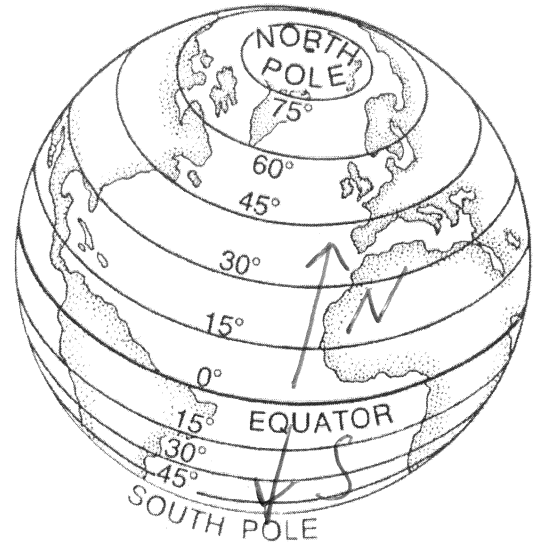


W.S. – Latitude and Longitude

Notes

What is Latitude?

Latitude is defined as a measurement of distance in degrees north and south of the equator. There are 90 degrees of latitude from the equator to each of the north (90°N latitude) and south (90°S latitude) poles. Latitude lines are pictured on the globe to the right. Latitude lines are parallel, that is they are the same distance apart. In fact, they are sometimes called **parallels**. At 7,926 miles (12, 756 km) in length, the **equator** is the longest of all lines of latitude. It divides the earth into two halves and is measured as 0° (zero degrees). Positions on latitude lines above the equator are called “north” and are in the **northern hemisphere**. Miami, Florida, for example, is nearly twenty-five degrees north of the equator. Its approximate latitude is written as 25°N. Positions on latitude lines below the equator are called “south”. Brisbane Australia, for example, is near the thirty degree latitude line too, but in the **southern hemisphere**. Its latitude is written as 30°S.



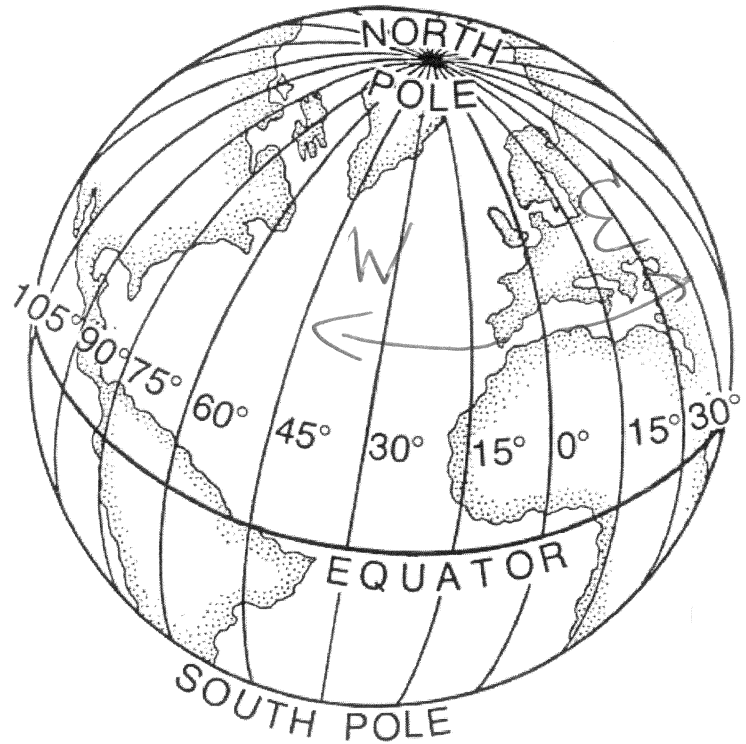
Complete the Following

1. Lines of latitude are Parallel to the equator.
2. There are 90° degrees of latitude north and south of the equator.
3. The equator is 0° degrees.
4. Another name for latitude lines is parallel.
5. The equator divides the earth into 2 equal parts.
 N. Hemisphere
 S. Hemisphere
6. Write a definition of latitude.

Angular distance North + South of
the equator (but run E → W)

What is Longitude?

