

NAME: _____

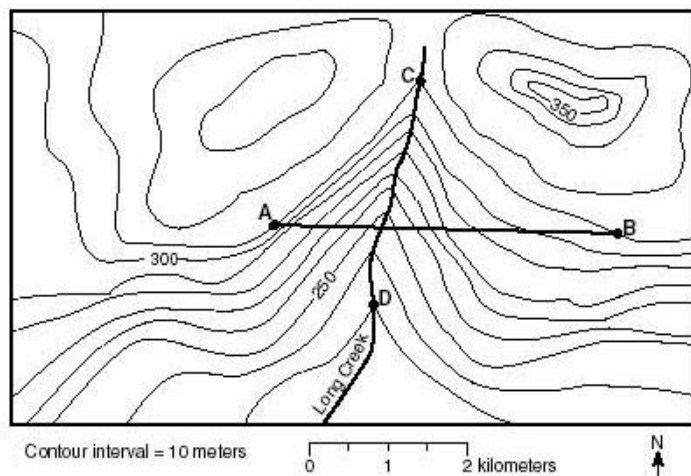
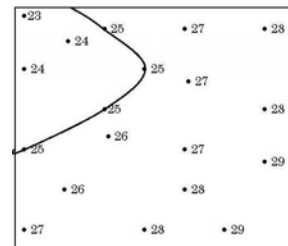
MEASURING THE EARTH NOTES

Log onto YouTube and search for [jocrisci channel](#).

TOPO MAPS (Videos 2.3a, 2.3b, 2.4, 2.5, 2.6, 2.7, 2.8 ESRT 1b part on gradient)

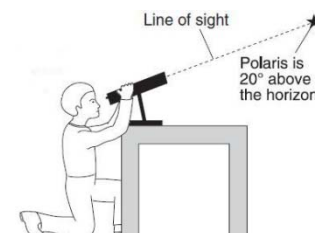
1. You will be given a series of elevations and you will be asked to contour these points to produce a topographic map.
2. You will be given a topographic map with a line drawn on it. You will be asked to construct a profile along that line. (You will practice profiles in class and in labs, very important don't miss!)
3. For the topographic map to the right you must be able to:

- Determine the contour interval
- Determine the elevation of a specific point, either on a contour line or between contour lines
- Calculate the gradient between two points (using the equation in the reference tables)
- Determine the direction of stream flow
- Determine the maximum elevation possible of a mountain
- Identify areas of gentle and steep slopes



LATITUDE AND LONGITUDE (Videos 2.2 ESRT 3a)

1. Determine the latitude and longitude (in degrees and minutes) of a location, with the correct directions: i.e. N, S, etc.
 - a. Which city is located at the following coordinates?
 - i. $42^{\circ} 05' N$ $75^{\circ} 55' W$
 - ii. $44^{\circ} 00' N$ $75^{\circ} 55' W$
 - iii. $42^{\circ} 40' N$ $73^{\circ} 45' W$
 - b. What is the latitude and longitude of the following locations?
 - i. Kingston
 - ii. Old Forge
 - iii. Mount Marcy
2. Determine the altitude of Polaris for any location in the Northern Hemisphere
 - a. What is the altitude of Polaris for the following locations?
 - i. $41^{\circ} N$ $76^{\circ} W$
 - ii. $35^{\circ} S$ $80^{\circ} W$
 - b. In the diagram to the right what is the observer's latitude?



Measuring Earth Facts

- Videos 2.1 ESRT 1a & 14a
1. The true shape of the earth is / an oblate spheroid, bulging equator, flattened at the poles (Earth “appears” round)
 2. Lithosphere is the / solid land part of the earth (made of crust and rigid mantle)
 3. Hydrosphere is the / liquid layer of the Earth (oceans)
 4. Atmosphere is the / gas portion, broken down into 4 layers, lowest is the troposphere
- Videos 2.2 ESRT 3a *
5. Latitude lines run / horizontal, but measure **north** – **south** of Equator (latitude = flatitude)
 6. Longitude lines run / up and down, but measure **east** – **west** of Prime meridian
 7. On the same line of longitude you have the same / time (based on observations from the sun)
 8. Time zones are separated by / 15° degrees of longitude, which equals 1 hour per time zone
 9. As you go East / time does increase (toward London)
 10. As you go West / time gets less (toward California)
 11. The altitude of Polaris equals / your latitude (only in the Northern Hemisphere!)
 12. Polaris is a special star because / it is in line with earth’s axis of rotation and only star in the night sky that doesn’t move.
- Videos 2.3a – 2.8 ESRT 1.b
13. An isoline is / a line connecting points of equal value
 14. Special isolines include: Isobars / pressure; Isotherm / temperature; Contour / elevation
 15. Contour interval is the / amount between each contour line; Ocean is sea level 0'
 16. A set of circles inside circles indicates / a hill
 17. To get the highest possible elevation / subtract one from the next possible contour line
 18. Tick marks on a topo map indicate / depressions; the first tick marked line is the same elevation as the one before it
 19. Lines close together mean / steeper gradient
 20. Water flows / downhill; opposite the bends (“V”) in contour lines (they point upstream)

Earth's Dimensions

Earth's shape

Evidence

Fact(s) to memorize: 1



Spheres of Earth:

1) Lithosphere-

includes:

2) Hydrosphere –

includes:

3) Atmosphere -

Fact(s) to memorize: 2 - 4



Selected Properties of Earth's Atmosphere: Earth Science Reference Table page 14

Name the boundary that separates each of the following:

- (a) the troposphere and the stratosphere _____
- (b) the stratosphere and the mesosphere _____
- (c) the mesosphere and the thermosphere _____

Layer	Highest Altitude		Temperature Range (°C)	
	Miles	Kilometers		
Troposphere			From	to
Stratosphere			From	to
Mesosphere			From	to
Thermosphere			From	to

1. Which layer of the atmosphere is most of the water vapor is located. _____
2. Name the layer, closest to Earth's surface, where the temperature increases as you increase altitude _____
3. What happens to atmospheric pressure as you increase altitude. _____
4. What is the atmospheric pressure at sea level _____ atm
5. What is the temperature at the Tropopause? _____
6. At what boundary is the coldest temperatures found? _____
7. Name the boundary where the atmospheric pressure is approximately .25 atms.

8. In which layers of the atmosphere can the temperature be 15 °C? _____
9. What is the highest concentration of water vapor? _____ g/m³
10. In what layer is the concentration of water vapor 10 g/m³ ? _____

Average Chemical Composition of Earth's Crust, Hydrosphere, and Troposphere
Earth Science Reference Table Practice page 1

1. _____ is the most abundant element in Earth's hydrosphere.
2. The chemical symbol for Calcium is _____
3. In Earth's crust, what is the percentage of magnesium by volume? _____ %
4. Name the two ways in which information regarding the Crust has been categorized. _____ and _____
5. Name the element that can be found in the crust, hydrosphere and troposphere.

6. What is the percentage of iron in the Earth's Crust (by volume)? _____ %
7. What is the most abundant element in the Troposphere? _____
8. What is the percentage of Aluminum in the Earth's Crust (by mass)? _____ %
9. Name the two most abundant elements in the Earth's Crust by mass (include %)
a. _____ % b. _____ %
10. Name the two most abundant elements in the Earth's Crust by volume (include %)
a. _____ % b. _____ %
11. What are the two elements that compose the hydrosphere? (include %)
a. _____ % b. _____ %
12. List the following in order from least to most dense.
Hydrosphere *Atmosphere* *Lithosphere*
Least dense _____
Most dense _____
13. What is the percentage of calcium in the Earth's Crust (by mass)? _____ %
14. When comparing percent by mass and percent by volume in the Earth's crust, which element has a lower percentage by mass? _____
15. Name the only element found in the crust that is a higher percent by volume than percent by mass.

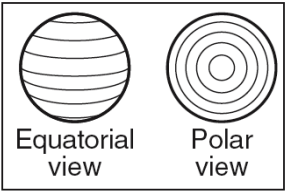
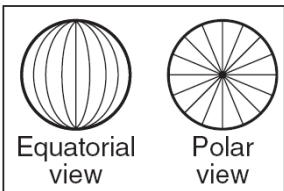
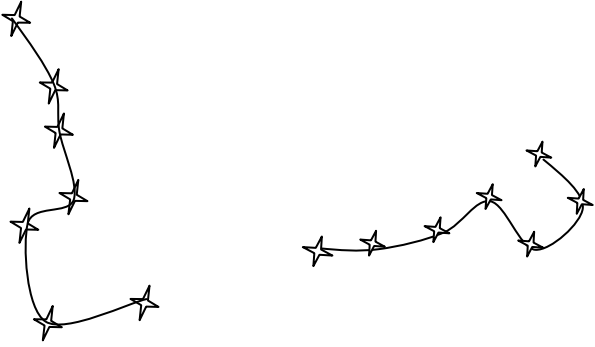
16. What is the percentage by mass that aluminum, iron and calcium combined make up? _____ %
17. Which two elements listed on the chart are not found in Earth's crust?
_____ and _____
18. What percentage of Earth's crust by mass is made of silicon and oxygen combined? _____ %
19. What percentage of Earth's crust by volume is made of silicon and oxygen combined? _____ %

