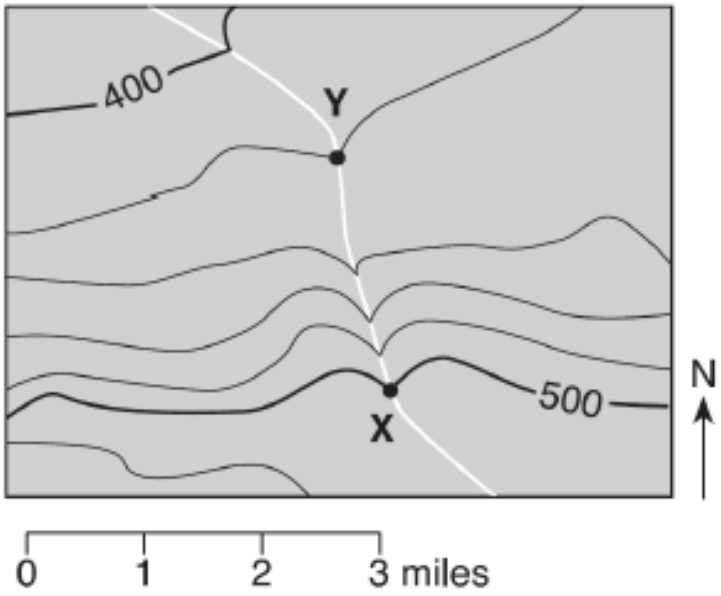
a.) 15 m/km
b.) 25 m/km
c.) 10 m/km
d.) 20 m/km



3.) What is the approximate gradient from point *A* to point *B* on the map?

a.) 25 feet per mile
b.) 50 feet per mile
c.) 75 feet per mile
d.) 100 feet per mile

The topographic map below shows a stream crossing several contour lines and passing through points *X* and *Y*. Elevations are measured in feet.



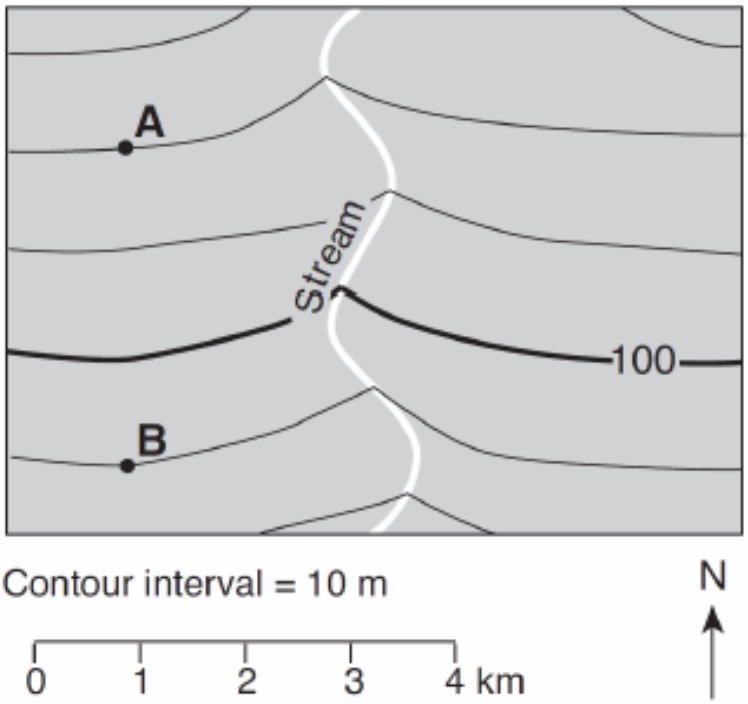
4.) What is the approximate gradient between point *X* and point *Y*?

a.) 10 ft/mi
b.) 20 ft/mi
c.) 40 ft/mi
d.) 80 ft/mi

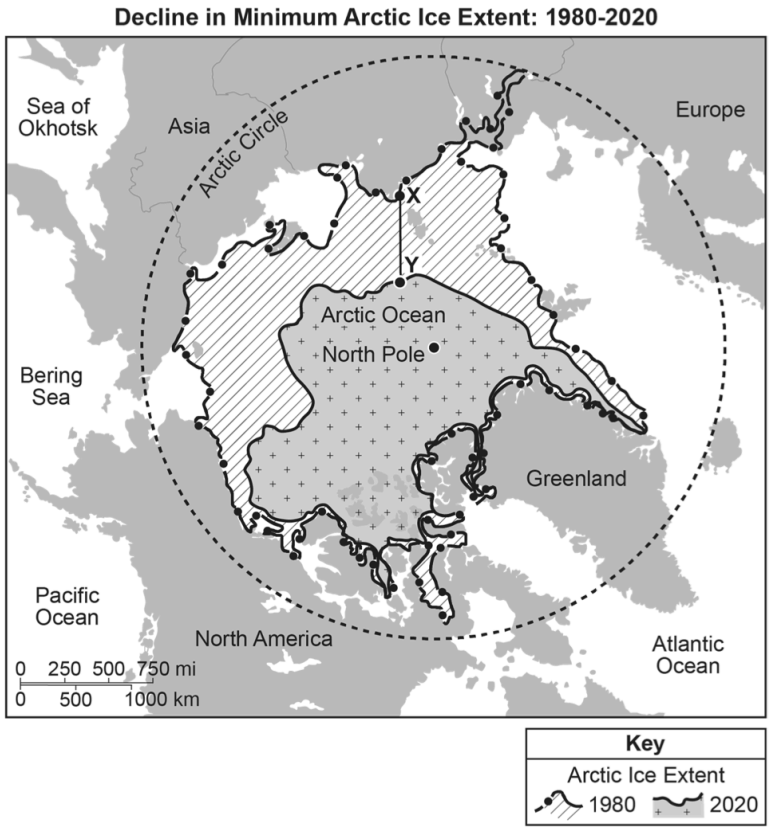
The topographic map below shows the location of a stream. Points *A* and *B* are locations on Earth's surface.

