

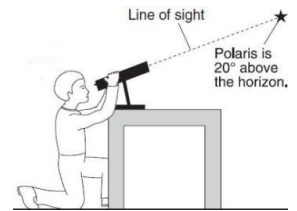
Name: _____

Measuring the Earth

Log on to YouTube and search for **jocrisci** channel. All videos listed with numbers below and sorted into playlists for easy access. Use these videos if you need extra practice or instruction.

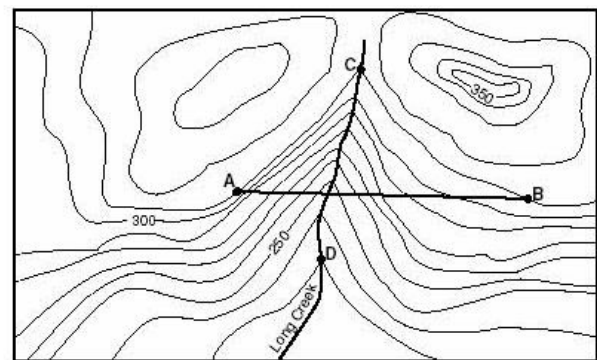
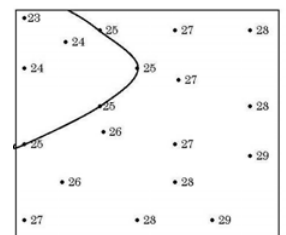
Latitude and Longitude (Videos 2.1, 2.2 ESRT 3a)

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



Topographic Maps (Videos 2.3ab, 2.4, 2.5, 2.6, 2.7, 2.8 ESRT 1b)

- You will be given a series of elevations and you will be asked to contour these points to produce a topographic map.
- 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!)
- 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



Contour interval = 10 meters
0 1 2 kilometers



Measuring the Earth Facts

(Search Quizlet for username MsCWood – Measuring the Earth Facts)

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

-
5. Latitude lines run / horizontal, but measure **north – south** of Equator
 6. Longitude lines run / up and down, but measure **east – west** of Prime meridian
 7. The altitude of Polaris equals / your latitude (only in the Northern Hemisphere!)
 8. 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.
 9. On the same line of longitude you have the same / time (based on observations from the sun)
 10. Time zones are separated by / 15° degrees of longitude, which equals 1 hour per time zone
 11. As you go East / time does increase (toward London)
 12. As you go West / time gets less (toward California)

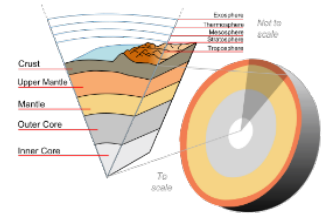
-
13. An isoline is / a line connecting points of equal value
 14. Special isolines include: Isobars / pressure; Isotherm / temperature; Contour / elevation
 15. Contour interval is the / amount between each contour line; Ocean is sea level 0'
 16. A set of circles inside circles indicates / a hill
 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)

-
21. Landscapes are determined by the / climate, bedrock, and geologic structures
 22. Plateaus are classified by / high elevations and horizontal bedrock
 23. Humid (wet) landscapes have / smooth, rounded slopes (think around here)
 24. Arid (dry) landscapes have / steep slopes with sharp angles (think Grand Canyon)

Earth's Dimensions

Models: _____

A model is not the real world thing, but a human construction.



Earth's Shape: _____

Evidence:

1. _____

2. _____

3. _____

4. _____

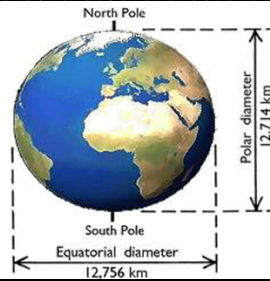
5. _____

6. _____

Earth's Dimensions:

Equatorial Diameter = _____

Polar Diameter = _____



Spheres of Earth:

Atmosphere	
Hydrosphere	
Lithosphere	
Geosphere	

Average Chemical Composition of Earth's Crust, Hydrosphere, and Troposphere

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

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

Selected Properties of Earth's Atmosphere:

ESRT pg. 14

1. Complete the table below using your ESRT's

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

2. Name the interface (boundary) that separates each of the following:

- Troposphere and Stratosphere → _____
- Stratosphere and Mesosphere → _____
- Mesosphere and Thermosphere → _____

3. Which layer of the atmosphere is most of the water vapor is located. _____

4. Name the layer, closest to Earth's surface, where the temperature increases as you increase altitude.

5. What happens to atmospheric pressure as you increase altitude? _____

6. What is the atmospheric pressure at sea level? _____

7. What is the temperature at the Tropopause? _____

8. At what boundary is the coldest temperatures found? _____

9. In which layers of the atmosphere can the temperature be 15°C? _____

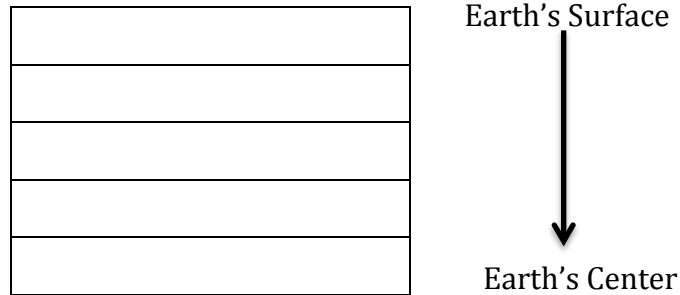
10. What is the highest concentration of water vapor? _____

11. In what layer is the concentration of water vapor 10 g/m³? _____

12. Name the boundary where the atmospheric pressure is approximately 0.25 atms.

Inferred Properties of Earth's Interior

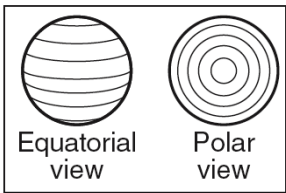
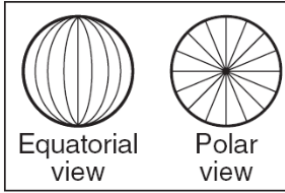

1. What are the 5 basic divisions of Earth's Interior? (*Consider the crust and rigid mantle to be one layer*)

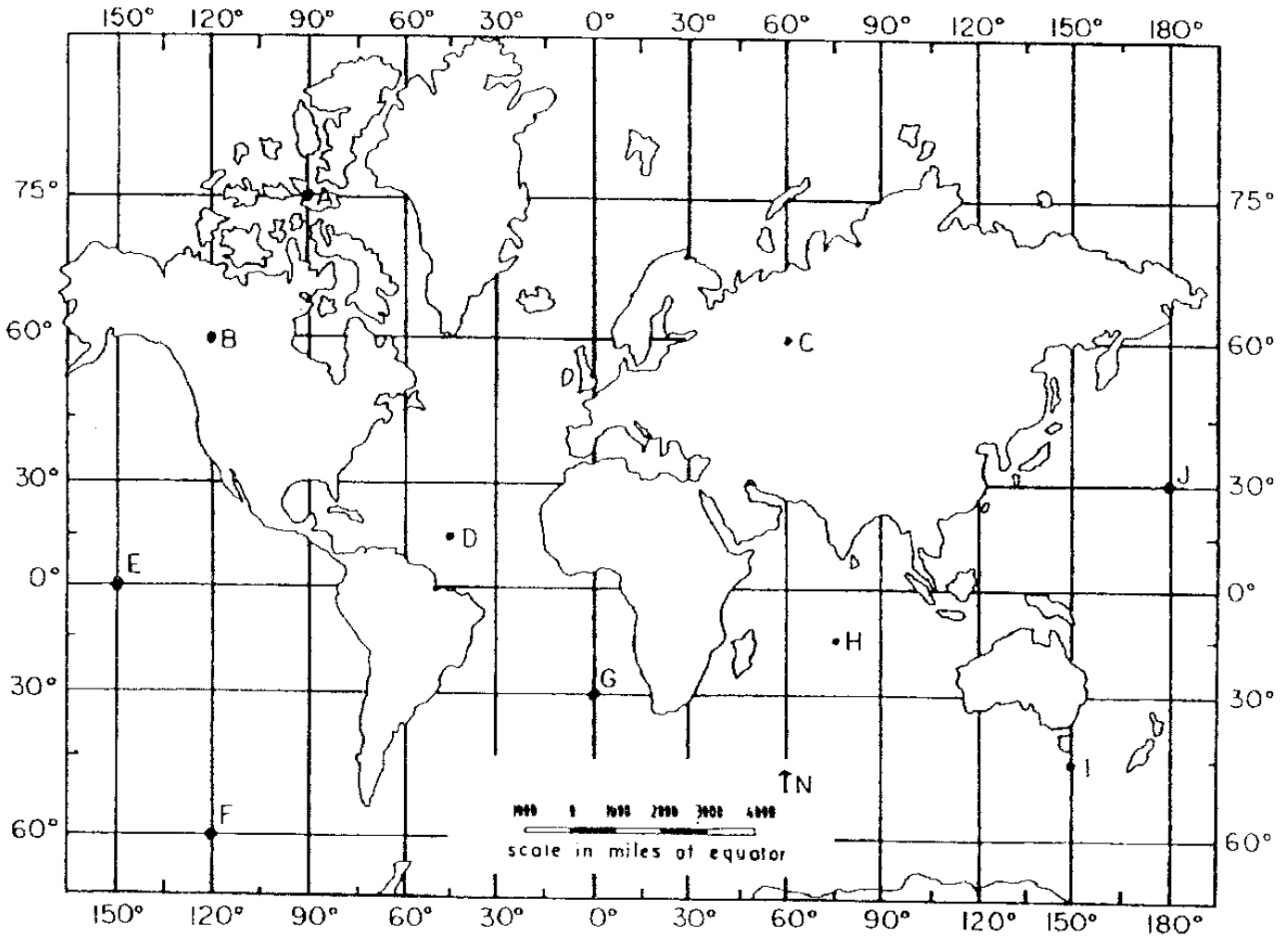


2. How far is it to the bottom of the Earth's outer core from the center of Earth? _____
3. What is the outer core made of? _____
4. What is the approximate thickness of the stiffer mantle? _____
5. What is the density of the continental crust? _____
6. What is the highest temperature that Earth's Interior reaches? _____
7. What is the composition of the oceanic crust? _____
8. What is the temperature of the boundary between the outer core and inner core?

9. What layer of the Earth would have a temperature of 4,000C? _____
10. What is the atmospheric pressure in the center of Earth? _____
11. What is the atmospheric pressure in the center of the outer core? _____
12. What layer of the Earth has a given density of 10g/cm³? _____
13. What is the atmospheric pressure at the boundary between the asthenosphere and stiffer mantle?

14. What is the temperature at the top of the outer core? _____
15. As the depth within the Earth's interior increases the density _____, temperature _____ and pressure _____.
16. In which layer is the melting point temperature lower than the actual temperature?

Latitude		Longitude
	Where is 0°	
	Name of Lines	
	Lines Run	
	Appearance	
	Lines Measure Degrees	
	Highest Degree	
	Miscellaneous	



Directions:

1. Label the compass directions next to your degrees of Latitude and Longitude
2. Complete the table below for locations A-I. Make sure to include degrees and compass directions!