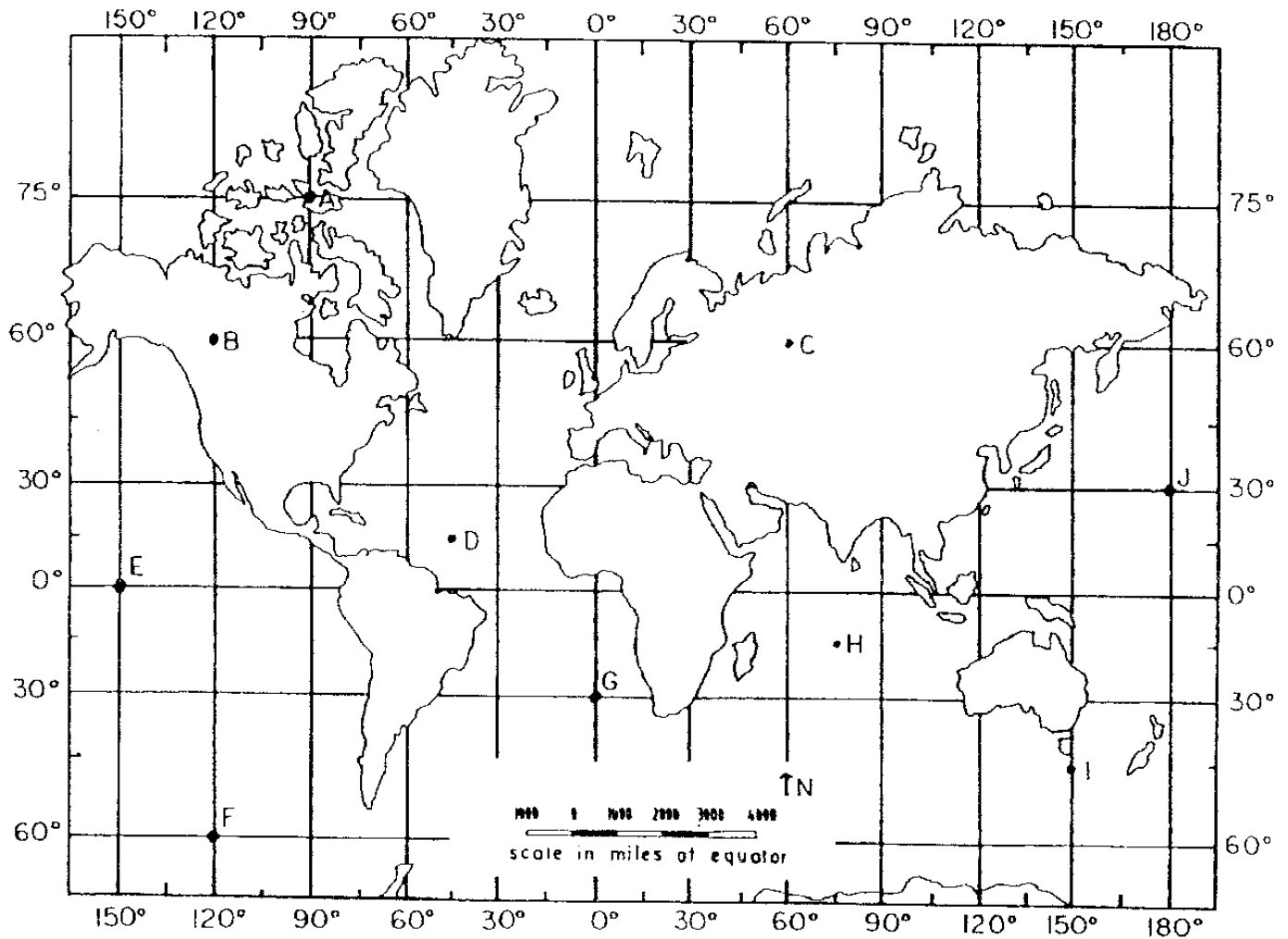
True or False?

20. _____ There is a greater volume of calcium in Earth's crust than there is sodium by mass.
21. _____ In the hydrosphere, hydrogen is the most abundant element by volume.
22. _____ In Earth's troposphere, most of the air we breathe is made up of oxygen.
23. _____ There is more silicon in the crust by mass than oxygen by volume
24. _____ Potassium is the only element found in Earth's crust.
25. _____ In Earth's crust (by mass) there is more magnesium than sodium.

Latitude

Longitude

	Where is 0°	
	Lines are called	
	Lines run	
	Appearance	
	Lines measure degrees	
	Highest degree	
Miscellaneous		
		



Directions:

1. Start by labeling your compass directions next to your degrees of Latitude.
2. Label your compass directions next to your degrees of Longitude.
3. Complete the table below for locations A - I.
4. You **DO NOT** use minutes on this map, only on the NYS Map in the ESRT!!

Example: 45°N, 10°E

Location	Latitude (degrees, direction)	Longitude (degrees, direction)
A		
B		
C		
D		
E		
F		
G		
H		
I		

Practice: Map Reading

Using the Earth Science Reference Tables, page 2 & 3, determine the lat and long for each of the follow:

Location	Latitude	Longitude
Albany		
Binghamton		
Buffalo		
Elmira		
Ithica		
Jamestown		
Kingston		
Messena		
Mt. Marcy		
New York City		

1. What is the elevation of Lake Erie? _____
2. What is the elevation of Lake Ontario? _____
3. Find the map scale. What is the largest number listed for miles? _____
4. Find the map scale. What is the largest number listed for kilometers? _____
5. What is the straight line distance, in miles, from Buffalo to Elmira? _____ miles
6. What is the straight line distance, in km from Watertown to Syracuse? _____ km

TIME ZONES

1. What is the longitude of the:

A. Prime Meridian _____

B. International Date Line _____

2. If Earth makes one complete rotation on its axis (360°) every 24 hours, what is the rate of Earth's rotation? (Show work)

3. How many time zones are there on Earth? _____

A. How many degrees wide is each time zone? _____

B. Using the map below, how many time zones are there in the continental United States? _____



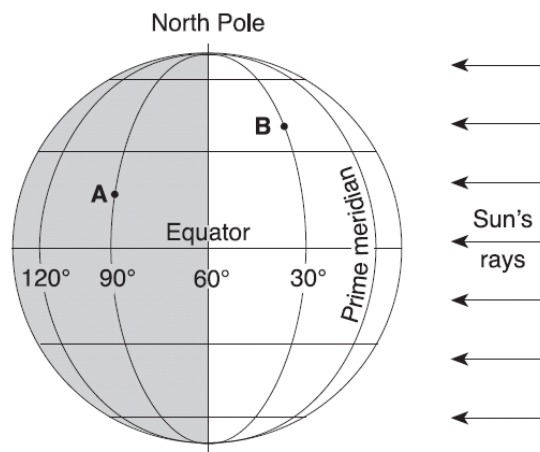
C. Is the time to our west earlier or later than our time in New York? _____

D. What time zone do we live in? _____

4. How many hours difference in time is there between:
 - A. New York and Phoenix _____
 - B. San Francisco and Salt Lake City _____
 - C. Atlanta and Denver _____
 - D. Miami and Honolulu _____
 - E. Anchorage and Oklahoma City _____
5. Using the map above, give the time:
 - A. In New York it is 11 AM. 'y j cv'ko g'ku'k'in Denver _____
 - B. In San Francisco it is midnight. 'y j cv'ko g'ku'k'in Detroit _____
 - C. In Seattle it is 3 PM. 'y j cv'ko g'ku'k'in Honolulu _____
 - D. In Boston it is 6 AM. 'y j cv'ko g'ku'k'in Las Vegas _____
 - E. In Louisville it is 4 PM. 'y j cv'ko g'ku'k'in Atlanta _____
6. For every 15° of longitude, time changes by _____
7. If you move west, time gets earlier/later.
8. If you move east, time gets earlier/later.

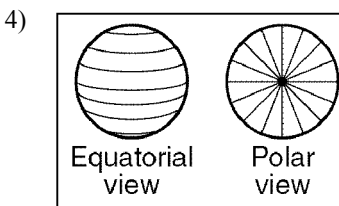
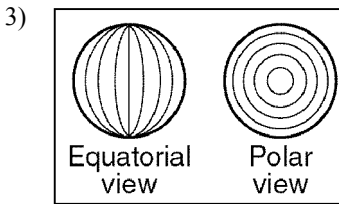
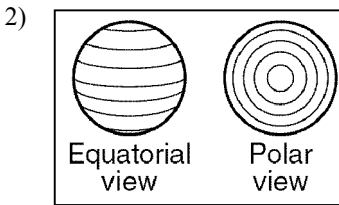
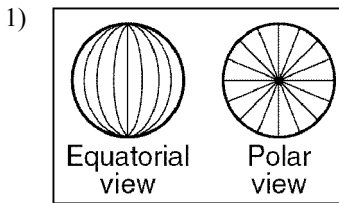
ANSWER THE QUESTIONS BELOW:

9. The diagram below shows the latitude-longitude grid on an Earth model. Points A and B are locations on the surface. On Earth, the solar time difference between point A and point B would be



- The approximate latitude of Utica, New York, is
 - 1) $43^{\circ}05' N$
 - 2) $43^{\circ}05' S$
 - 3) $75^{\circ}15' E$
 - 4) $75^{\circ}15' W$
- From which New York State location would Polaris be observed to have an altitude closest to 43° above the northern horizon?
 - 1) Binghamton
 - 2) Utica
 - 3) Watertown
 - 4) New York City
- At which New York State location will an observer most likely measure the altitude of *Polaris* as approximately 42° ?
 - 1) Jamestown
 - 2) Plattsburgh
 - 3) Oswego
 - 4) New York City

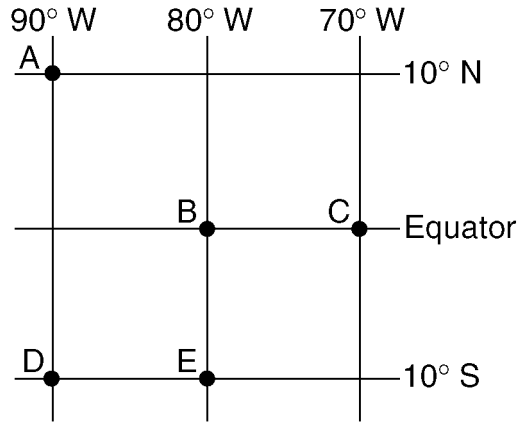
- The lines on which set of views best represent Earth's latitude system?