5.) What is the gradient between points *A* and *B*?

a.) 1 m/km
b.) 2 m/km
c.) 10 m/km
d.) 20 m/km



The map below shows some information about the change in Arctic Ocean ice extent. Line X–Y is a reference line.



6.) Which claim identifies the current rate of Arctic ice change along line X–Y and its effect on the North Pole?

a.) In the next two years, the North Pole will most likely be ice-free because the rate of decline in the last 40 years is 12.5 mi/yr.

b.) In the next five years, the North Pole will still be covered in ice because the rate of decline in the last 40 years is approximately 12.5 mi/yr.

c.) In the next ten years, the North Pole will most likely be ice-free because the rate of decline in the last 40 years is 12.5 km/yr.

d.) In the next fifty years, the North Pole will most likely still be covered in ice because the rate of change over the last 40 years is approximately 12.5 km/yr.

7.) Which piece of evidence best supports the claim that there is less sea ice formation in the Eastern Arctic Ocean off the coast of Northern Europe?

a.) The Polar Easterlies push sea ice to the eastern side of the Arctic Ocean.

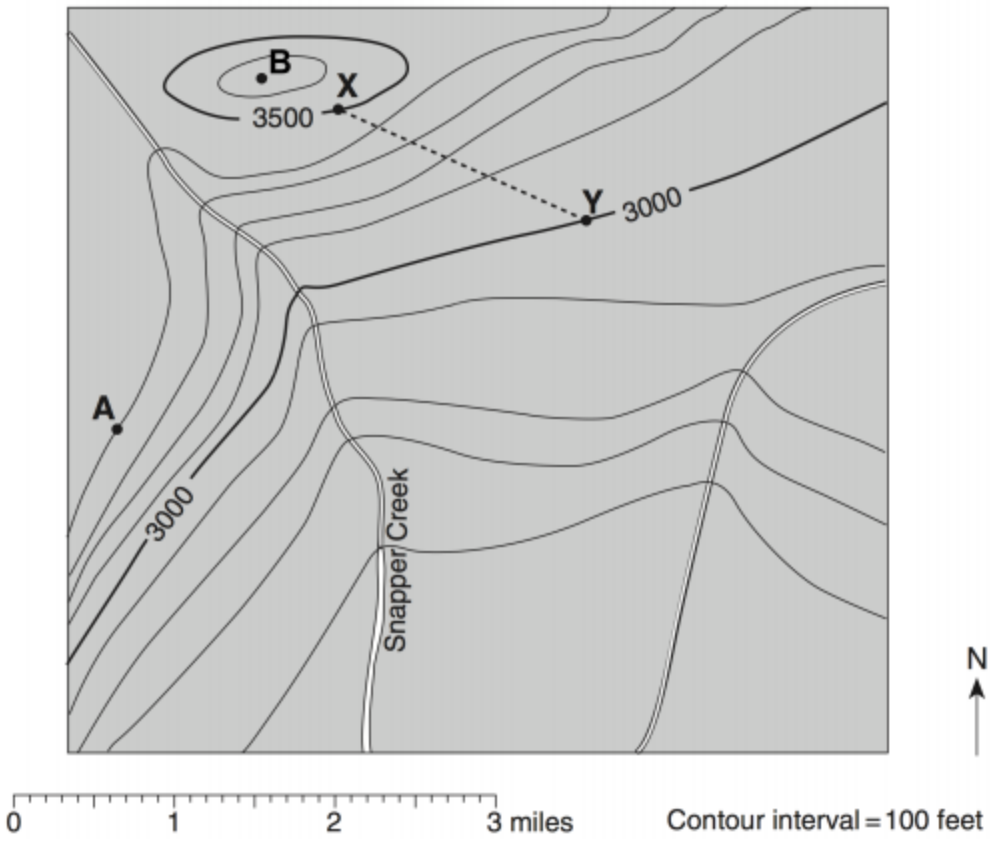
b.) The East Greenland Current causes regional warming of the Arctic Ocean.

c.) The Norwegian Current causes regional warming of the Arctic Ocean.

d.) The Polar Front Jet Stream clears sea ice from the eastern side of the Arctic Ocean.