Location	Latitude	Longitude
A		
B		
C		
D		
E		
F		
G		
H		
I		

Latitude, Longitude, Degrees and Minutes

Each degree is about 111 kilometers so the shaded box ($1^{\circ} \times 1^{\circ}$) in which Ithaca is located covers over 12,000 square kilometers of land.

We need to be more precise in locating certain locations.

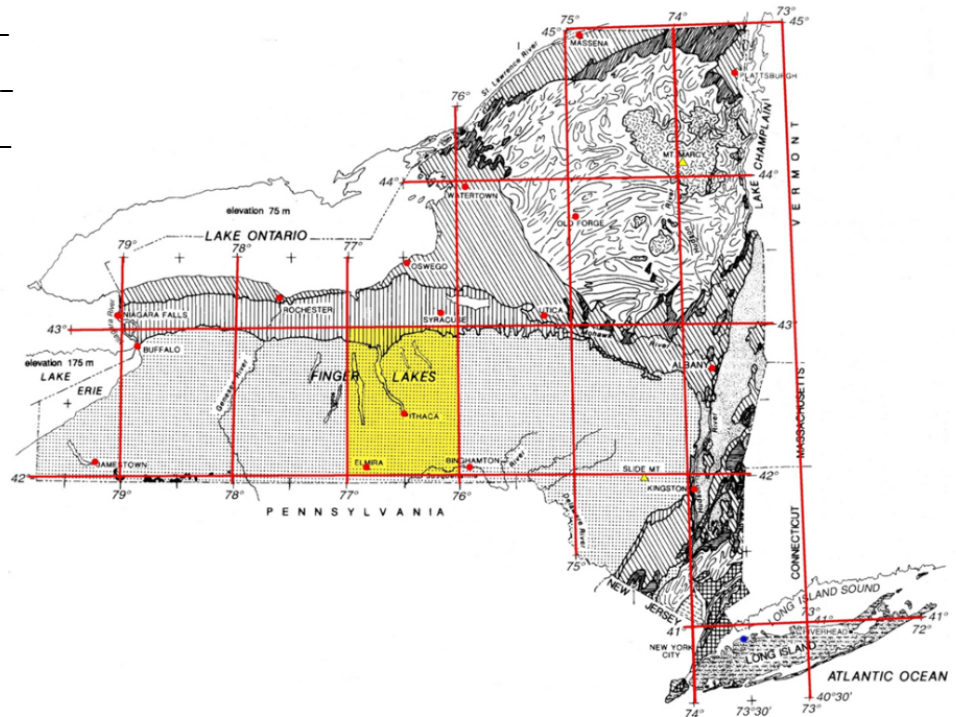
We can do that by:

- _____
- _____

The symbol for degrees is _____

The symbol for minutes is _____

The symbol for seconds is _____



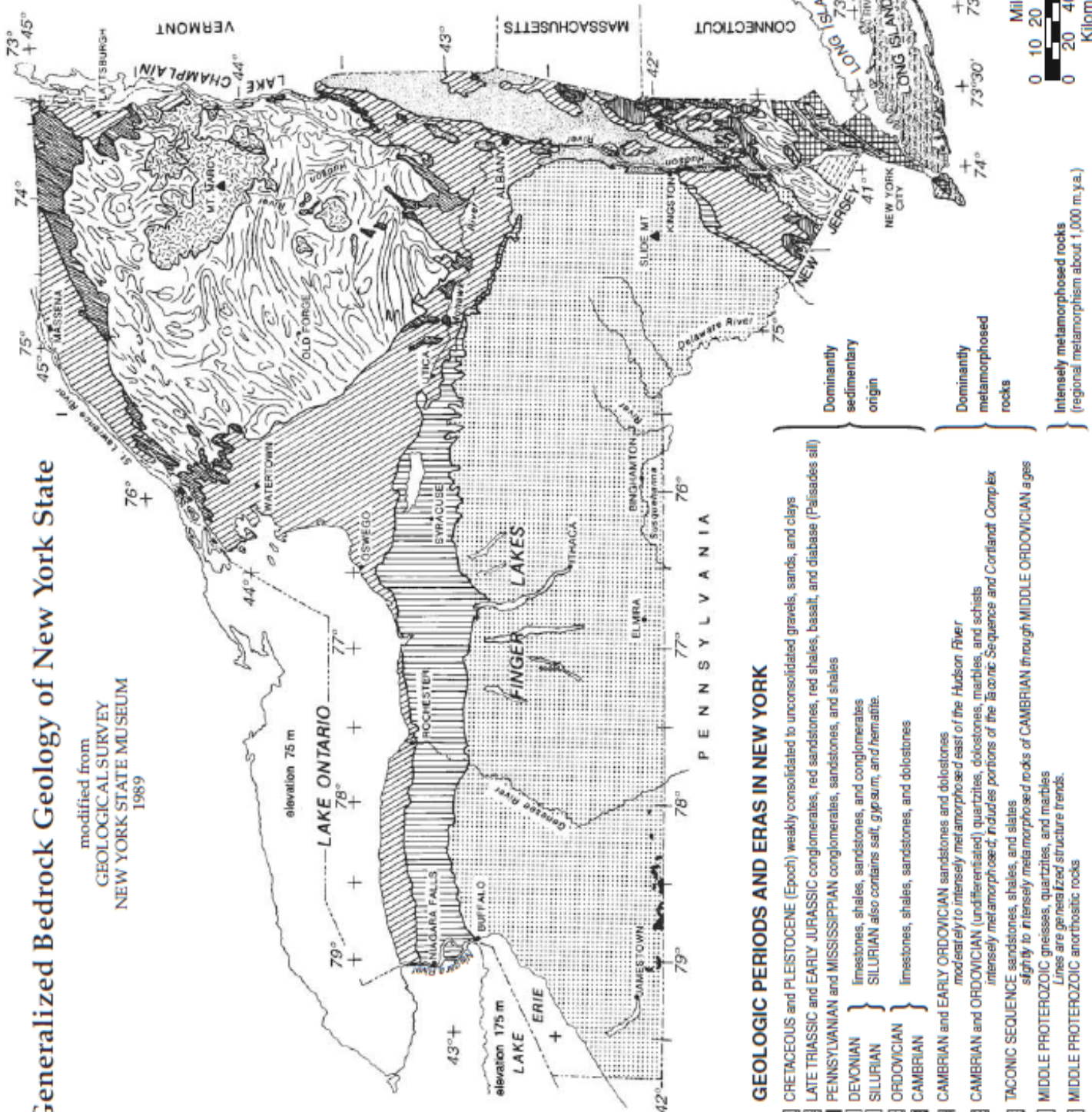
Notes to Remember:

1. Latitude is written first and must always include N (north) or S (south) of the equator
2. Longitude is written next and must always include E (east) or W (west) of the prime meridian.
3. All latitudes in New York State are N (north), and longitudes in New York State are W (west).
4. Each degree of latitude or longitude can be divided into 60 minutes.
5. Each minute can be divided into 60 seconds.
6. A minute, as used here, is a unit of distance on the earth's surface. It is not a unit of time.
7. The map on page 3 of your reference tables is small and it is impossible to be absolutely precise. Your best estimate should be to the nearest 5 or 10 minutes. In other words, an estimate of $73^{\circ}25'W$ is OK but $73^{\circ}28'W$ is trying to be more accurate than is reasonably possible with this map.
8. As with anything else you learn you will get better with practice..

Generalized Bedrock Geology of New York State

modified from
 GEOLOGICAL SURVEY
 NEW YORK STATE MUSEUM
 1989

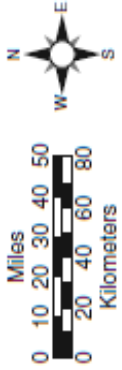
Choose 1 color to draw all lines of Latitude
 Choose a second color to draw all lines of Longitude



GEOLOGIC PERIODS AND ERAS IN NEW YORK

- CRETACEOUS and PLEISTOCENE (Epoch) weakly consolidated gravels, sands, and clays
- LATE TRIASSIC and EARLY JURASSIC conglomerates, red sandstones, red shales, basalt, and diabase (Palisades sill)
- PENNSYLVANIAN and MISSISSIPPIAN conglomerates, sandstones, and shales
- DEVONIAN } limestones, shales, sandstones, and conglomerates
- SILURIAN } SILURIAN also contains salt, gypsum, and hematite.
- ORDOVICIAN } limestones, shales, sandstones, and dolostones
- CAMBRIAN }
- CAMBRIAN and EARLY ORDOVICIAN sandstones and dolostones moderately to intensely metamorphosed east of the Hudson River
- CAMBRIAN and ORDOVICIAN (undifferentiated) quartzites, dolostones, marbles, and schists intensely metamorphosed; includes portions of the Taconic Sequence and Cortland Complex
- TACONIC SEQUENCE sandstones, shales, and slates slightly to intensely metamorphosed rocks of CAMBRIAN through MIDDLE ORDOVICIAN ages
- MIDDLE PROTEROZOIC gneisses, quartzites, and marbles
- MIDDLE PROTEROZOIC anorthostic rocks

Dominantly sedimentary origin
 Dominantly metamorphosed rocks
 Intensely metamorphosed rocks (regional metamorphism about 1,000 m.y.a.)



NYS Map Reading Practice

Using the Earth Science Reference Tables, page 2 & 3, determine the latitude and longitude for each of the following: Include degrees, minutes and compass directions!

Location	Latitude	Longitude
Albany		
Binghamton		
Buffalo		
Elmira		
Ithaca		
Jamestown		
Kingston		
Massena		
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? _____ mi.
6. What is the straight-line distance, in kilometers from Watertown to Syracuse? _____ km.

Time Zones

Facts to Memorize: 9-12

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 if it is:

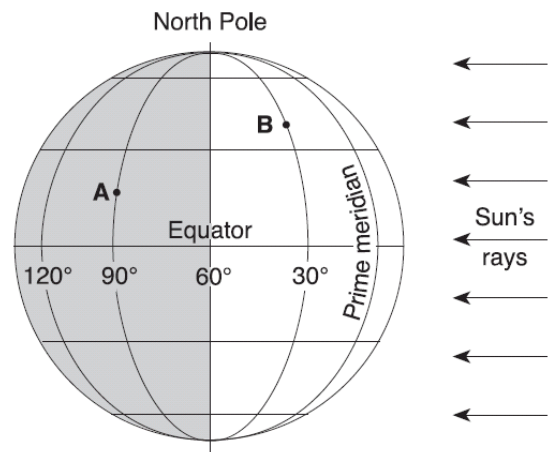
- a. 11am in New York, what time is it in Denver? _____
- b. 12am in San Francisco, what time is it in Detroit? _____
- c. 3pm in Seattle, what time is it in Honolulu? _____
- d. 6am in Boston, what time is it in Las Vegas? _____
- e. 4pm in Louisville, what time is it in Atlanta? _____

6. For every 15° of longitude, time changes by ____ hour.

7. If you move west, time gets earlier / later .

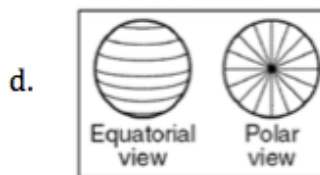
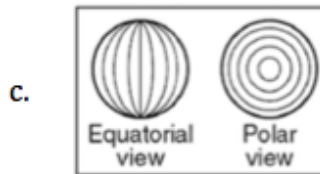
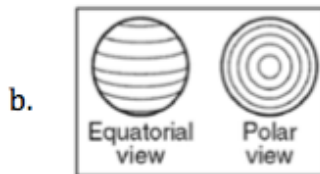
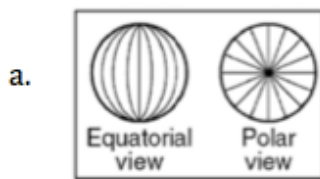
8. If you move east, time gets earlier / later .