- What is the approximate location of the Canary Islands hot spot?
 - 1) $32^{\circ} S 18^{\circ} W$
 - 2) $32^{\circ} S 18^{\circ} E$
 - 3) $32^{\circ} N 18^{\circ} W$
 - 4) $32^{\circ} N 18^{\circ} E$

- As a ship crosses the Prime Meridian, an observer on the ship measures the altitude of *Polaris* at 60° . What is the ship's location?
 - 1) 60° south latitude and 0° longitude
 - 2) 60° north latitude and 0° longitude
 - 3) 0° latitude and 60° east longitude
 - 4) 0° latitude and 60° west longitude

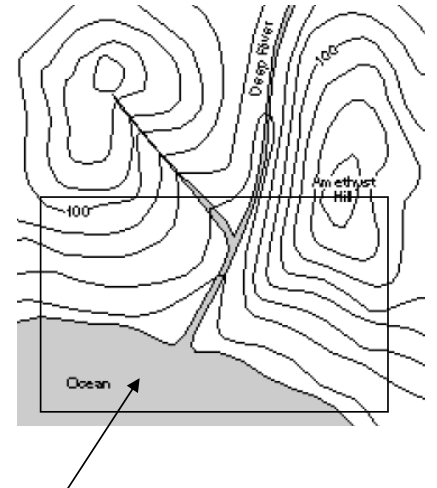
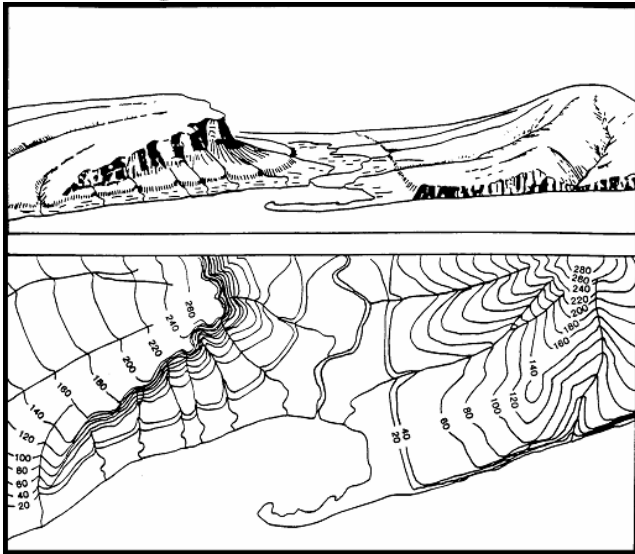
Base your answers to questions 7 and 8 on the map below, which shows the latitude and longitude of five observers, *A*, *B*, *C*, *D*, and *E*, on Earth.



- Which two observers would be experiencing the same apparent solar time?
 - 1) *A* and *C*
 - 2) *B* and *C*
 - 3) *B* and *E*
 - 4) *D* and *E*
- What is the altitude of *Polaris* (the North Star) above the northern horizon for observer *A*?
 - 1) 0°
 - 2) 10°
 - 3) 80°
 - 4) 90°
- When the time of day for a certain ship at sea is 12 noon, the time of day at the Prime Meridian (0° longitude) is 5 p.m. What is the ship's longitude?
 - 1) $45^{\circ} W$
 - 2) $45^{\circ} E$
 - 3) $75^{\circ} W$
 - 4) $75^{\circ} E$
- At which location will the highest altitude of the star *Polaris* be observed?
 - 1) Equator
 - 2) Tropic of Cancer
 - 3) Arctic Circle
 - 4) central New York State

Topographic Maps

Fact(s) to memorize: 13 - 20



Isolines - _____

Isotherms - _____

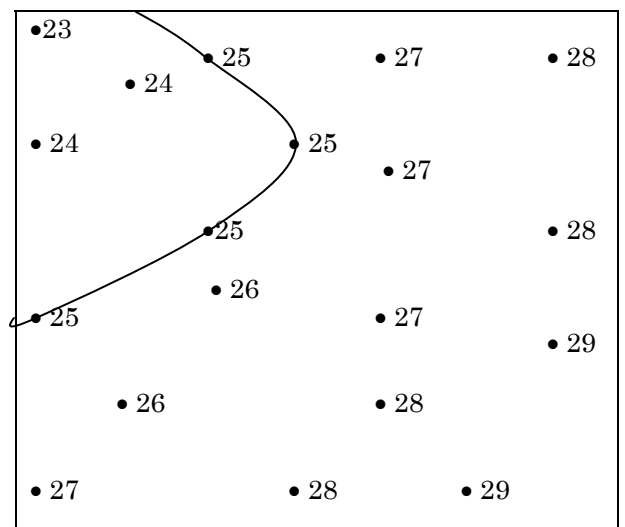
Isobars - _____

Contour lines - _____

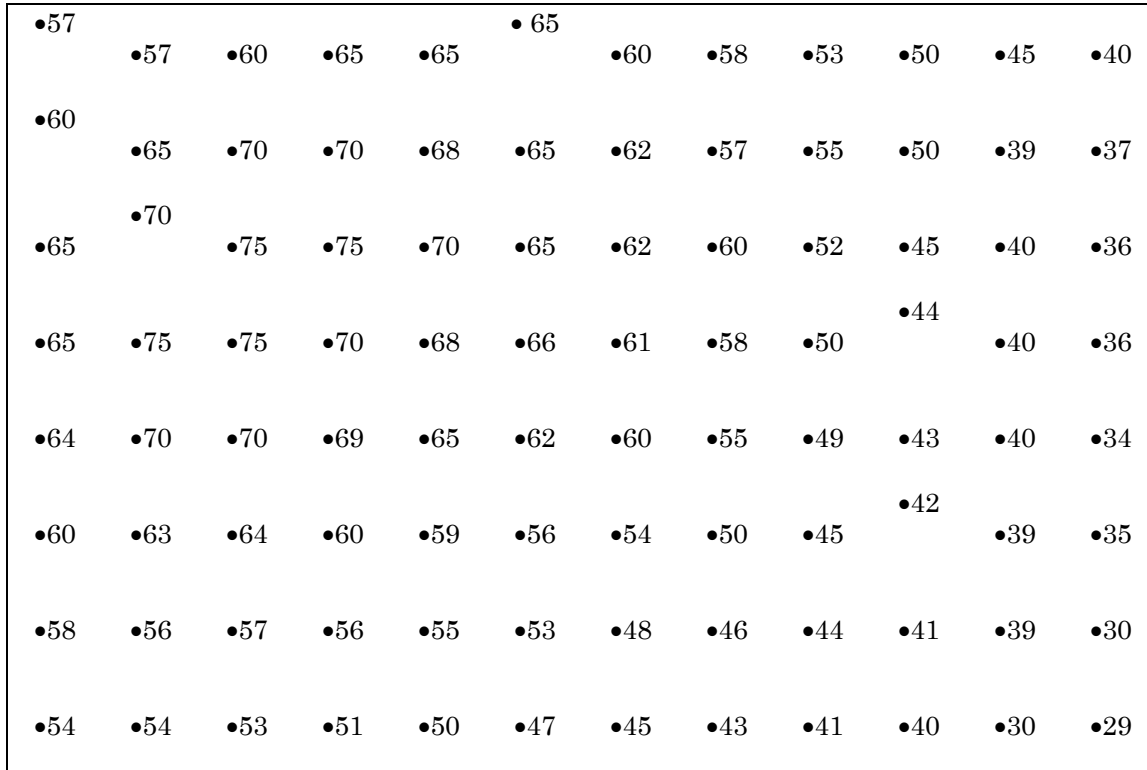
Contour interval _____

Drawing isolines:

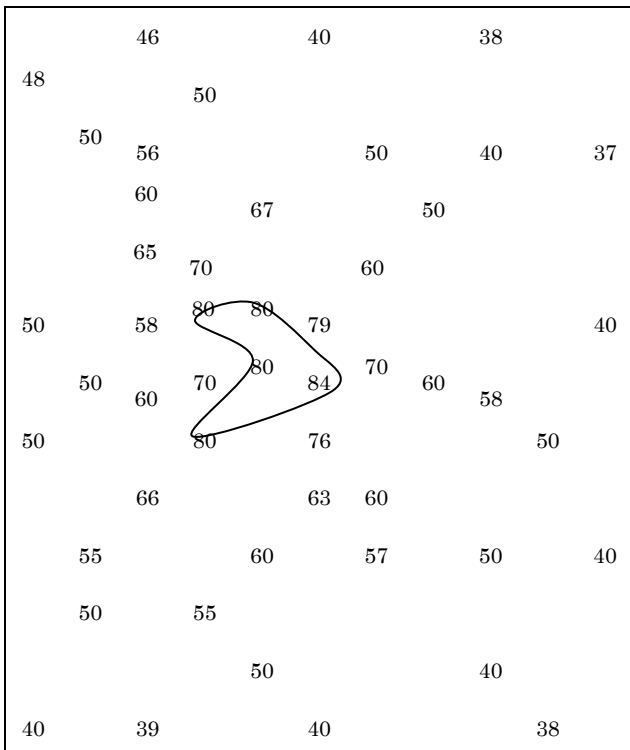
- Try to locate a pattern where numbers may be bunched together
- The 25 isoline has been drawn on the map to the right
- Follow a similar pattern for the line drawn
- When drawing the 26 isoline, make sure it falls between the 25 and 27 values
- Using a pencil, softly draw a line connecting equal values