8.) Calculate the gradient between points X and Y. Units must be included in your answer.

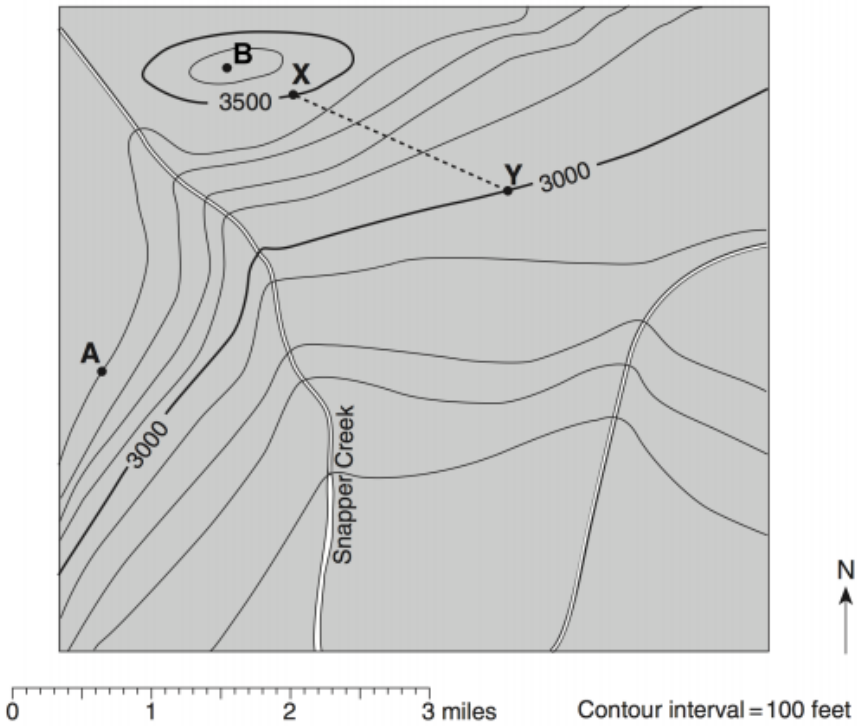
Gradient = _____

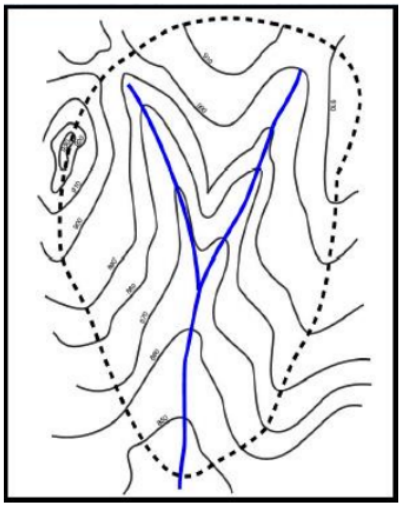


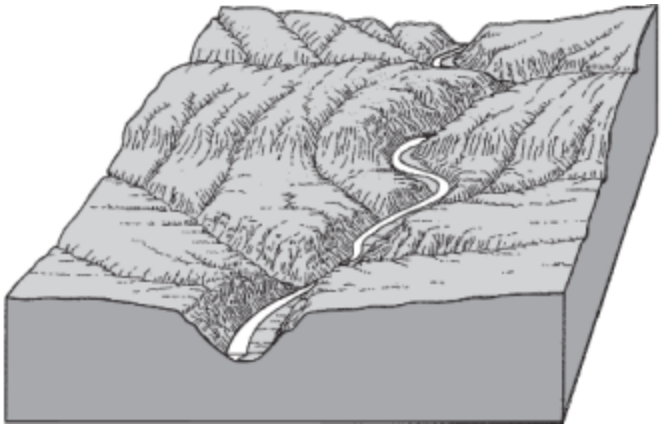
Direction of River Flow:

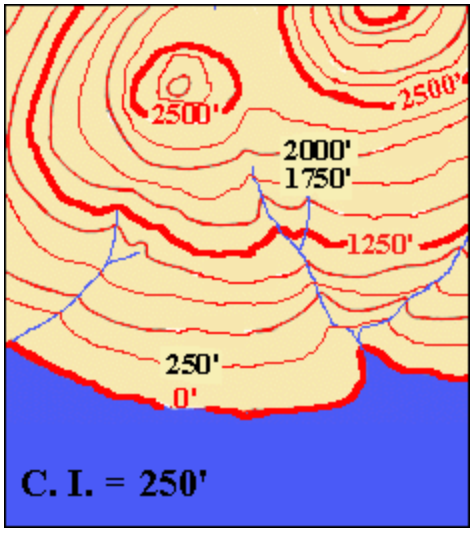
Example I: Look at the map from the previous page below.