9. The diagram to the right 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: _____



Latitude & Longitude Practice Regents Questions

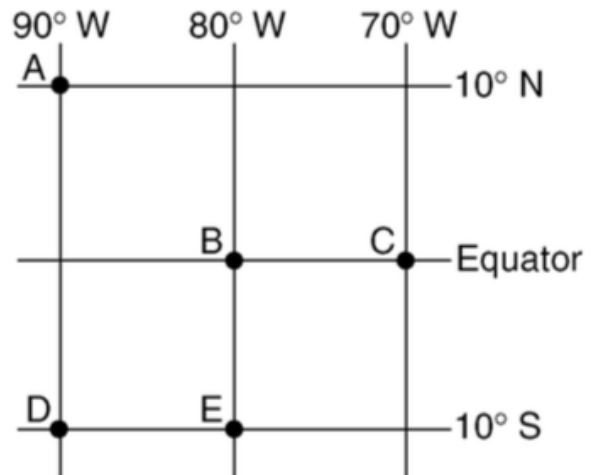
- The approximate latitude of Utica, New York, is:
 - $43^{\circ}05'N$
 - $43^{\circ}05'S$
 - $75^{\circ}15'E$
 - $75^{\circ}15'W$
- From which New York State location would Polaris be observed to have an altitude closest to 43° above the northern horizon?
 - Binghamton
 - Utica
 - Watertown
 - New York City
- At which New York State location will an observer most likely measure the altitude of Polaris as approximately 42° ?
 - Jamestown
 - Plattsburgh
 - Oswego
 - New York City
- The lines on which set of views best represent Earth's latitude system?



- What is the approximate location of the Canary Island hot spots?
 - $32^{\circ}S, 18^{\circ}W$
 - $32^{\circ}S, 18^{\circ}E$
 - $32^{\circ}N, 18^{\circ}W$
 - $32^{\circ}N, 18^{\circ}E$

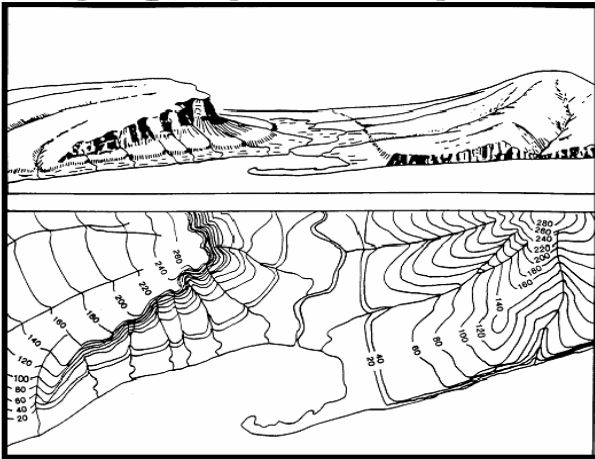
- As a ship crosses the Prime Meridian, an observer on the ship measures the altitude of Polaris at 60° . What is the ship's location?
 - $60^{\circ}S, 0^{\circ}$
 - $60^{\circ}N, 0^{\circ}$
 - $0^{\circ}, 60^{\circ}E$
 - $0^{\circ}, 60^{\circ}W$

Base your answers to questions 7 to 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?
 - A and C
 - B and C
 - B and E
 - D and E
- What is the altitude of Polaris above the northern horizon for observer A?
 - 0°
 - 10°
 - 80°
 - 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 5pm. What is the ship's longitude?
 - $45^{\circ}W$
 - $45^{\circ}E$
 - $75^{\circ}W$
 - $75^{\circ}E$
- At which location will the highest altitude of Polaris be observed?
 - Equator
 - Tropic of Cancer
 - Arctic Circle
 - New York State

Topographic Maps



Field - _____

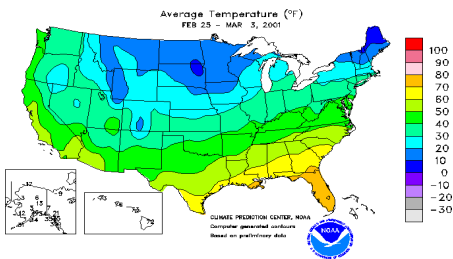
Isoline - _____

Isotherms - _____

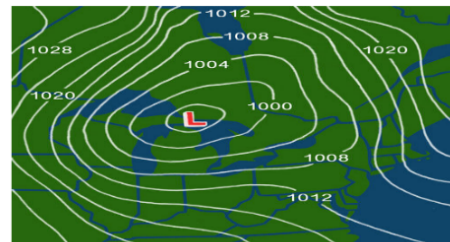
Isobars - _____

Contour Lines - _____

Contour Interval - _____



Parallel Isolines



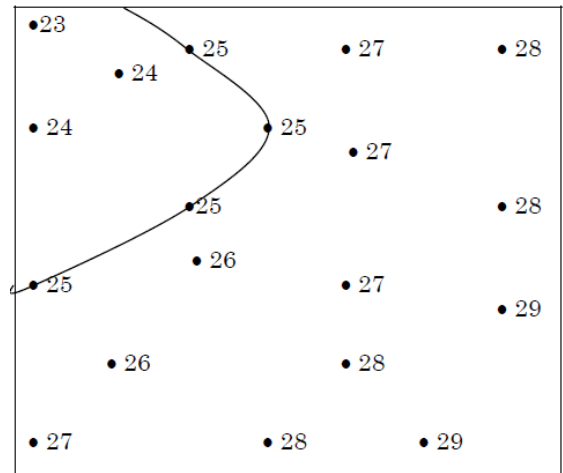
Closed Isolines

Associated with - _____

Associated with - _____

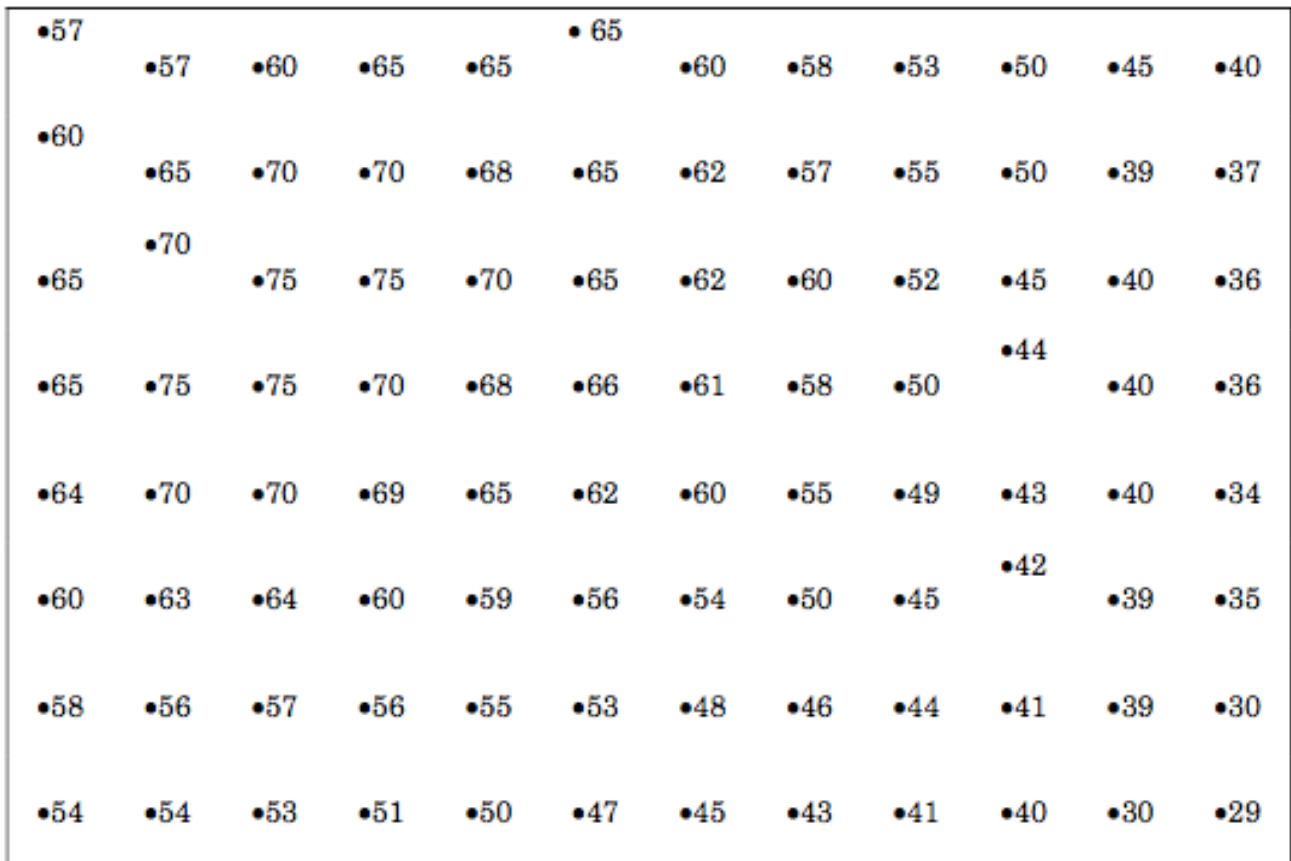
Drawing Isolines:

- 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

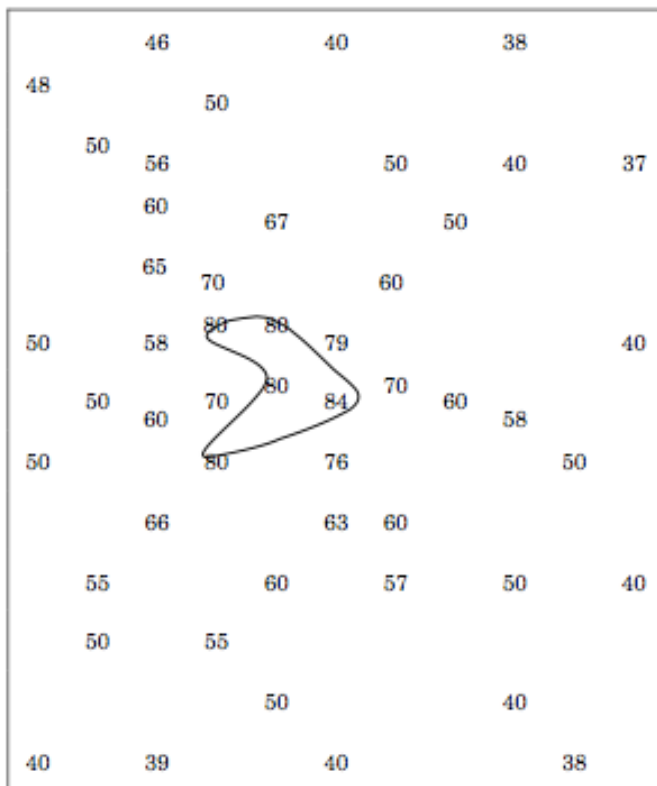


Drawing Contour Lines Practice

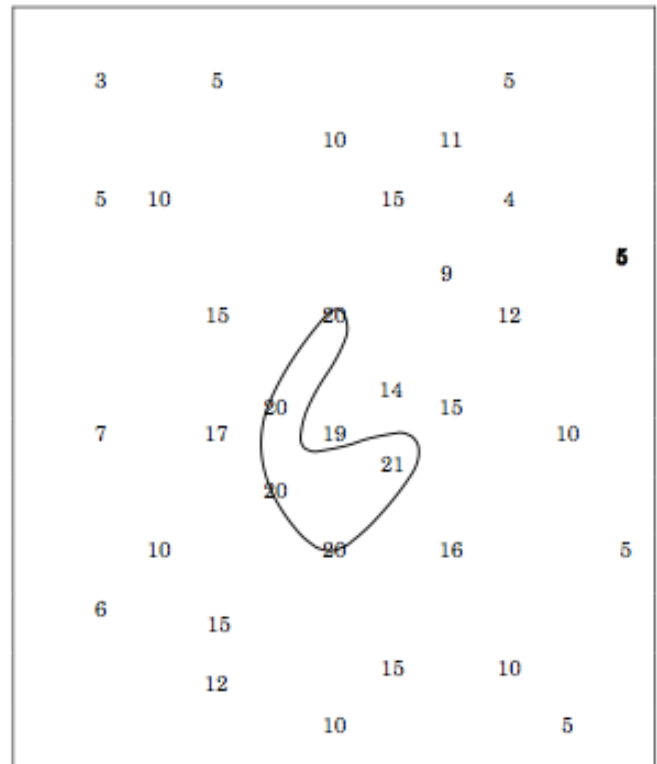
Contour Interval = 5



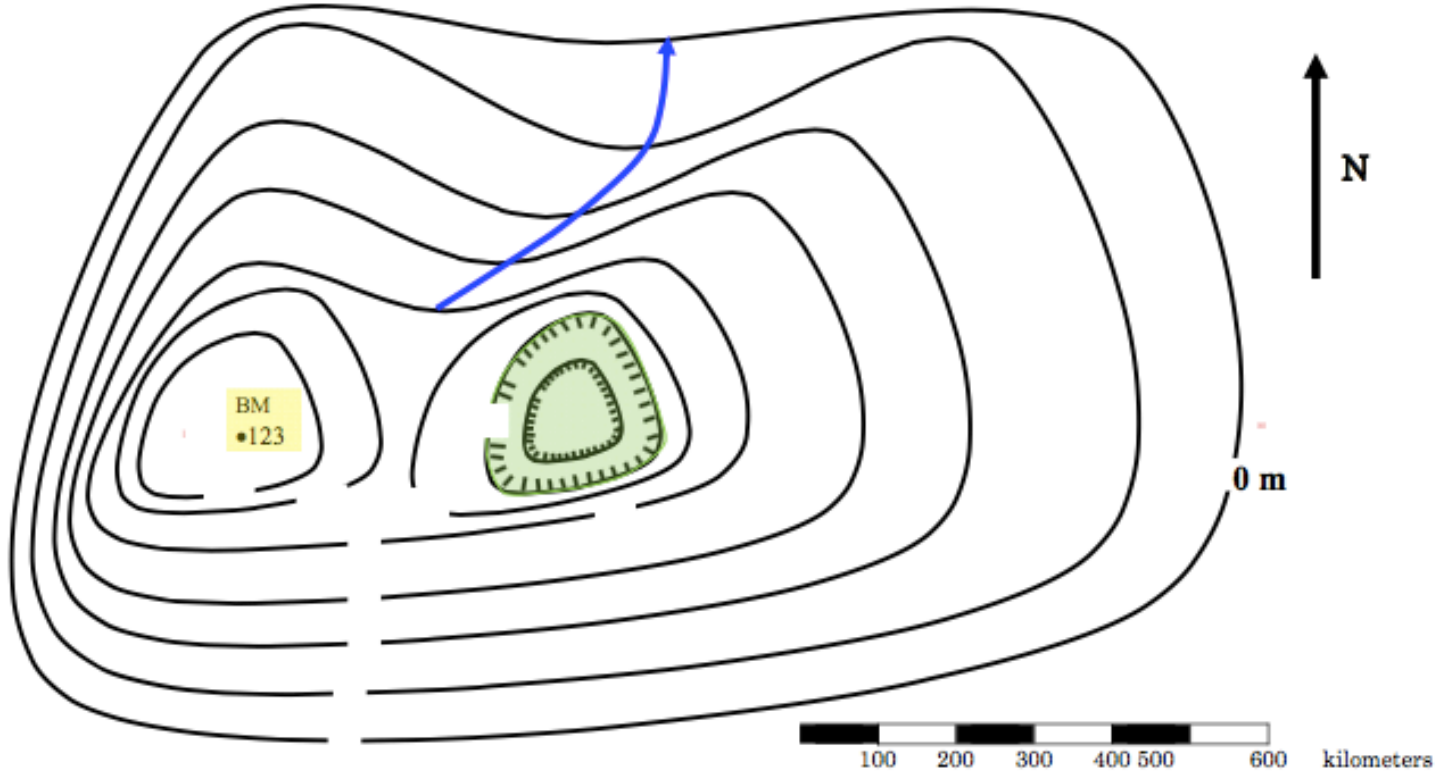
Contour Interval = 10



Contour Interval = 5



Reading a Topographic Map



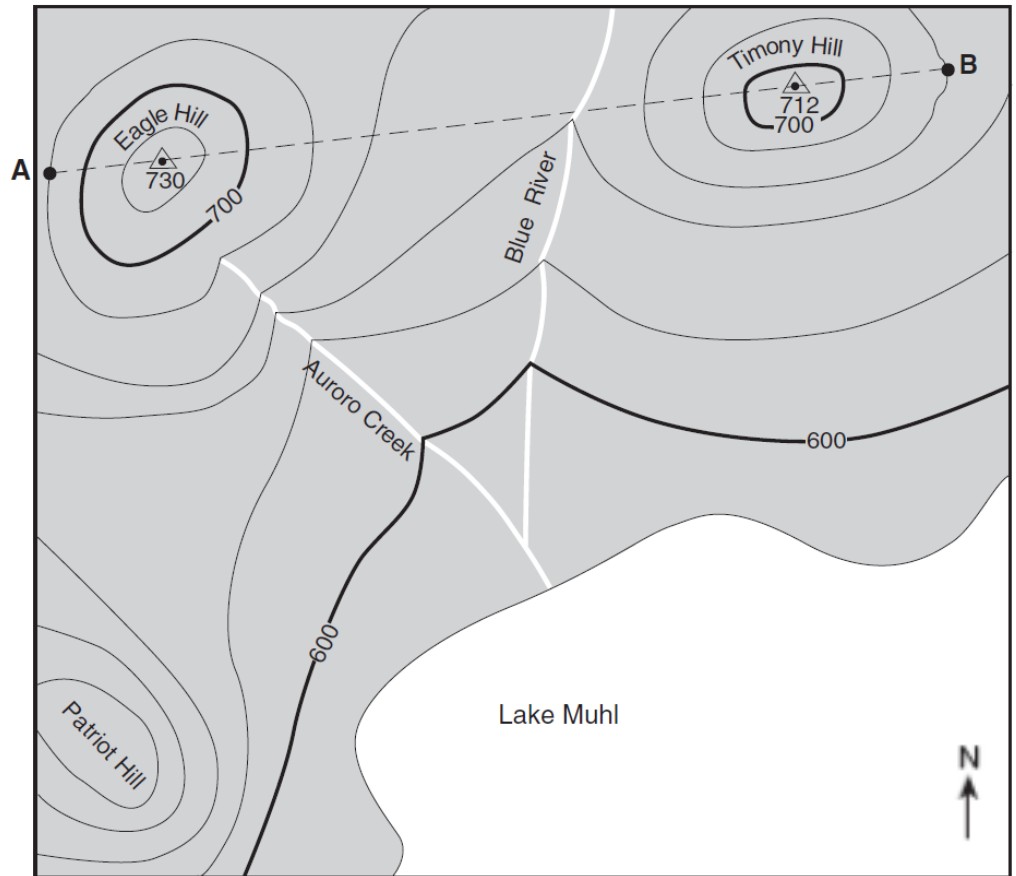
Define and label the following features on the map above.

Features	Definition	Example from the Map
Map Scale		
Direction of Stream Flow		
Steepest Section		
Depression		
Bench Mark		
Islands		
Highest Elevation		

Topographic Map Practice Questions

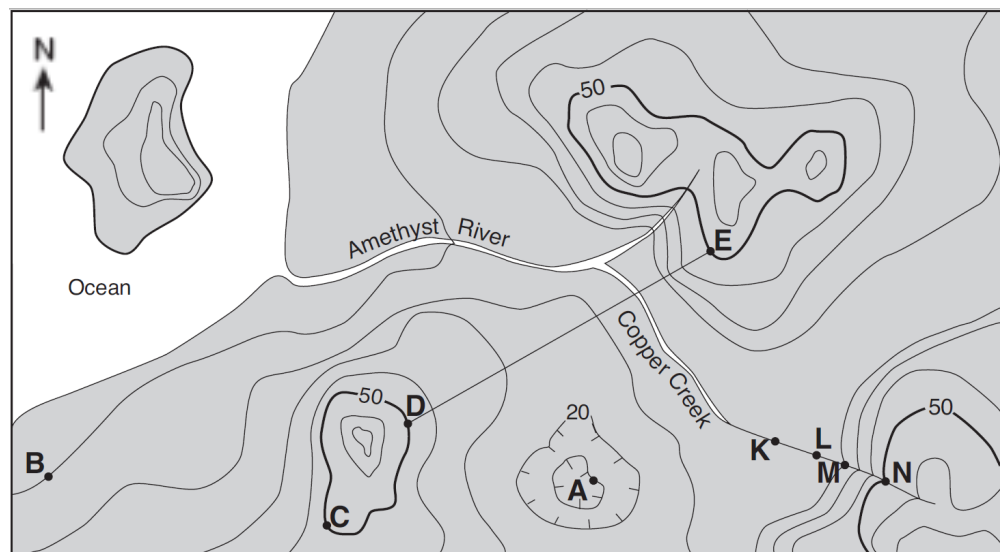
Base your answers to questions #1-5 on the map below.

1. What is the contour interval for this map?
2. What direction is Blue River flowing?
3. How can you tell the direction of stream flow based on the shape of contour lines?
4. What is the highest possible elevation at Patriot Hill?
5. What is the elevation at point B?



Base your answers to questions #6-10 on the map below

6. What is the elevation at point A?
7. Which lettered location (C, B, M, D) has the steepest elevation?
8. How can you tell when an area has the steepest elevation?
9. List a possible elevation for location K.