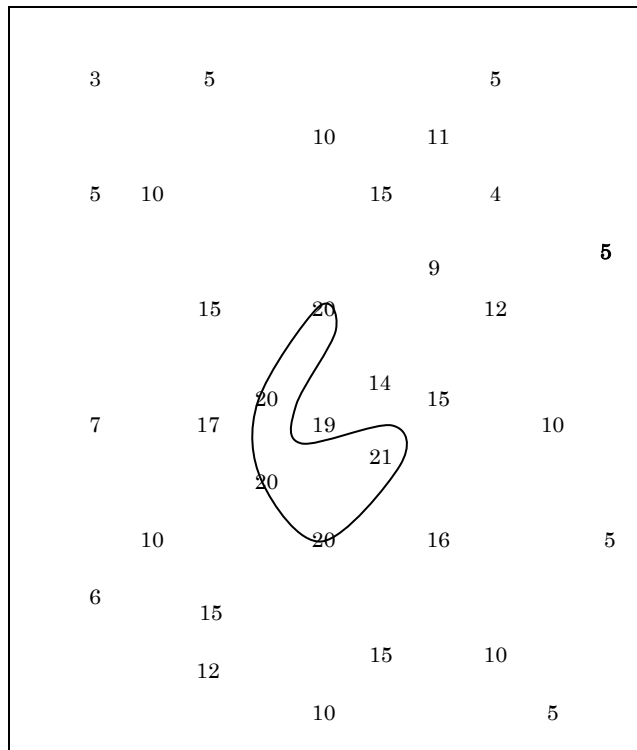
Use an interval of 5 for the following field



Contour interval = 10

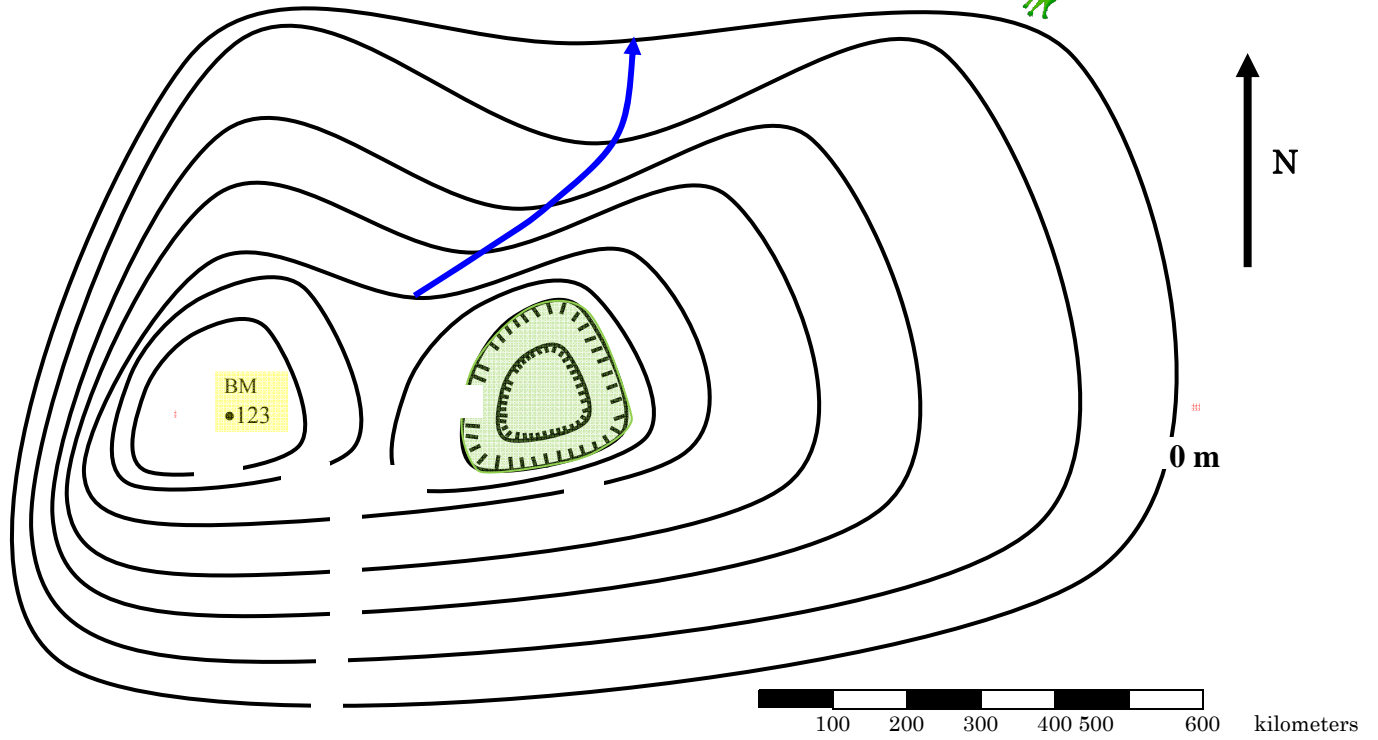


Contour interval = 5



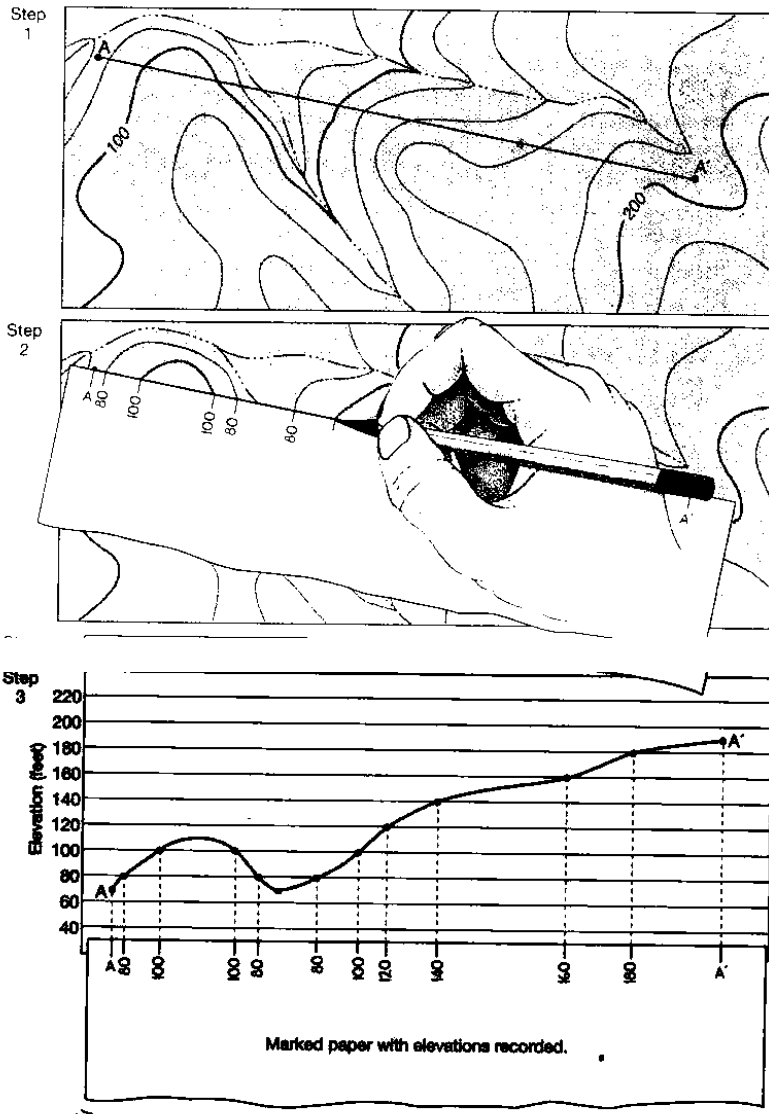
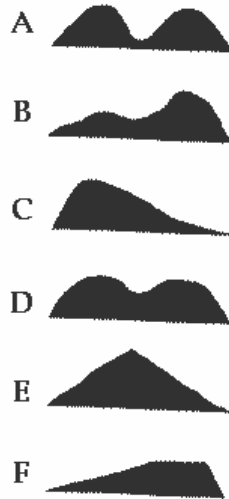
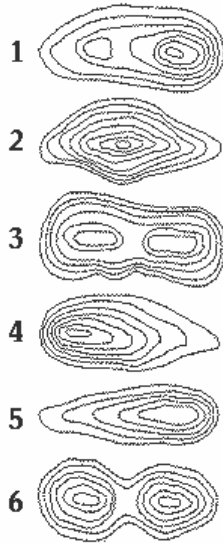