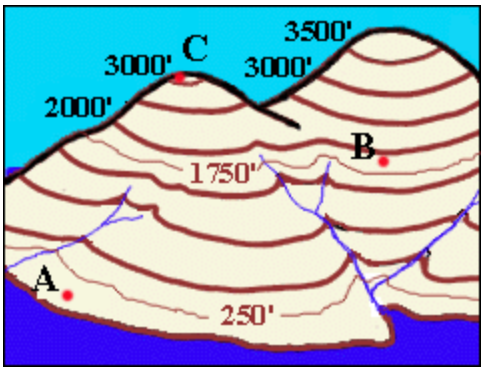
Notice how the stream, Snapper Creek, causes the contour lines to "bend" when they cross the river. When a contour line crosses a river or stream, the bend or V-shape always points upstream.



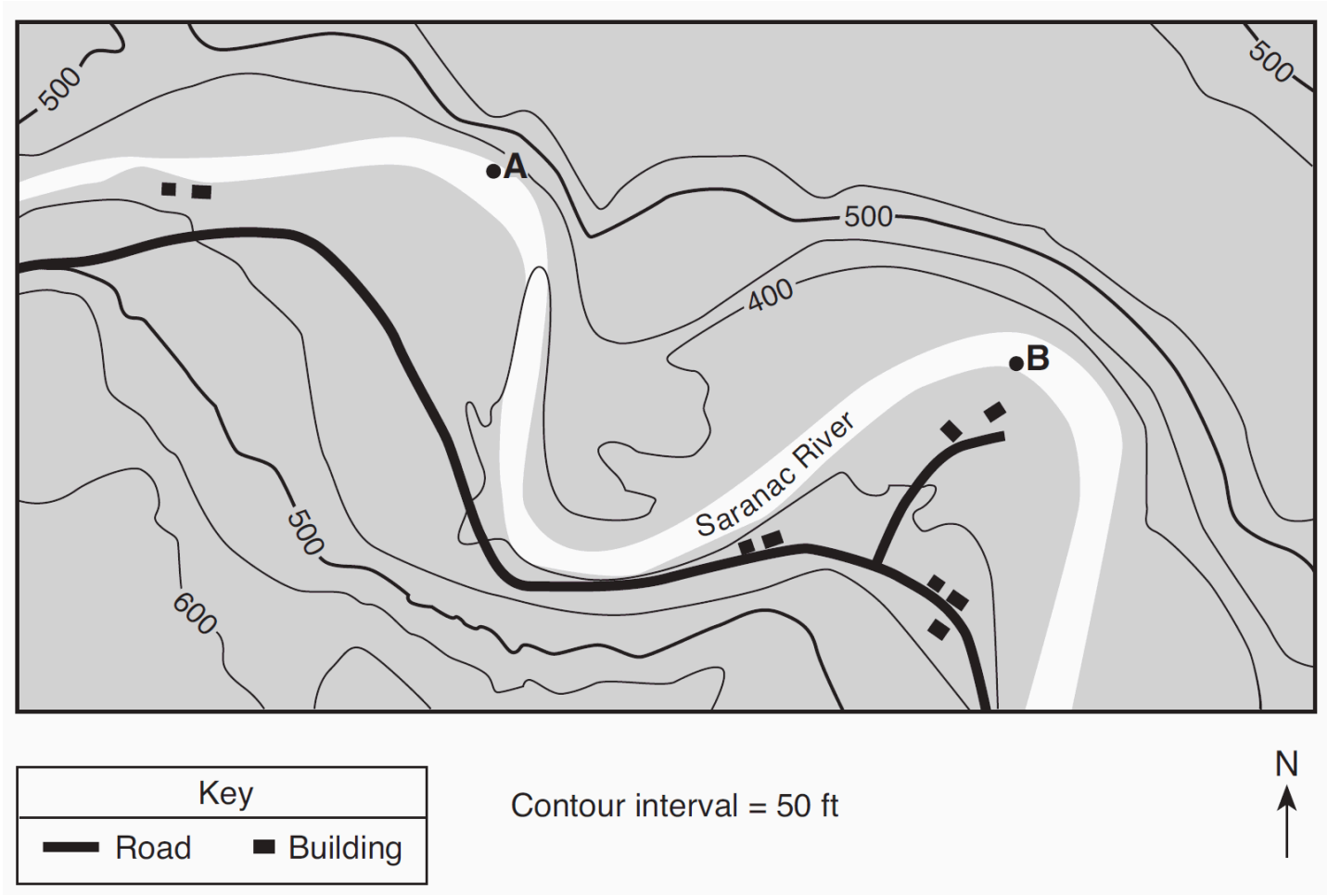








Example II:



Describe how the contour lines in this map indicate that the Saranac River flows from Point *A* to Point *B*.