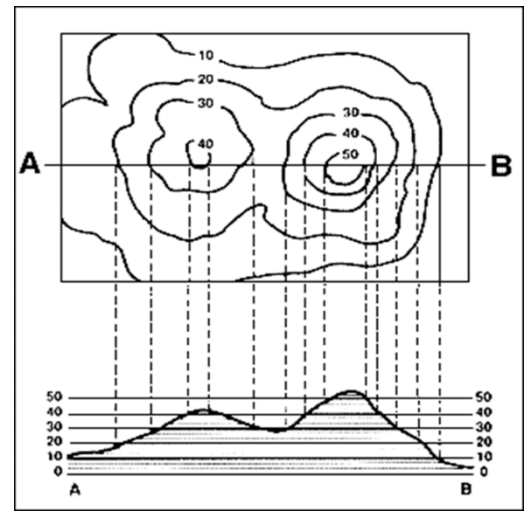


10. What direction is Amethyst River flowing?

Constructing a Profile from a Contour Map

A profile is _____

Profiles use upward and downward changes of a line to show changes in elevation and slope



Match the Contour Map to the appropriate Profile.

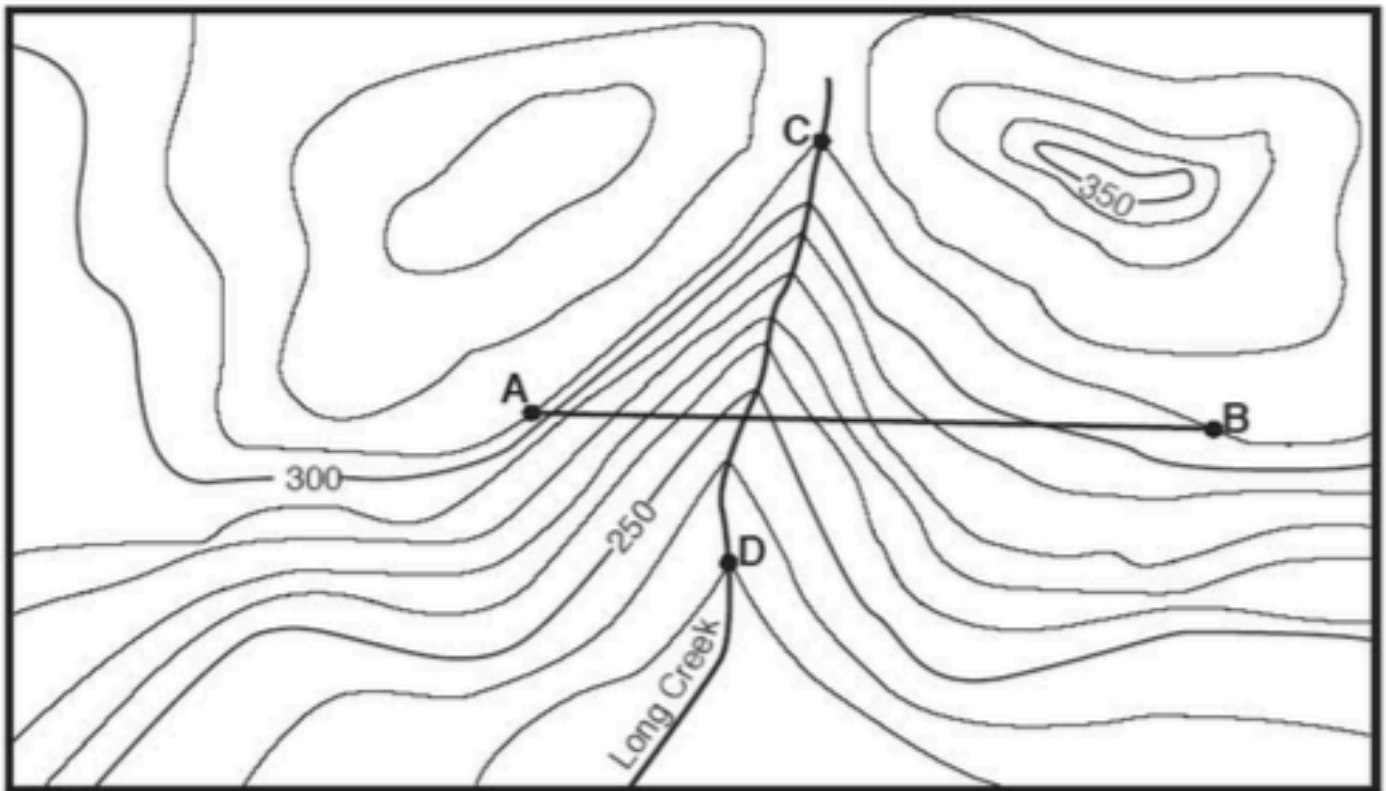
- 1
- 2
- 3
- 4
- 5
- 6

- A
- B
- C
- D
- E
- F

Steps for Construction of a Profile:

- _____
- _____
- _____
- _____
- _____
- _____
- _____

Drawing a Profile Practice

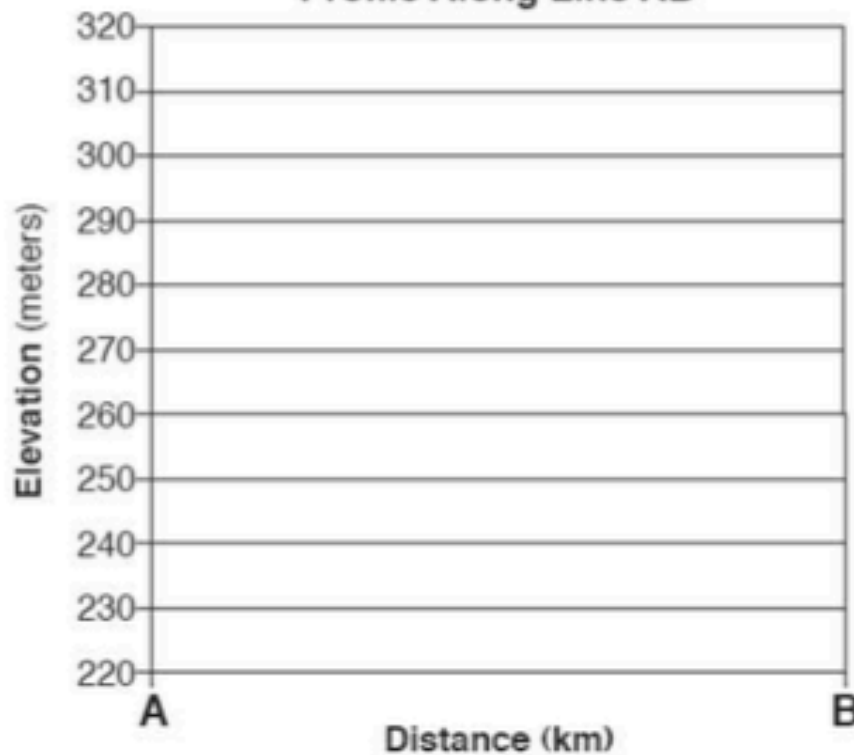


Contour interval = 10 meters

0 1 2 kilometers



Profile Along Line AB



Gradient

Gradient Formula:

ESRT pg. 1

1. 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:

Substitution:

Answer with units:

2. 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:

Substitution:

Answer with units:

3. 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?

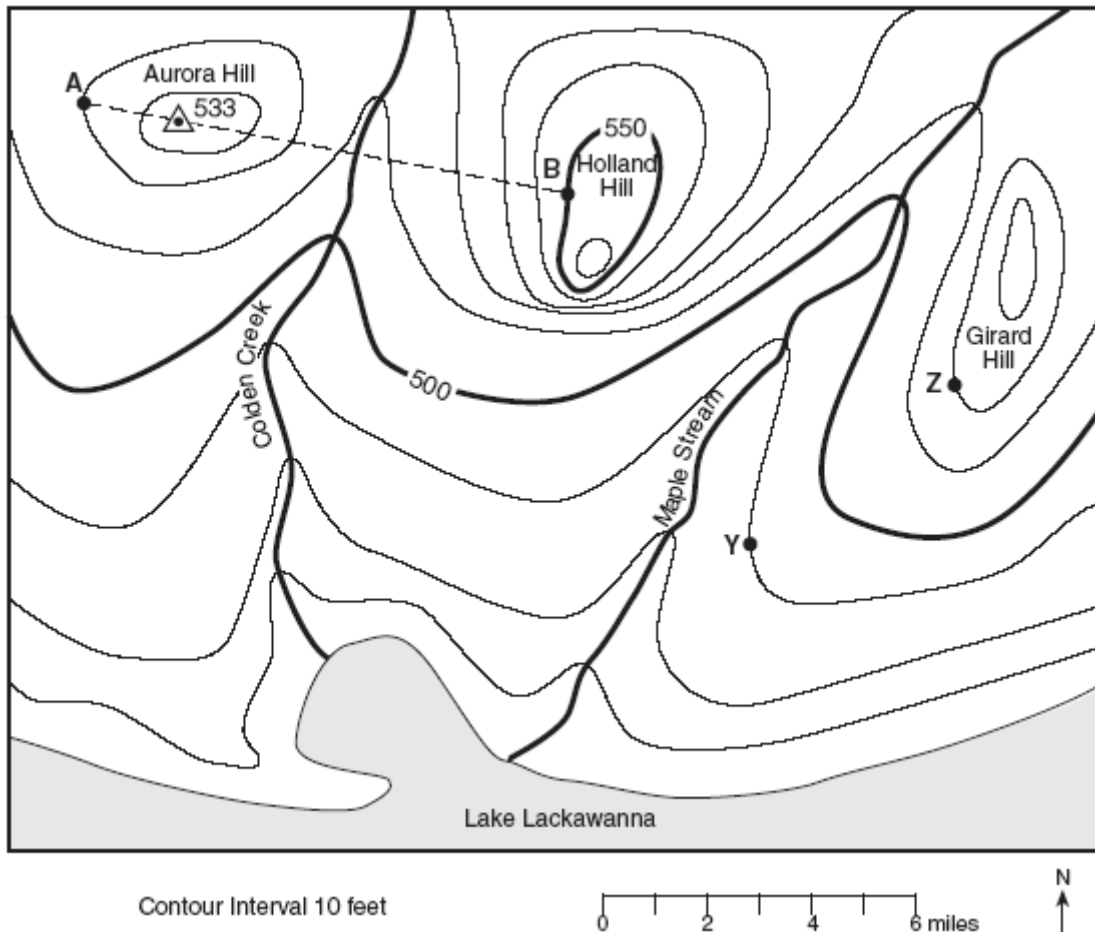
Formula:

Substitution:

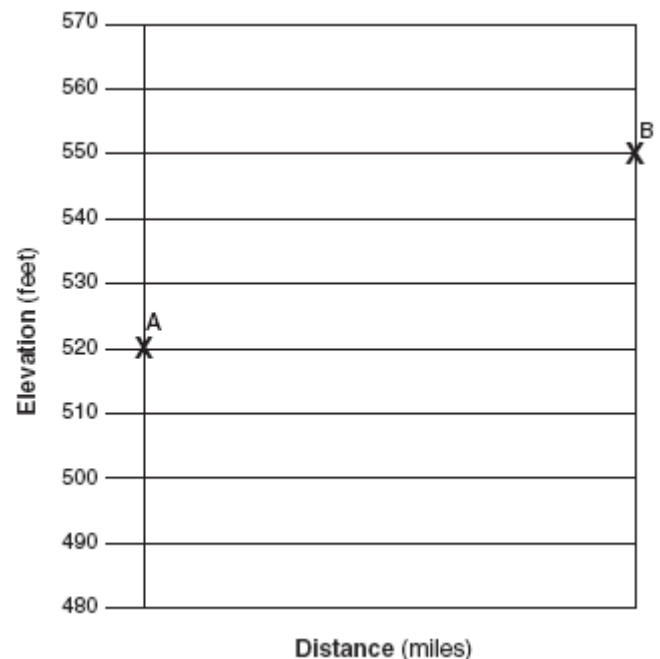
Answer with units:

Gradient, Profile & Topographic Map Practice Questions

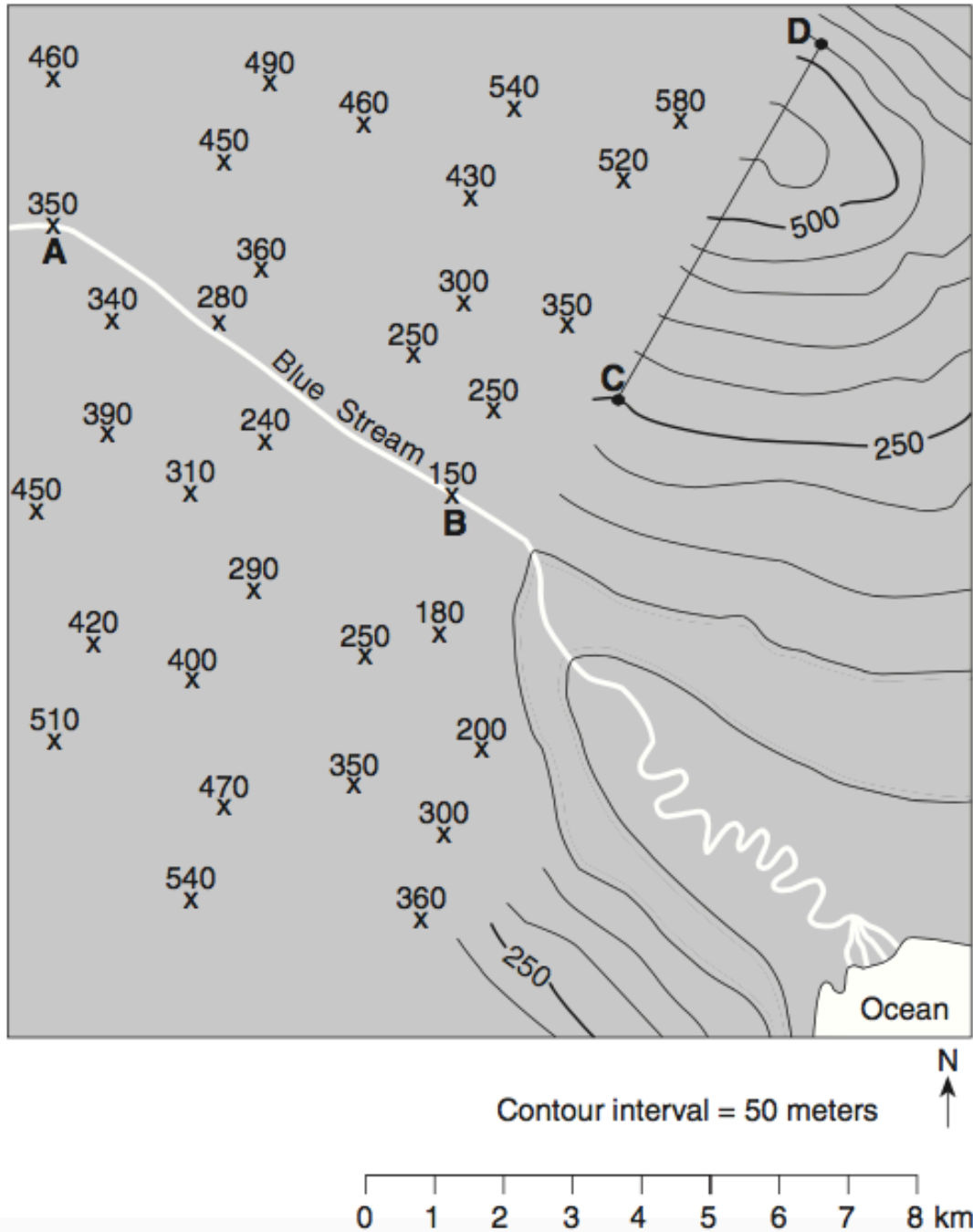
Points A, B, Y and Z are reference points on the topographic map. The symbol 533 represents the highest elevation on Aurora Hill.



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. (Label 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 points A to B.

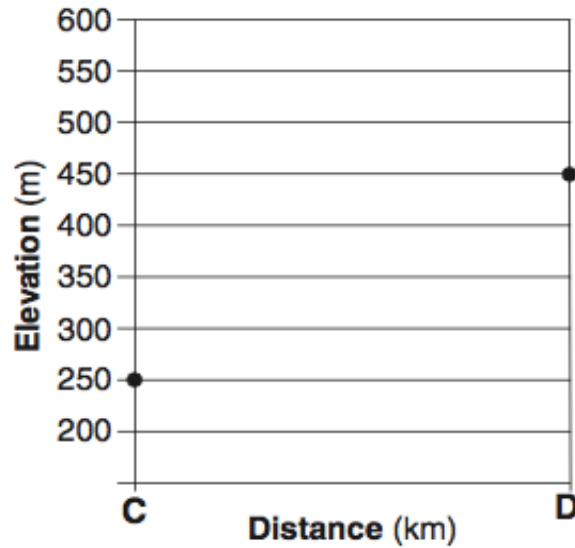


Base your answers to questions #6-9 on the map below, which shows partially drawn contour lines. X's indicate elevation in meters. Letters A, B, C and D represent locations on the map.



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

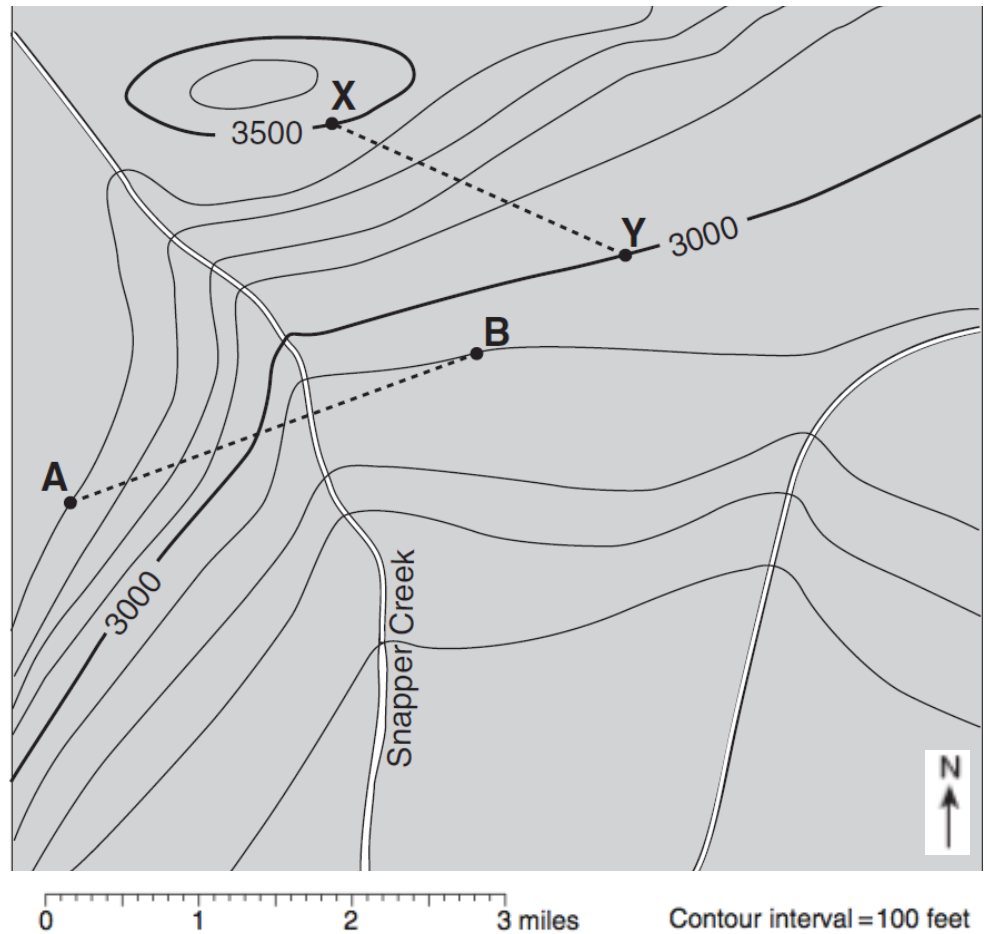
9. On the grid below, construct a topographic profile along line CD. Plot with an X the elevation of each contour line that crosses CD. Connect the points from C to D with a smooth, curved line to complete the profile. Elevations C and D have already been plotted.



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

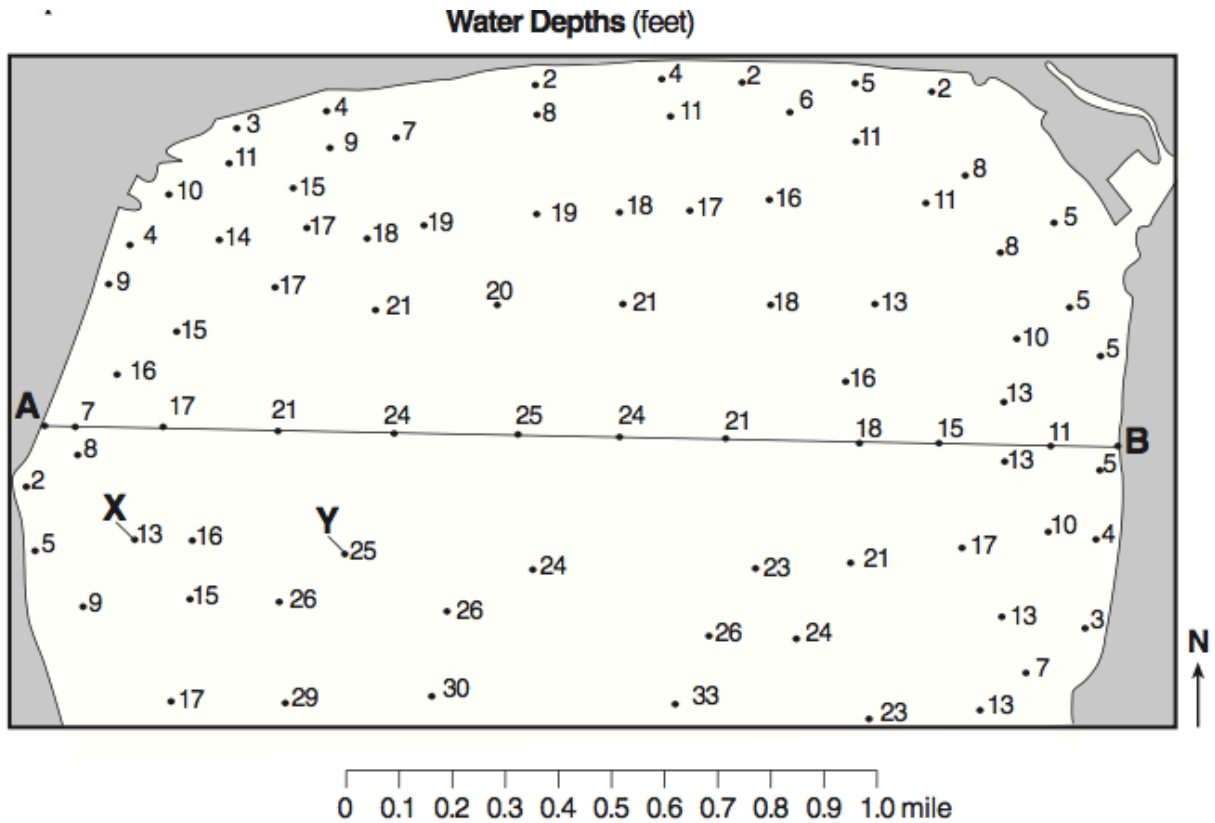
10. Toward what compass direction is Snapper Creek flowing?