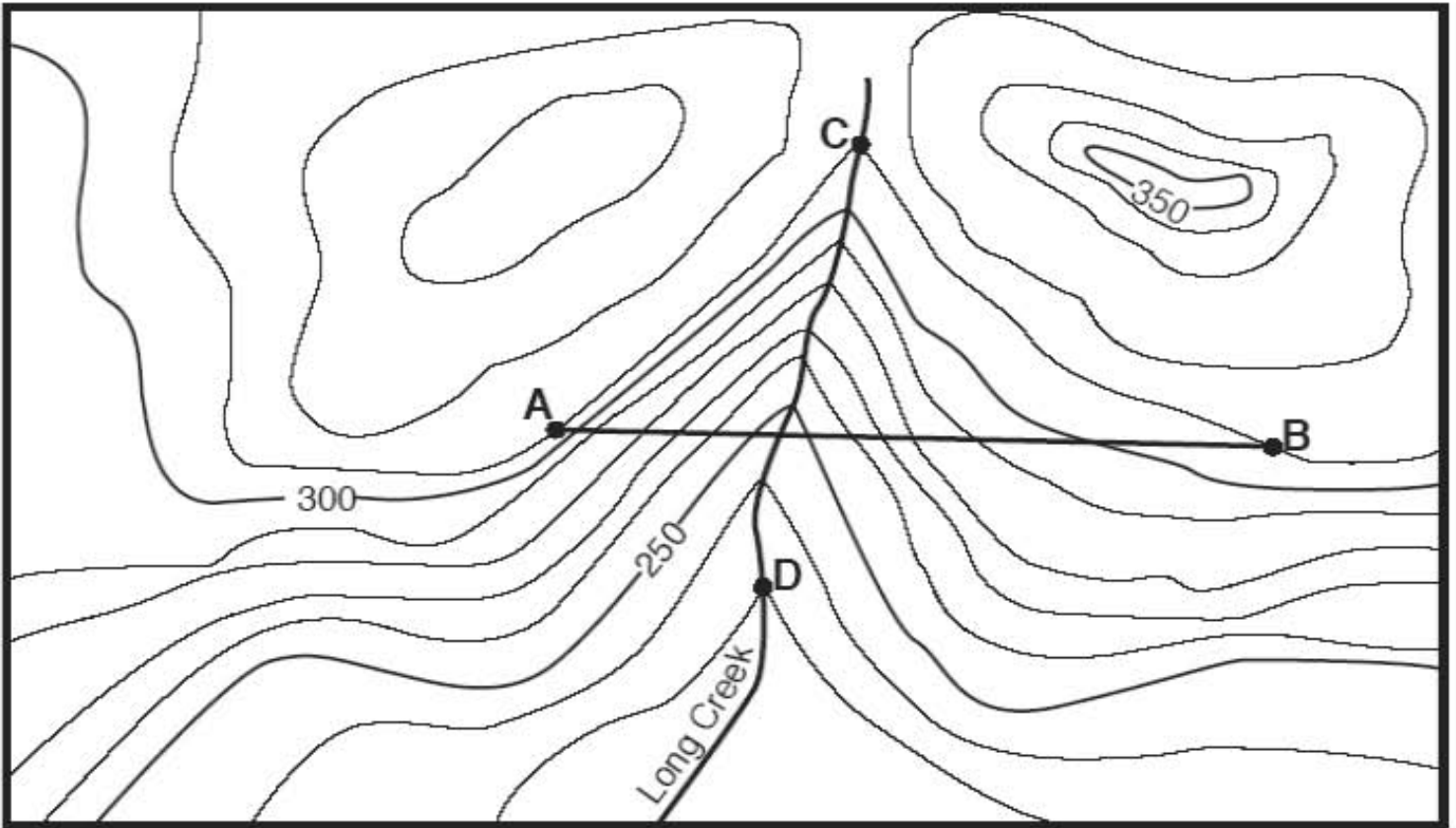
Topographic Maps:



Map Scale
Contour interval
Direction of stream flow
Steepest section
Bench mark
Depressions
Islands
Highest elevation

Please match the contour map on the left with the profile on the right.



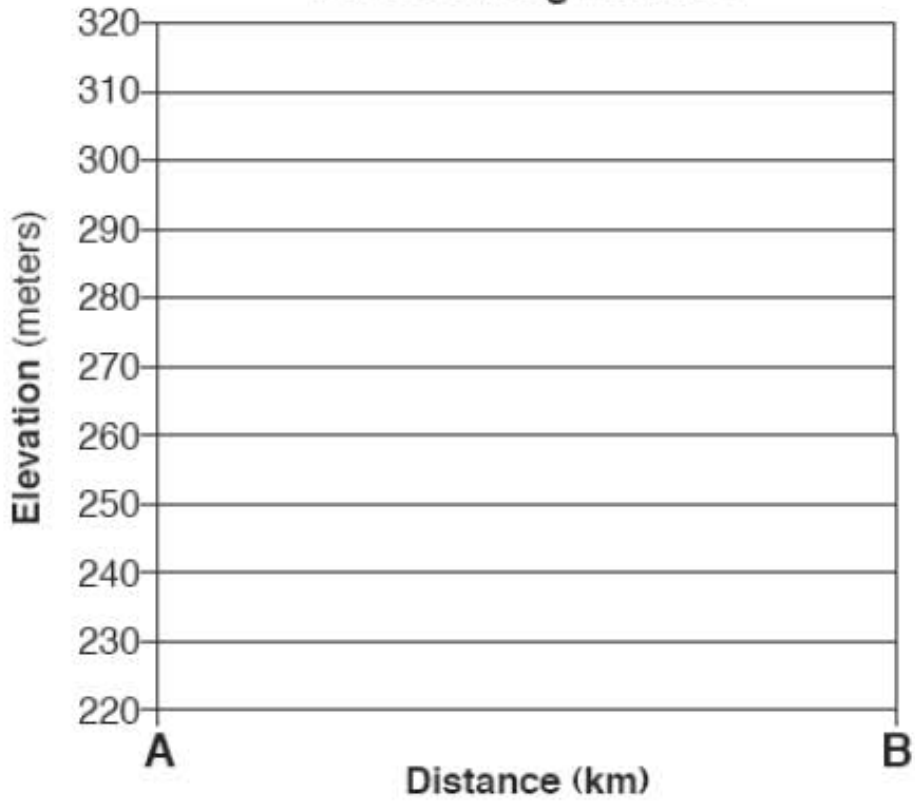


Contour interval = 10 meters

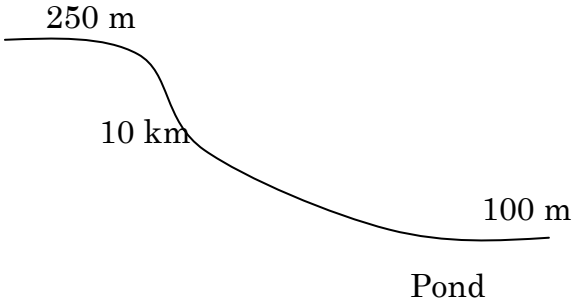
0 1 2 kilometers



Profile Along Line AB



Gradient =



A stream begins at an elevation of 250 m and flows into a pond that is at an elevation of 100 m. The length of the stream is 10 km. What is the gradient?

Formula:

Substitute Numbers

Solution (with units)

A map shows two locations A and B. They are 15 kilometers apart. Location A has an elevation of 525 meters and location B has an elevation of 150 meters. What is the gradient between the two locations?

Formula:

Substitute Numbers

Solution (with units)

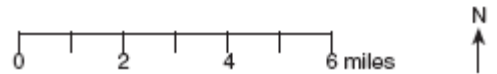
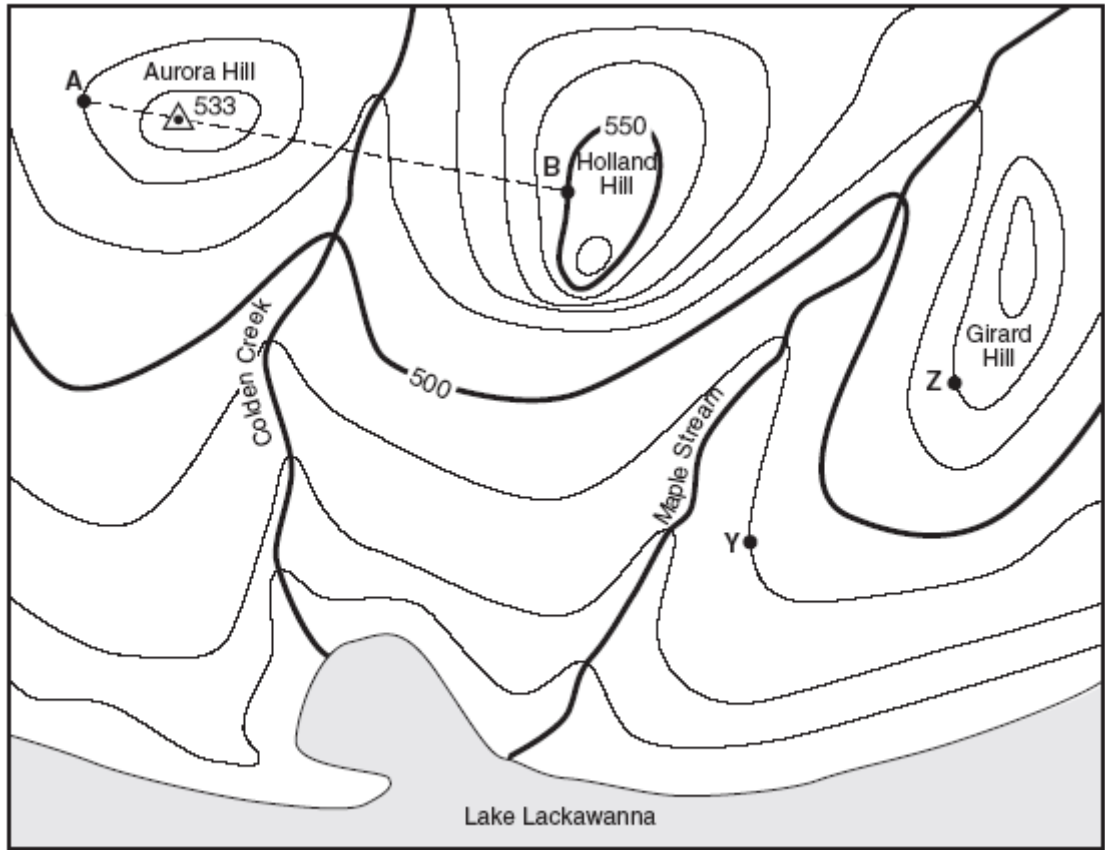
The difference in elevation between two locations is 800 meters. The distance between them is only .05 kilometers. What is the gradient between the two points?