Answer: _____

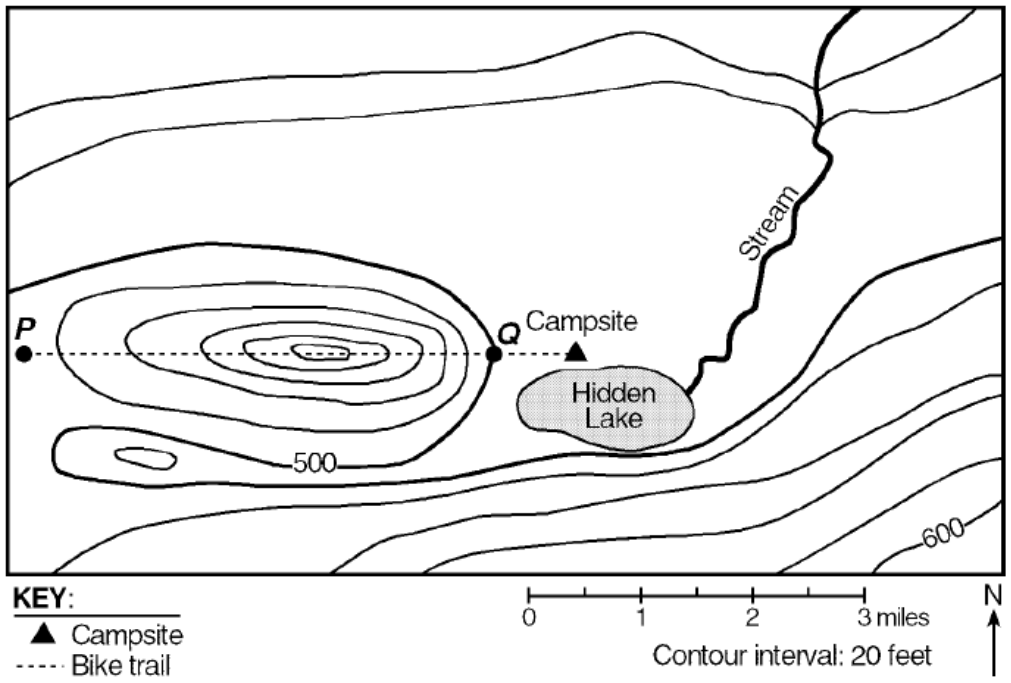
_____

_____

Stream Direction Practice:

1.) State the general compass direction in which the stream is flowing in the given map.