11. Calculate the gradient between points X and Y. Correct units must be included in your answer.

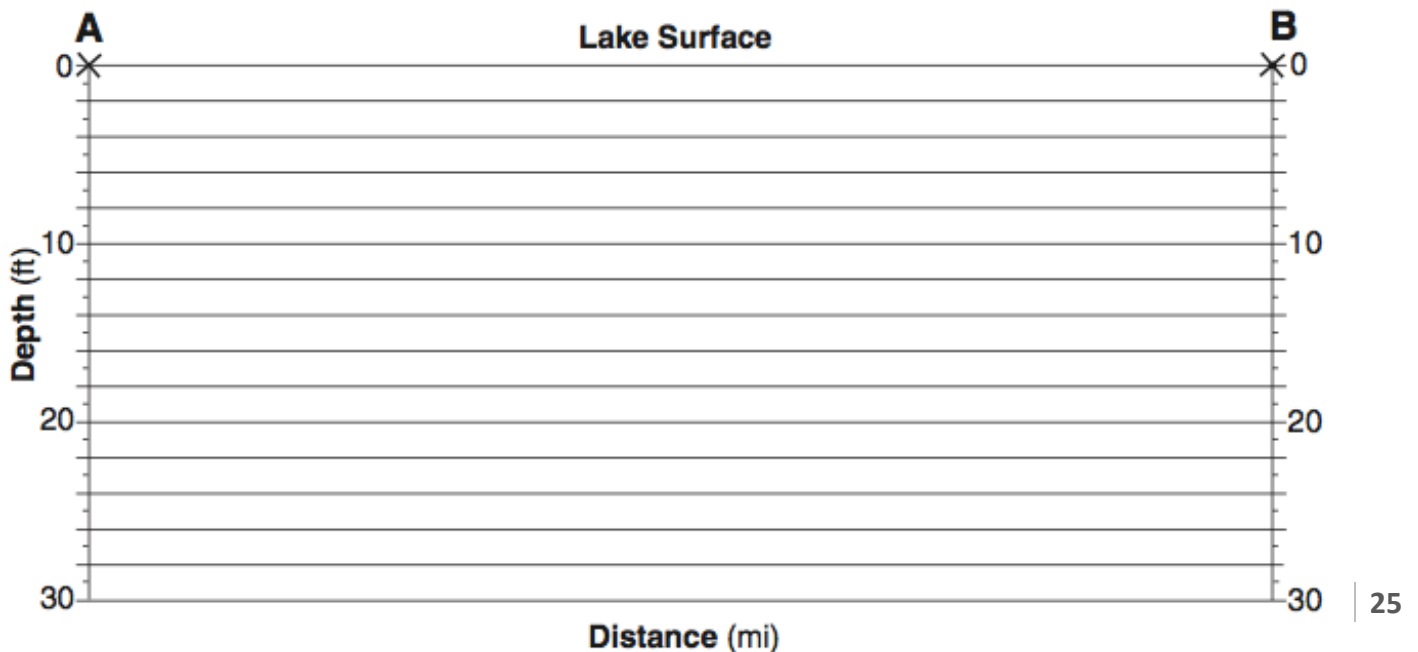


Base your answers to questions #12-14 on the map below. The map shows the water depth, measured in feet., at the north end of one of the Finger Lakes. Points A and B are locations at the lake's shoreline. Points X and Y are locations on the bottom of the lake.

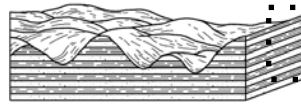
12. On the map below, draw the 20-foot depth isoline. The isoline must extend to the edge of the map.



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



Landscape Regions



Facts to Memorize: 21-24

Landscapes are determined by _____

Mountains (highlands) _____

Plateaus _____

Lowlands (plains) _____

Arid Landscapes _____

Humid Landscapes _____

1. How old are the oldest rocks in New York State? _____

ESRT pg. 2+3

Hint: Oldest rocks are at the bottom of the bedrock map key; younger as you move up!

2. In what landscape region are the oldest rocks located? _____

3. In what landscapes region do you live? _____

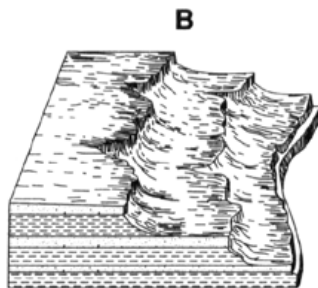
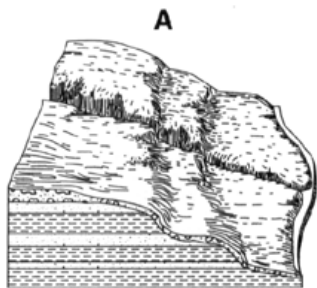
4. Complete the following table using the Bedrock Geology of NYS map on page 3 ESRT:

Location	Latitude	Longitude	Landscape Region
Niagara Falls			
Rochester			
Mt. Marcy			
Massena			
Ithaca			

5. Find the Finger Lakes. These lakes were created as glaciers scratched the bedrock. Based on the orientation of the lakes from what direction did the glaciers advance? _____

6. Most of New York State is exposed to the same type of weathering/climate. What is the reason why there are so many different types of landscapes? _____

7.



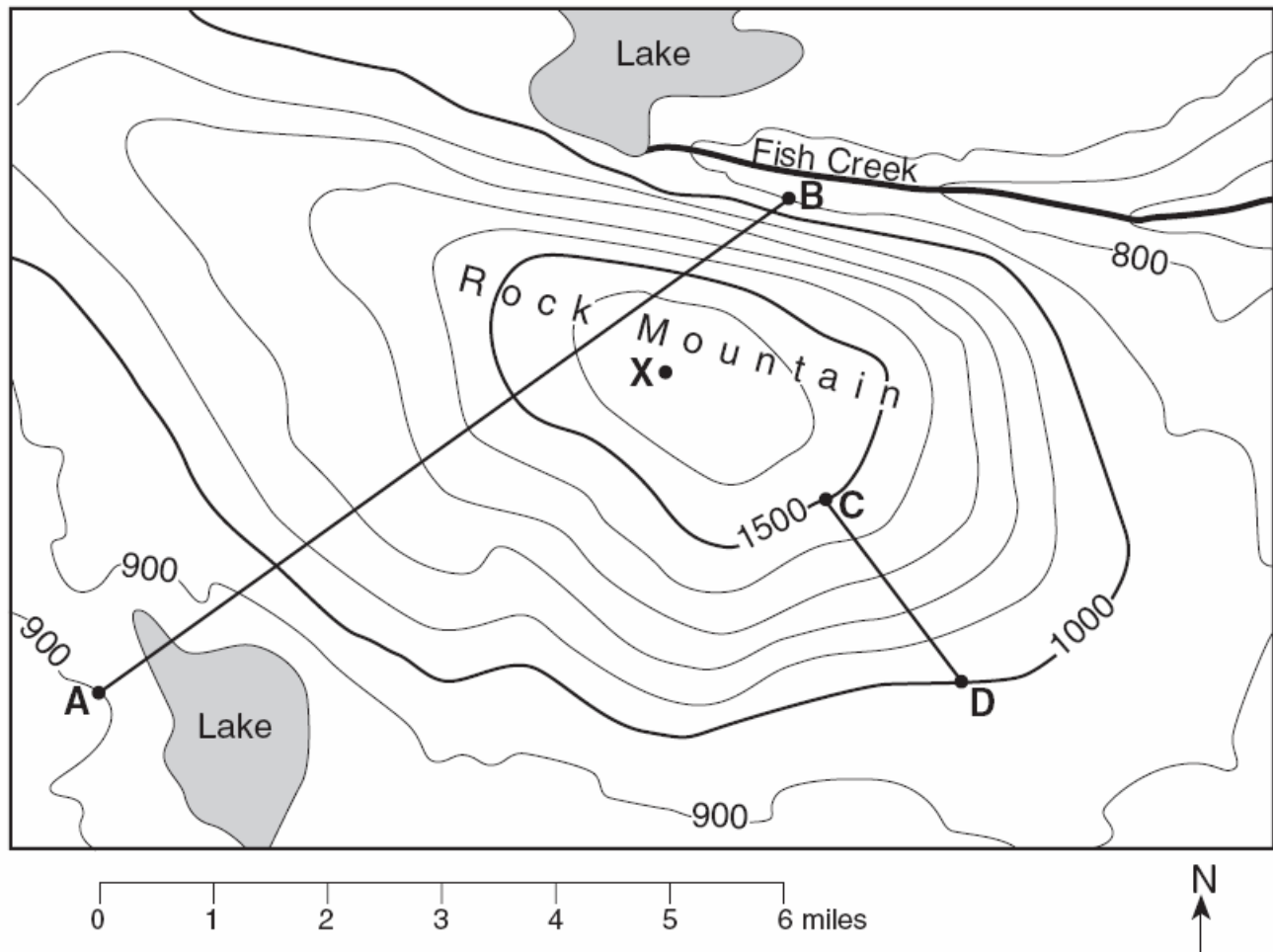
Which landscape, A or B, is located in a humid climate? How can you tell?

Directions: Please complete the chart and answer all the questions using pages 2 and 3 of your Earth Science Reference Tables.