Formula:

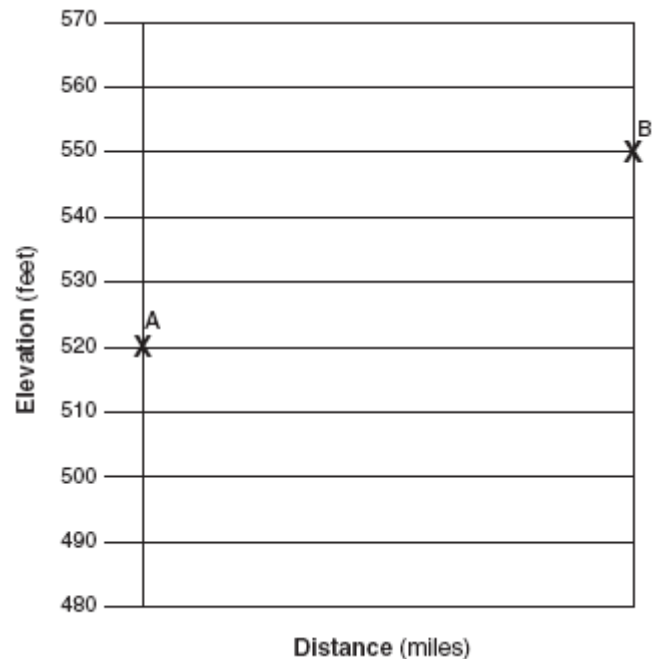
Substitute Numbers

Solution (with units)

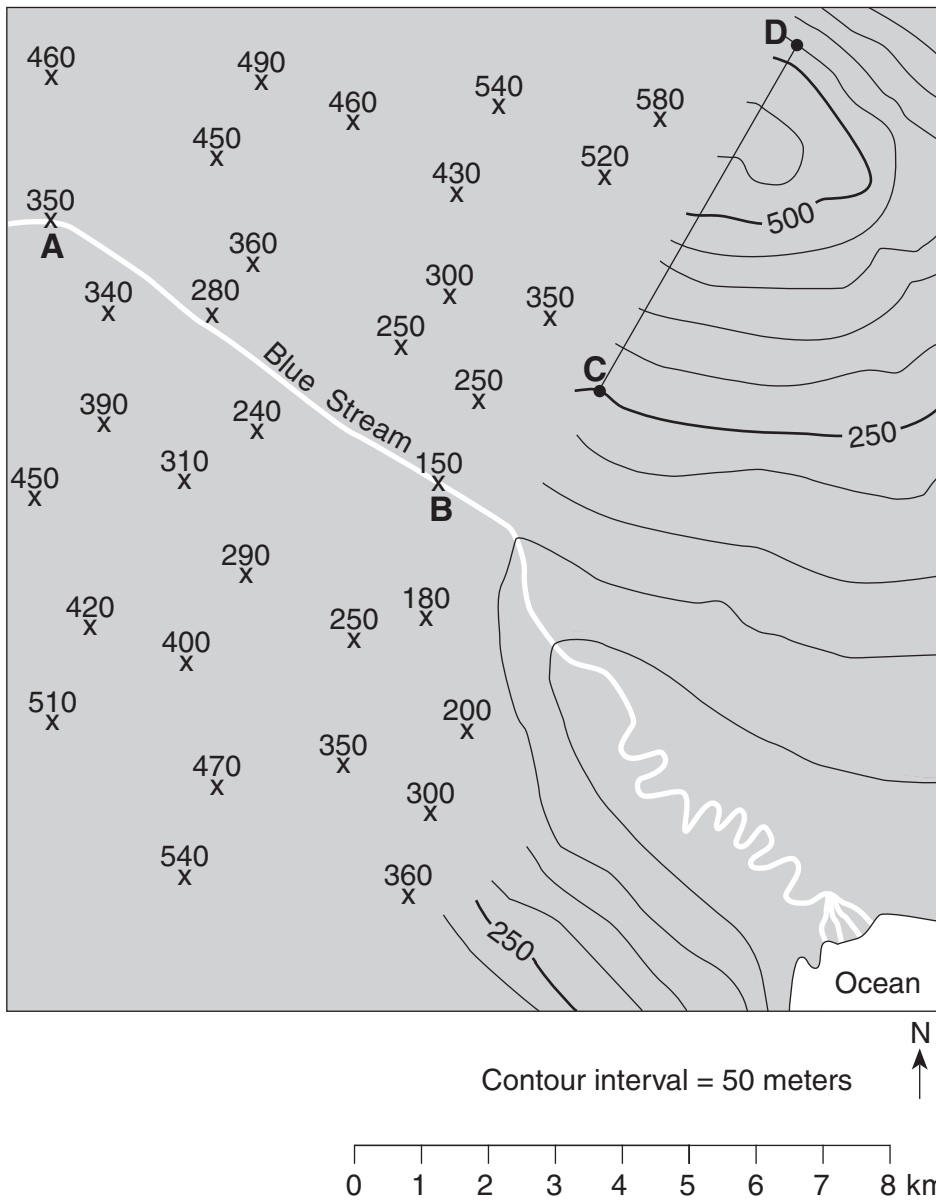
Points *A*, *B*, *Y*, and *Z* are reference points on the topographic map. The symbol $\triangle 533$ represents the highest elevation on Aurora Hill.



1. What is the contour interval for this map?
2. State the general compass direction in which Maple Stream is flowing.
3. Calculate the gradient between points *Y* and *Z* on the map, and label the answer with the correct units.
4. Describe the evidence shown on the map that indicates that the southern side of Holland Hill has the steepest slope.
5. On the grid provided to the right, construct a topographic profile from point *A* to point *B*.

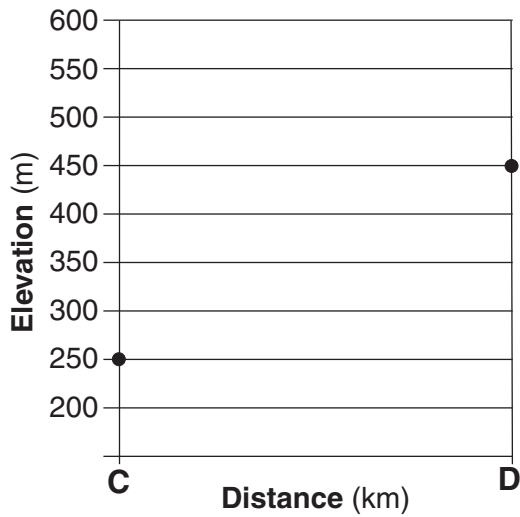


Base your answers to questions 6 through 9 on the map below, which shows partially drawn contour lines. X's indicate elevation in meters. Letters A, B, C, and D represent locations on the map.

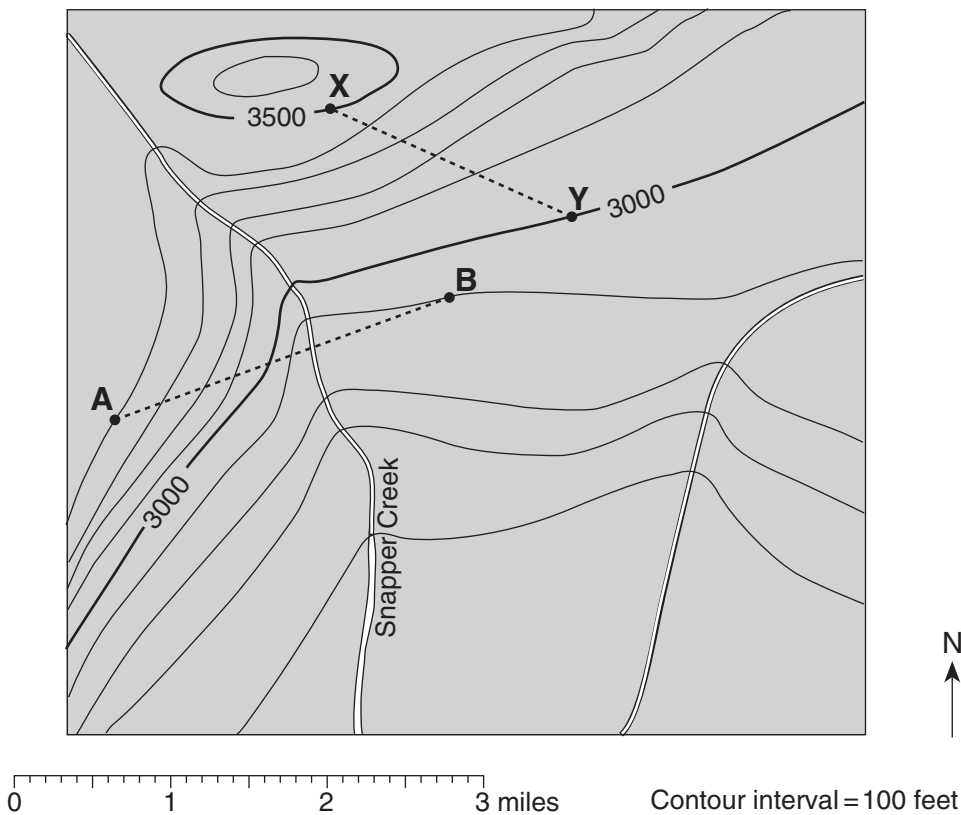


- On the map above, complete the 250-meter contour line.
- Place an X in the area where the elevation of 55 meters is located.
- Calculate the stream gradient from elevation A to elevation B. Label your answer with the correct units.

9. On the grid below, construct a topographic profile along line CD. Plot with an X the elevation of *each* contour line that crosses line CD. Connect the X's from C to D with a smooth, curved line to complete the profile. Elevations C and D have already been plotted.