Direction: _____



2.) State how contour lines provide the evidence for determining this direction

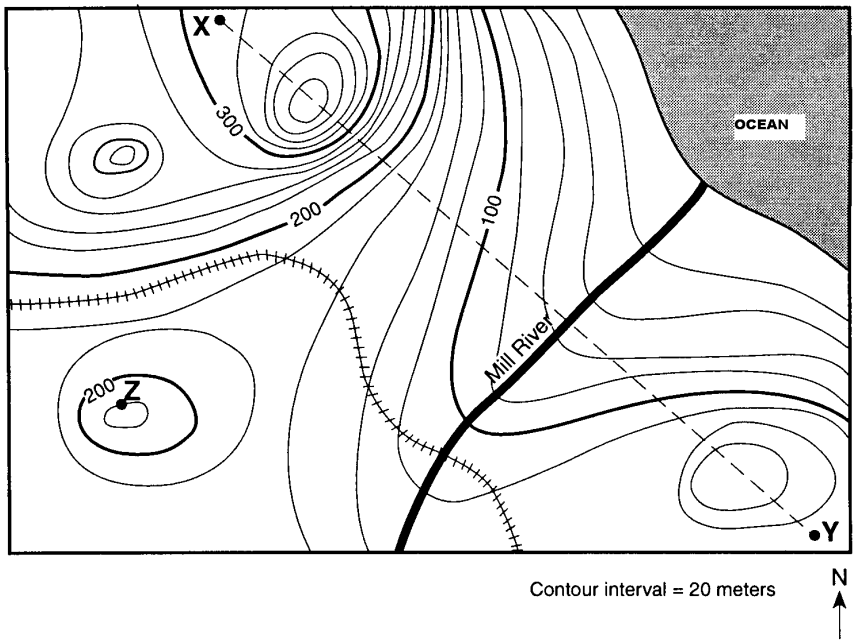
_____

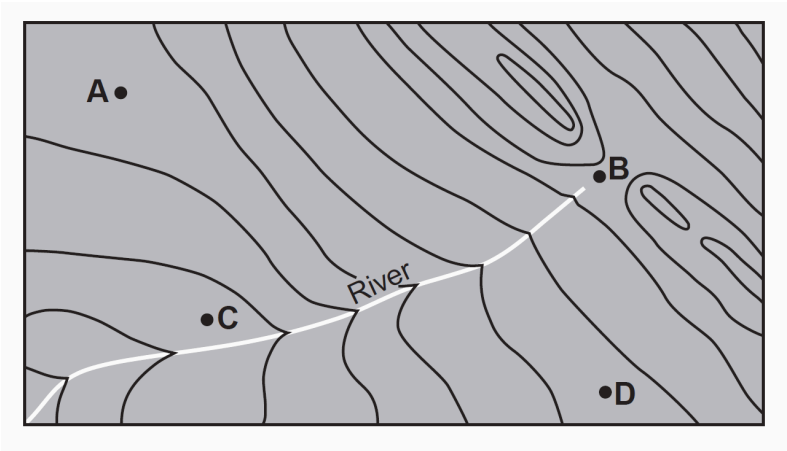
_____

_____

3.) Mill River generally flows toward the

a.) southeast
b.) southwest
c.) northeast
d.) northwest



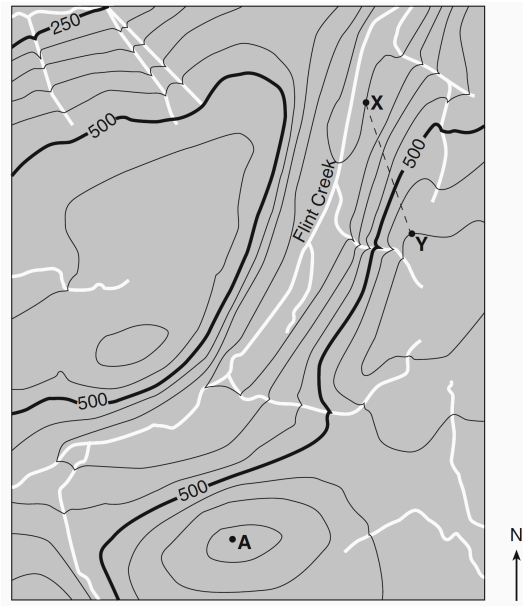


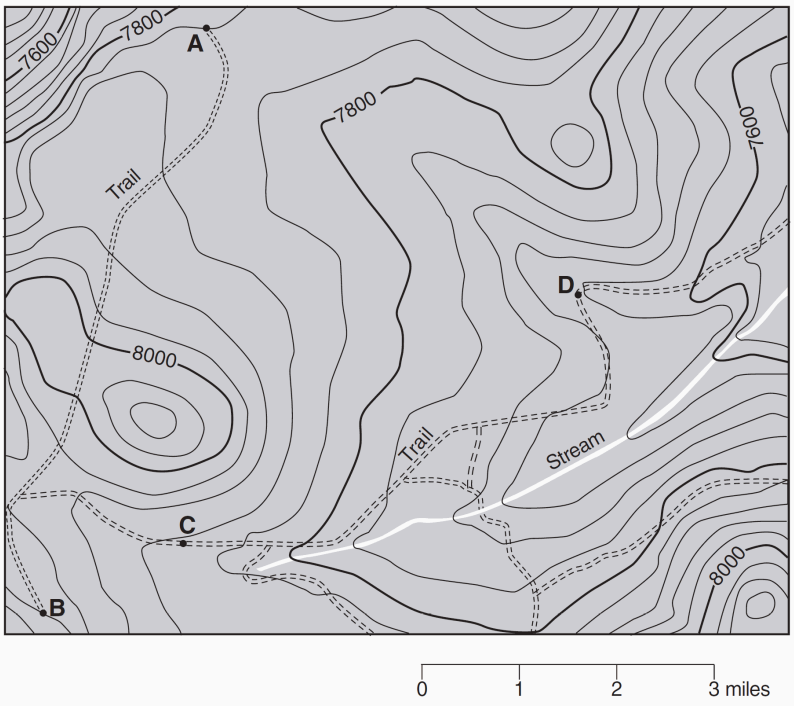
4.) Which lettered location has the highest elevation?

a.) A
b.) B
c.) C
d.) D

5.) In which general direction does Flint Creek flow?

a.) southwest
b.) southeast
c.) northwest
d.) northeast



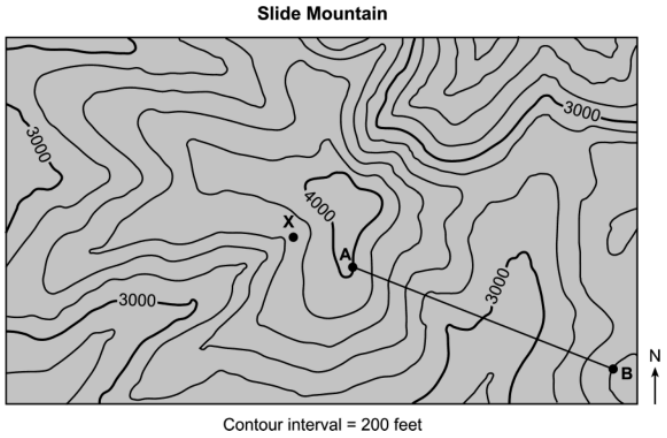


6.) On the map to the left, first, **draw an arrow on the stream** to show the direction in which the stream is flowing. Then state one piece of evidence shown on the map that supports the direction of the arrow you drew on the stream.