Landscape Region Name	Age of Bedrock (Silurian, Ordovician)	Bedrock Type (Sedimentary, Igneous, Metamorphic)	Bedrock Names (limestone, shale)	Mountain, Plateau, or Lowlands
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				

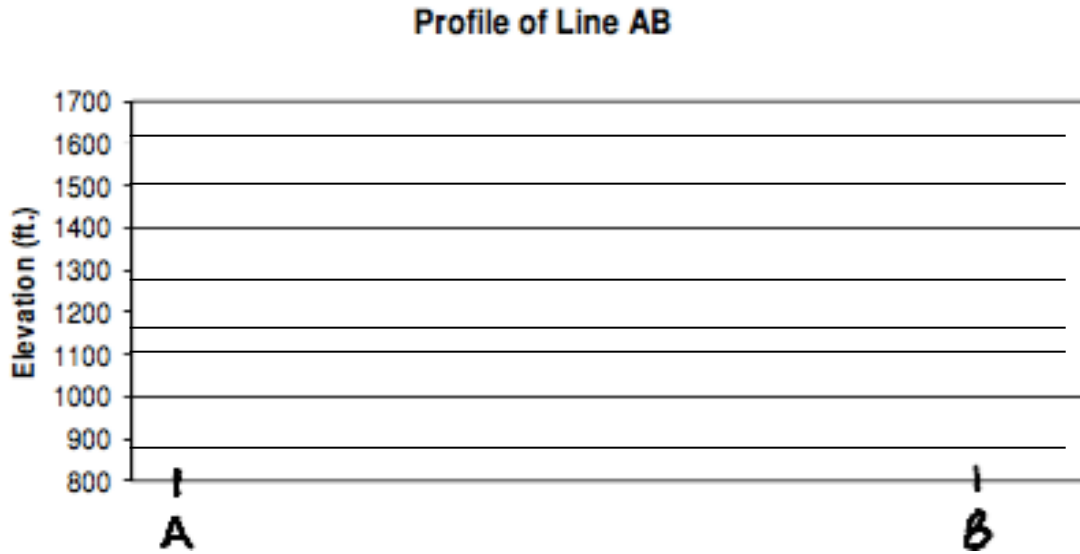
Measuring Earth Review

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. What is the distance from A to B?
4. Which direction does Fish Creek flow?
5. How can you determine that from the contour lines?
6. What is the gradient of line CD? Show all work

7. Draw the profile of line AB

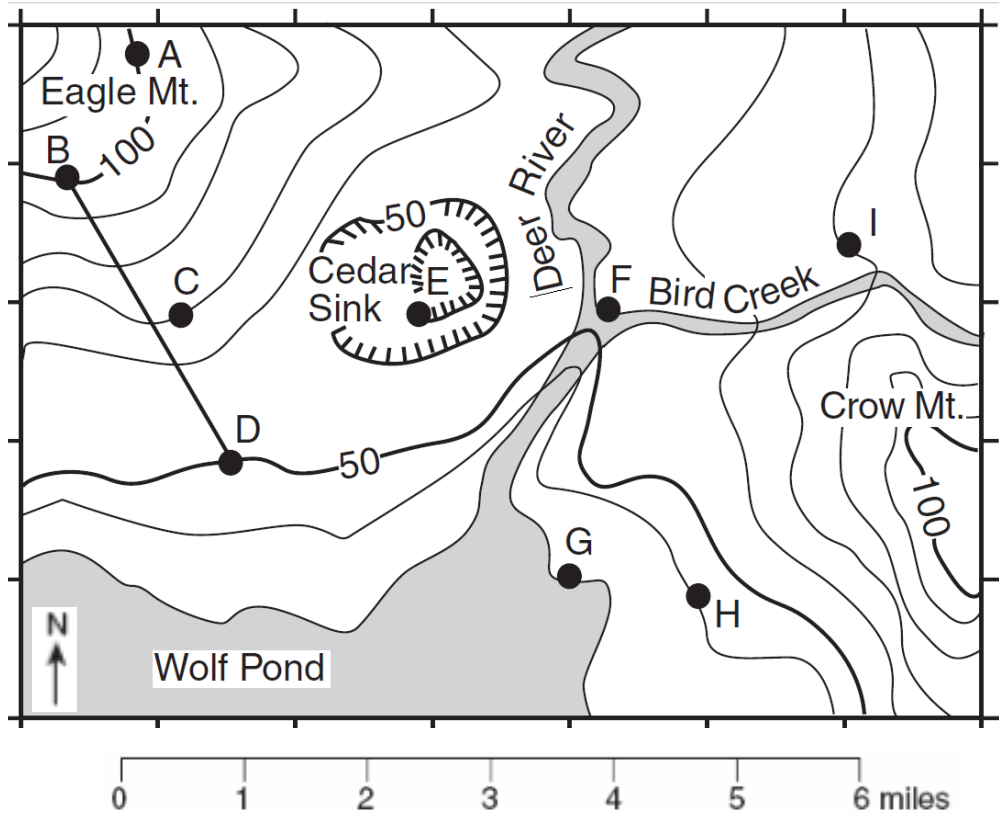


Use the map below to answer questions 8-10. Elevations are in feet.

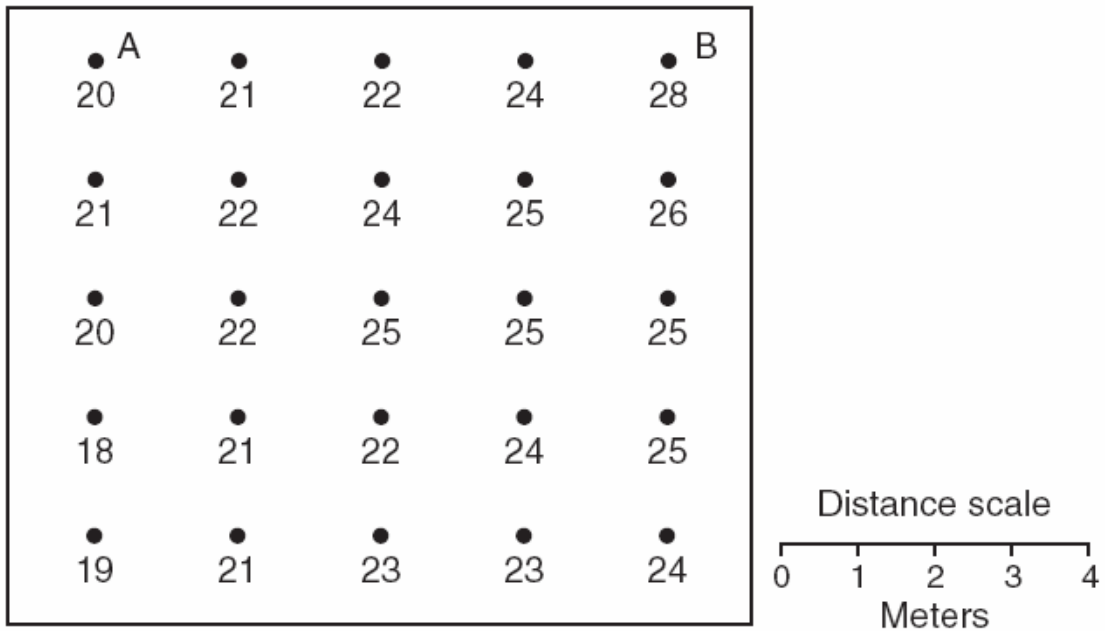
8. Which general direction does Deer River flow?

9. What is the gradient of line BD? Show all work.

10. What is the lowest possible elevation found in Cedar Sink?



Use the following picture to answer questions 11-13. Temperatures are in Celsius.



11. Connect the isolines for 20, 22, 24, & 26. Be sure to extend the edge of the field.

12. What's the specific name of these isolines?

13. What is the gradient from point A to B? Show all work.

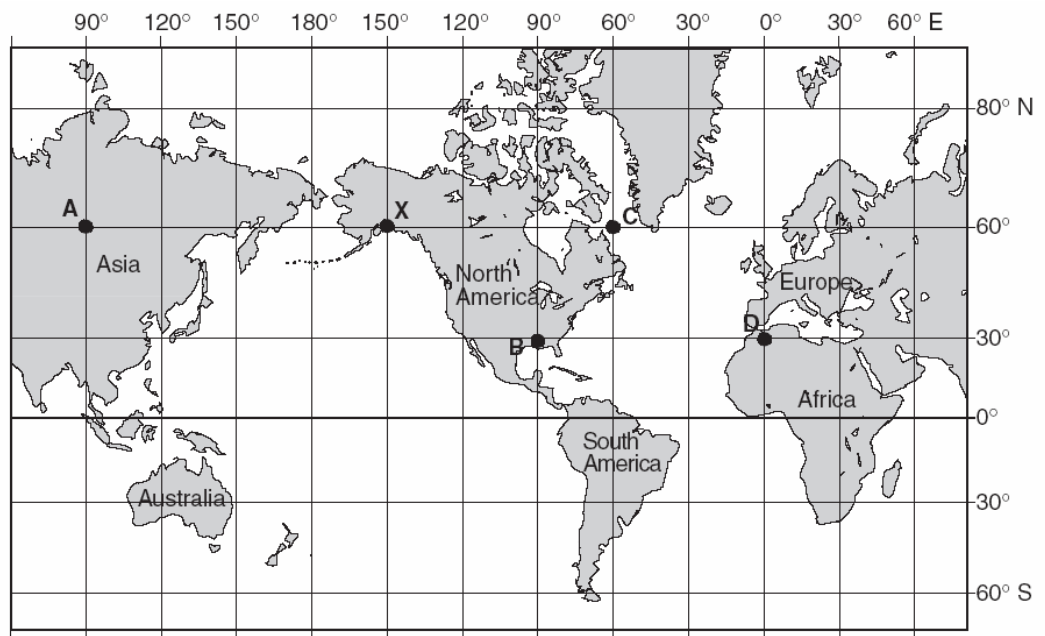
Use the following map to answer questions 14-17.

14. What is the latitude and longitude of point A?

15. What is the latitude and longitude of point D?

16. If it is 8:00am at point B, what time is it at point D?

17. Which three locations have the same altitude of Polaris?

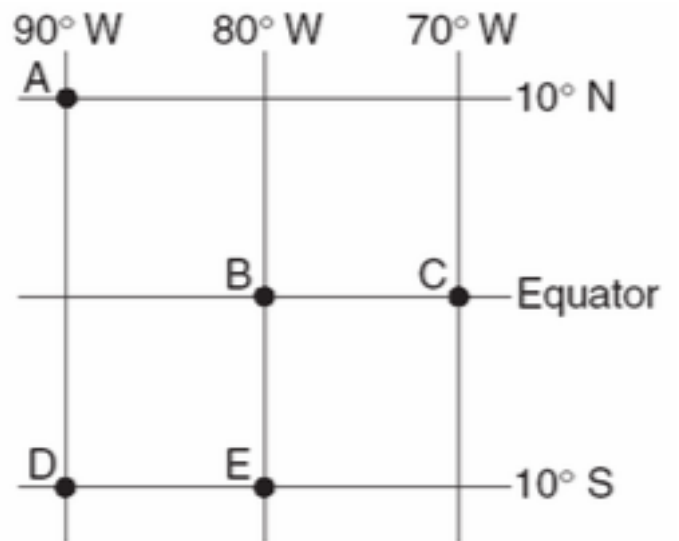


Use the following map to answer 18-20.

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

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

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



Use the following map to answer questions 21-23

21. Draw a circle around the area with the steepest temperature gradient.

22. Draw a triangle around the area with the least change in temperature gradient.

23. How do the isolines show where the steepest temperature gradient is located?

24. What would be a possible temperature for the ■ symbol on the map?