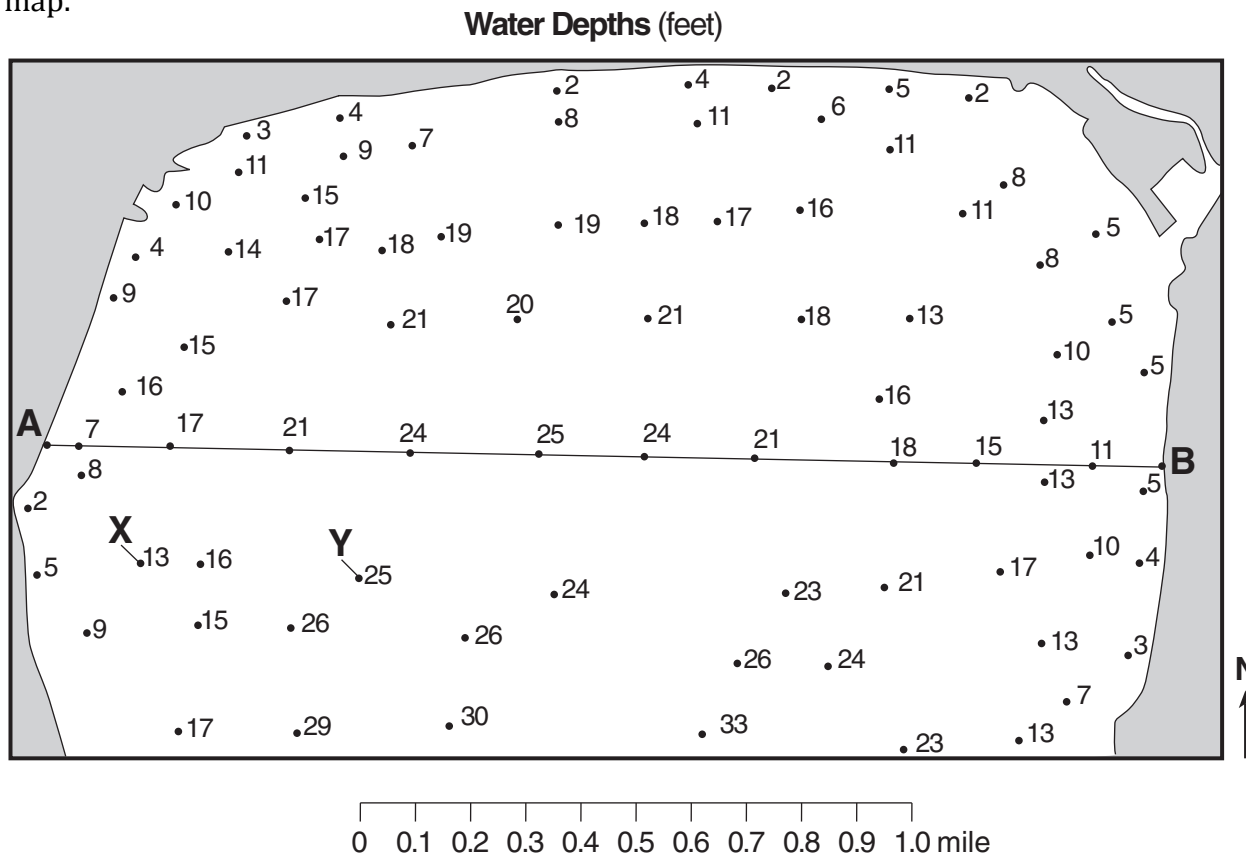
Base your answers to questions 10 through 12 on the topographic map below. Points A, B, X, and Y are locations on Earth's surface.



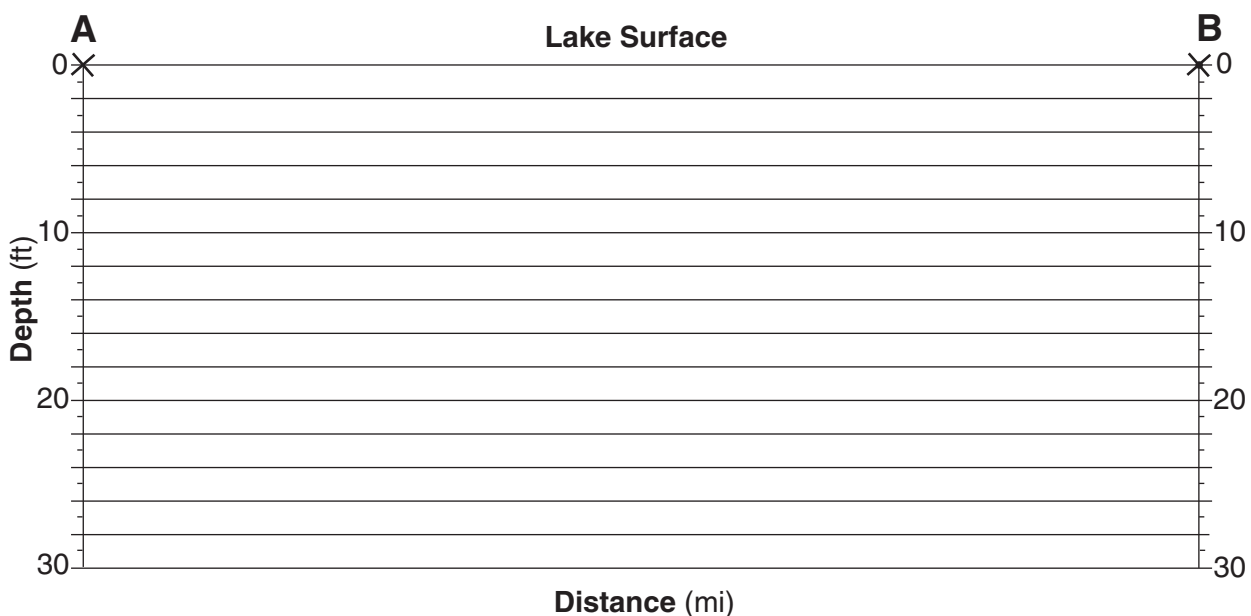
10. Toward which compass direction is Snapper Creek flowing?
11. Calculate the gradient between points X and Y. Units must be included in your answer.

Base your answers to questions through on the map below. The map shows the water depth, measured in feet, at the north end of one of the Finger Lakes. Points A and B are locations at the lake's shoreline. Points X and Y are locations on the bottom of the lake.

1 . On the map below, draw the 20-foot-depth isoline. The isoline must extend to the edge of the map.

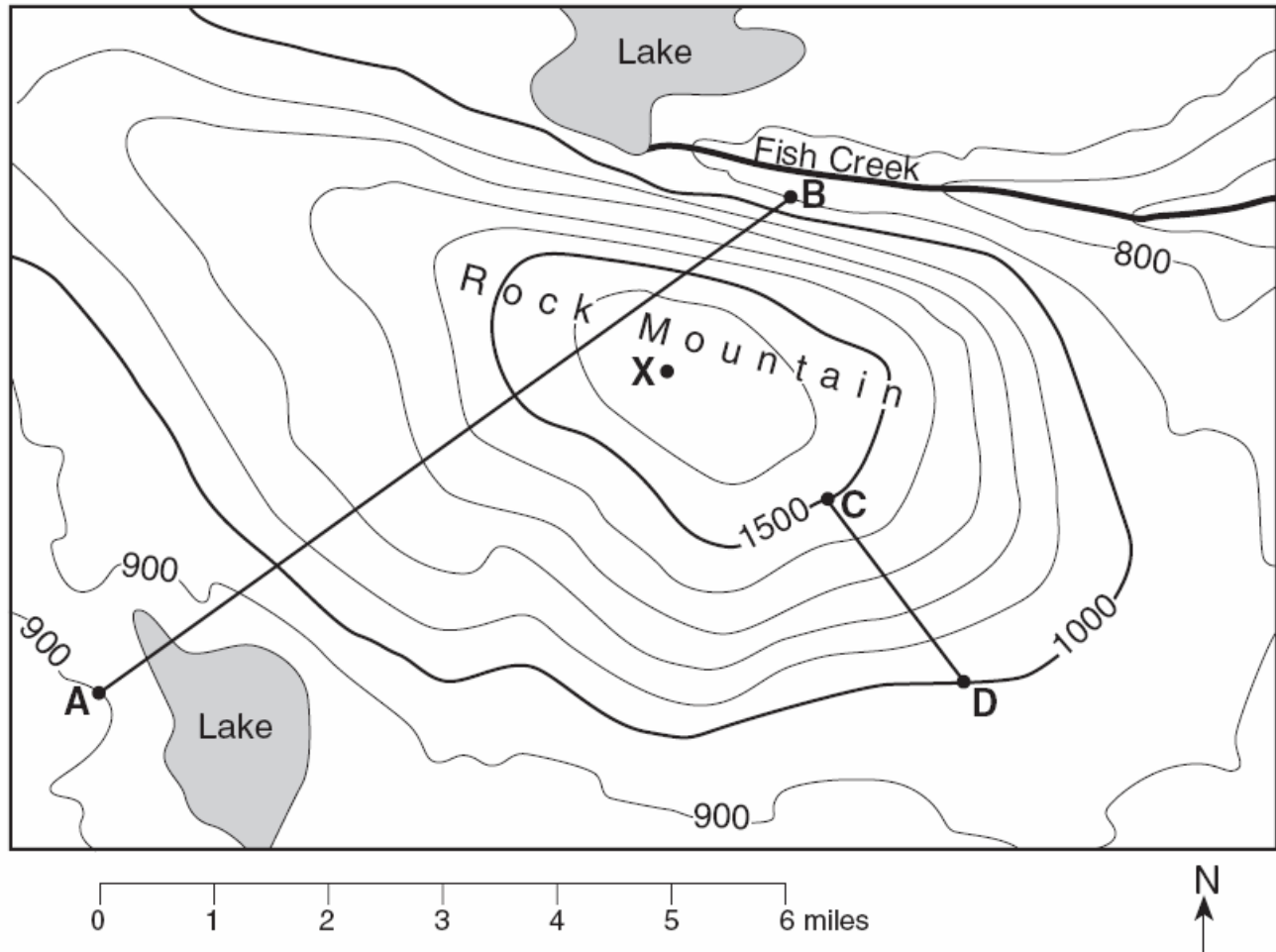


On the grid below, construct a profile along the line from point A to point B. Plot the depth along line AB by marking an X at each numbered point where a water depth is shown. Complete the profile by connecting the Xs with a smooth, curved line. The Xs for point A and point B have been plotted.