Evidence: _____

_____

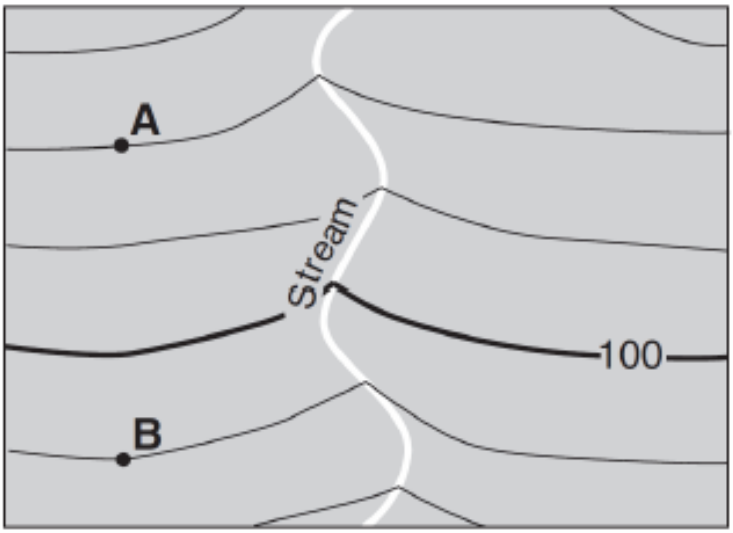
_____

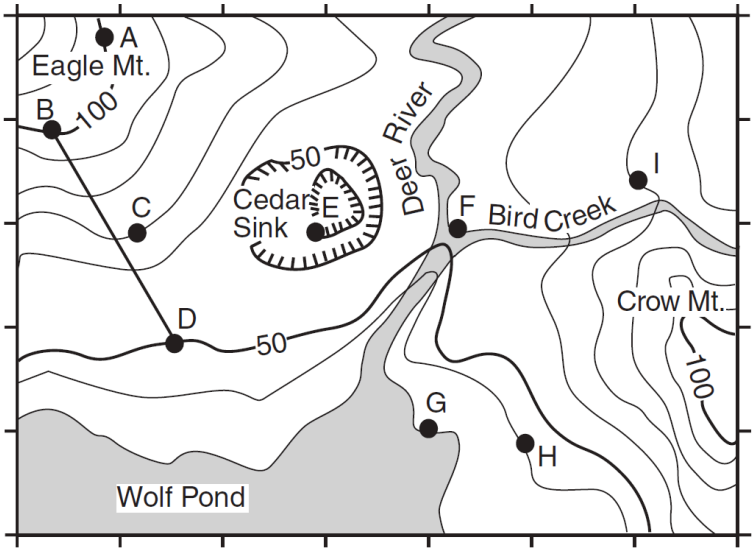


7.) On the map to the left, draw a line showing the most likely path of a stream that begins at point X and flows to the edge of the map.

8.) Identify the direction of stream movement based on the contour lines on the map to the right:

Direction: _____





9.) Identify the direction of stream movement of Bird Creek based on the contour lines on the map to the left:

Direction: _____

Exit Ticket Grade

_____/_____

Name: _____

Date: _____

Class: _____

OBJECTIVE

SWBAT calculate the gradient between to points on a topographic map.

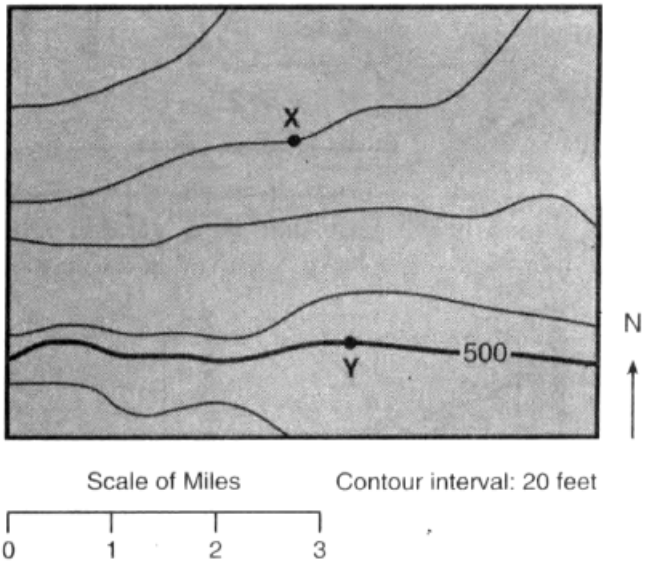
(NOVICE) 1 2 3 4 5 (MASTERY)

SWBAT determine the direction of stream flow on a topographic map based on the shape of the contour lines.

(NOVICE) 1 2 3 4 5 (MASTERY)

Exit Ticket

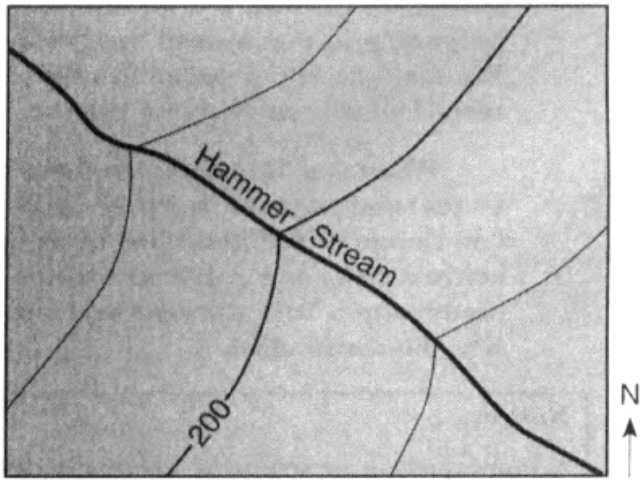
The topographic map below shows locations X and Y.



1.) What is the approximate gradient between X and Y?

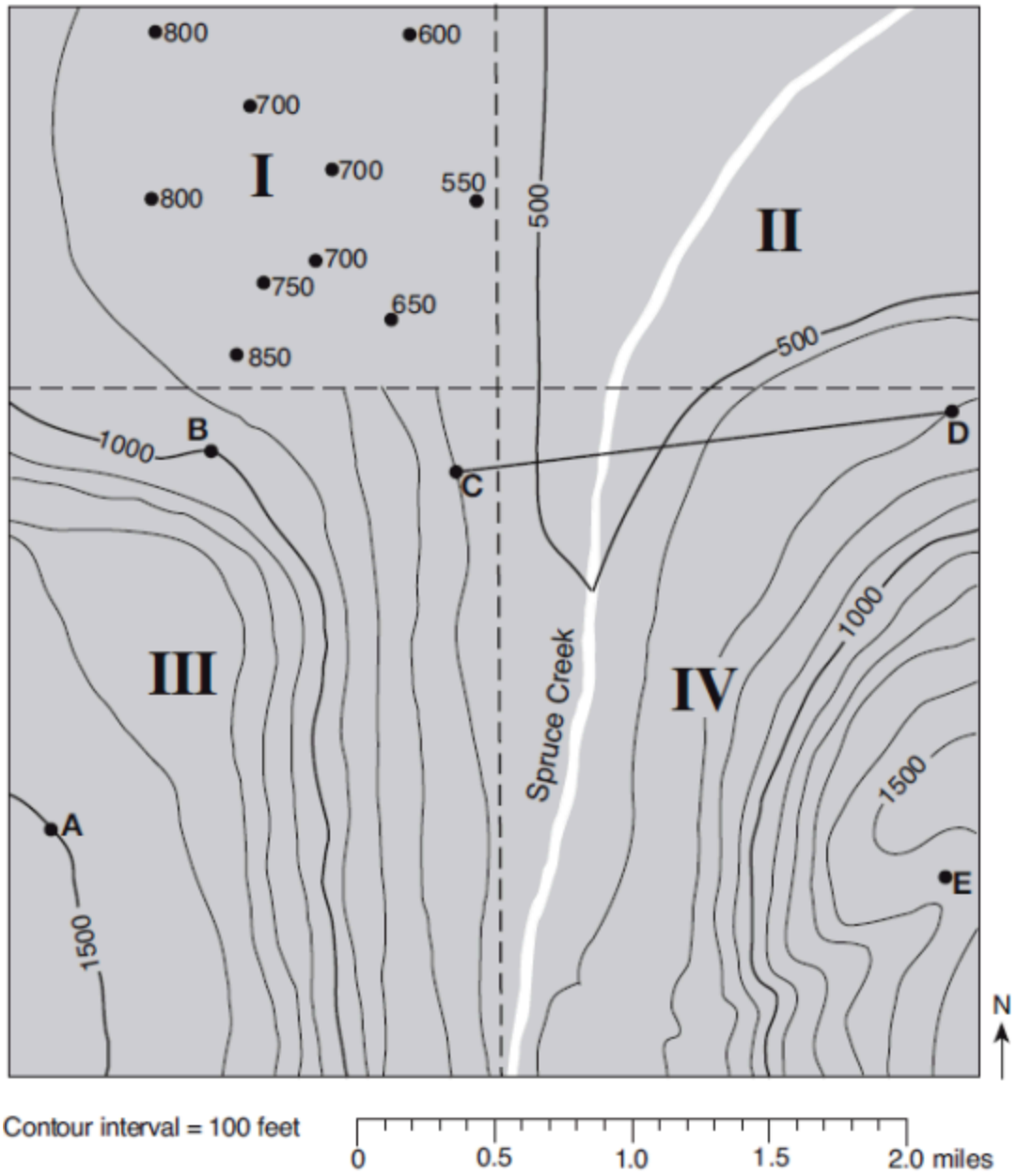
a.) 15 ft/mi
b.) 20 ft/mi
c.) 30 ft/mi
d.) 60 ft/mi

The topographic map below shows part of a stream.



2.) In which general direction is the stream flowing?

a.) northeast
b.) northwest
c.) southeast
d.) southwest



3.) On the map above, draw a line showing the most likely path of a second creek that begins at **location E** and flows into Spruce Creek

4.) What is the elevation of Point C?

_____ ft

5.) Calculate the gradient between locations A and B.

Gradient = _____ feet/mile