1 . Calculate the gradient between point X and point Y. Label your answer with the correct units.

Use the following picture to answer questions 1-7. Elevations are in feet.



1. What is the contour interval of the map?
2. What is the highest possible elevation of point X?
3. How long is line AB?
4. Which direction does Fish Creek flow?
5. How can you determine that from the only using the contour lines?

6. What is the gradient of line CD?

Formula

Substitute

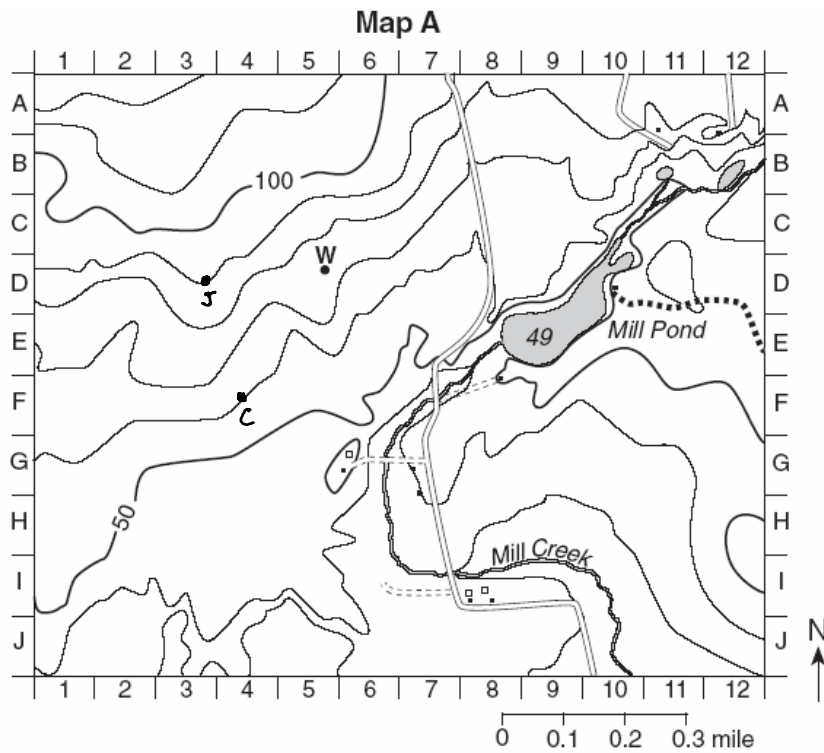
Solve

7. Draw the profile of line AB.

Profile of Line AB



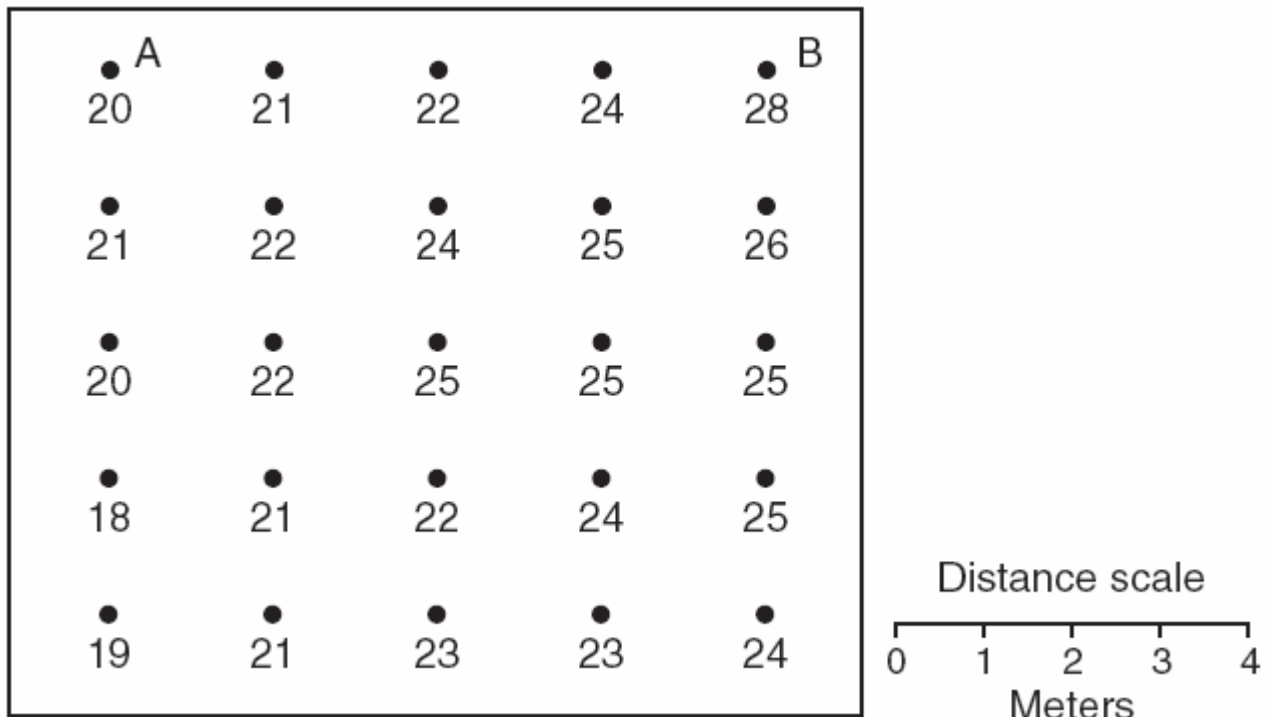
Use the map below to answer questions 8-9.



8. Which general direction does Mill Creek flow?

9. What is the gradient of line CJ? **Elevations are in feet.** (Show all work including formula)

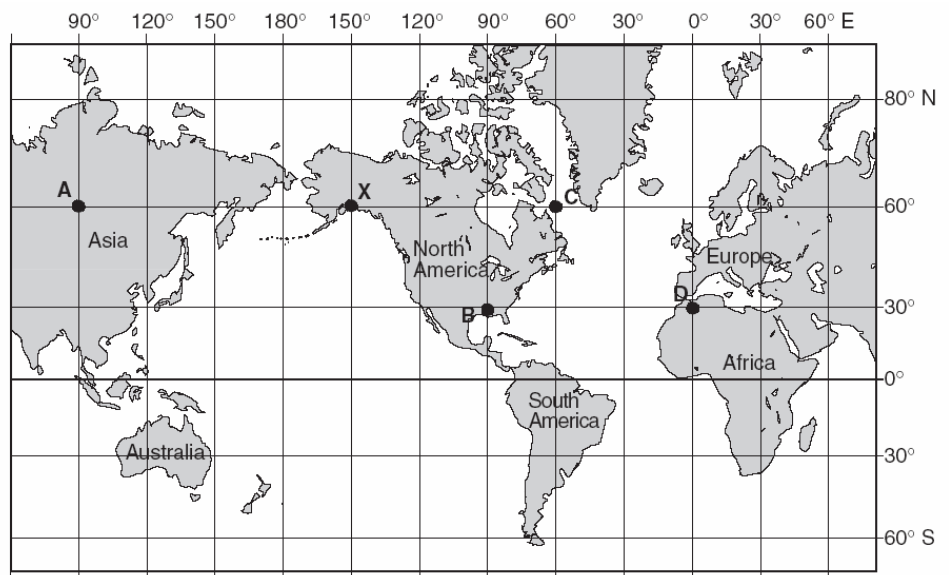
Use the following picture to answer questions 15-18.



15. What letter is the heat source? (**Temperatures are in Celsius**)
16. Connect the isolines for 20°C, 22°C, 24°C and 26°C. *Be sure the isolines extend to the edge of the field.*
17. What is the specific name of these isolines?
18. What is the gradient from point A to point B?

Use the following map to answer questions 19-22.

19. What is the latitude and longitude of point A?
20. What is the latitude and longitude of point D?
21. If it is 8:00 am at point B, what time is it at point D?
22. Which three locations have the same altitude of Polaris?

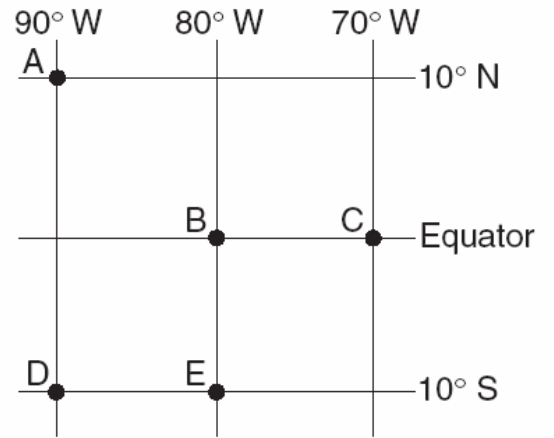


Use the following map to answer questions 23-25.

23. What do locations A and D have in common?

24. What is the altitude of Polaris at location A?

25. What is the altitude of Polaris at location E?



Use the following map to answer questions 26-28.

26. Label the area with the steepest temperature gradient.

27. Label the area with the smallest temperature gradient.

28. Draw a line from the ▲ to the ■ with the smallest change in temperature.