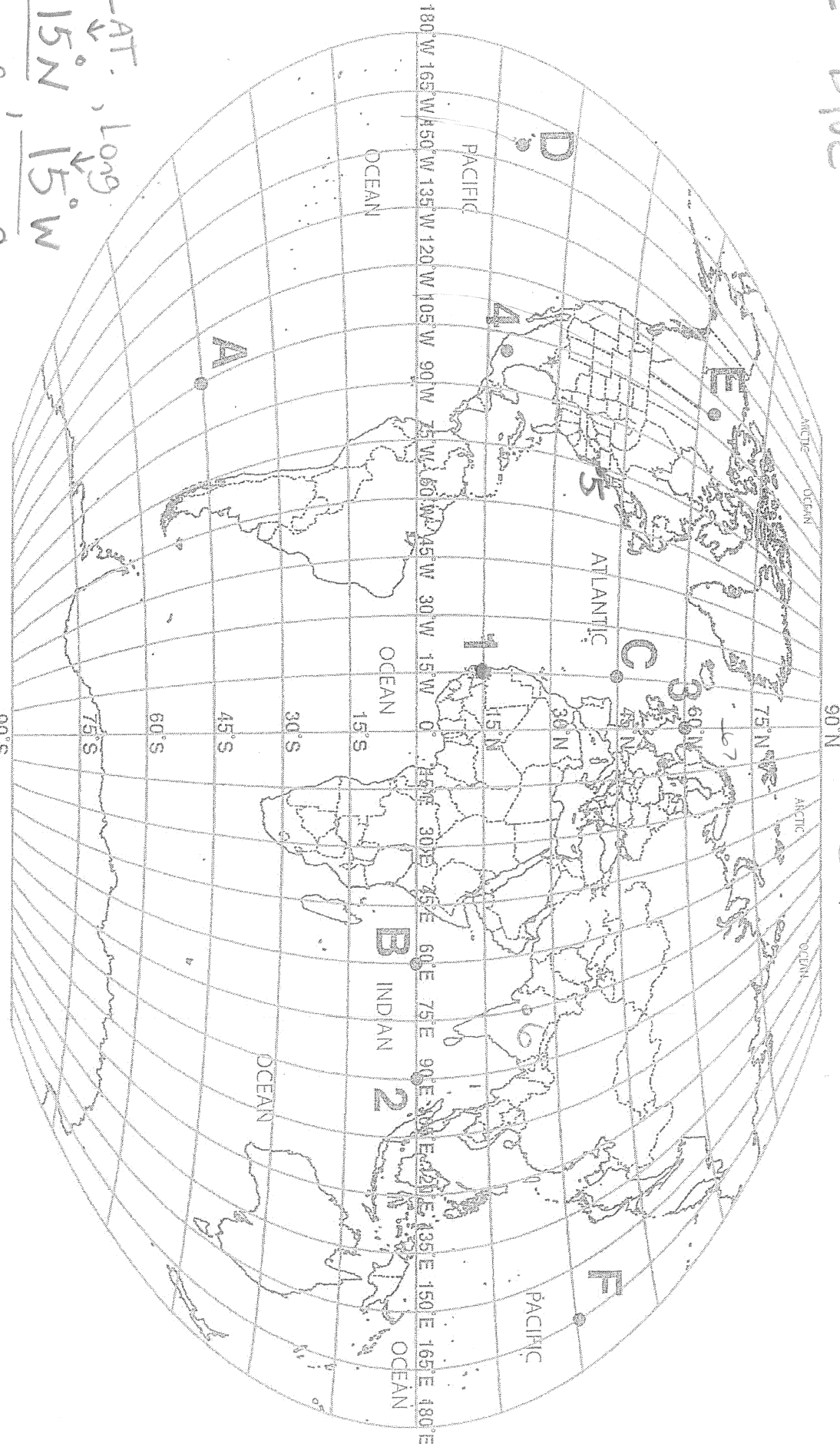
Longitude is defined as measurement of distance in degrees east or west of the prime meridian. The prime meridian divides the earth in half and is referred to as 0° longitude. The **prime meridian**, as do all other lines of longitude, pass through the north and South Pole. This is shown in the diagram to the right. Longitude lines are not parallel. They make the earth look like a peeled orange. There are 180 lines of longitude on the each side of the prime meridian. On the opposite side, the prime meridian is not zero degrees but 180 degrees. Here, it is called the **International Date Line**. Longitude lines to the left of the prime meridian give locations west, in the **western hemisphere**. Longitude lines to the right of the prime meridian give locations east, in the **eastern hemisphere**. Miami, Florida, for example, is near the 80° line of longitude. It is west of the prime meridian and is written 80°W .



Complete the Following

- Longitude lines connect the N. pole with the S. pole.
- The line of 0° longitude is called the prime meridian; $180^\circ =$ "IDL"
- Longitude lines give directions East and West of the prime meridian.
- There are 180° degrees of longitude each side of the prime meridian.
- Longitude lines are not parallel like latitude lines. (called meridians)
- Write a definition of longitude.
Distance East (to the right) and West (to the left) of the prime meridian (0°).

Equator = red
 Prime meridian = Blue
 TDL = Blue

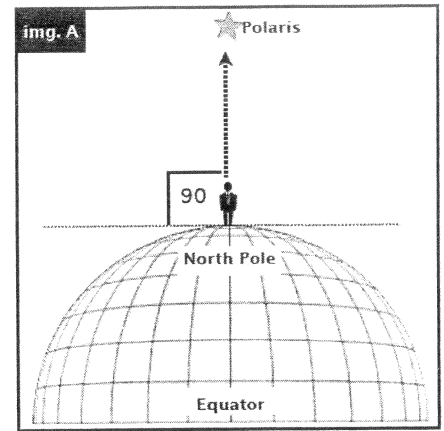


- LAT. ↓, LONG ↑
1. $15^{\circ}N$, $15^{\circ}W$
 2. 0° , $90^{\circ}E$, $18-20^{\circ}N$, $98-100^{\circ}W$
 3. $60^{\circ}N$, 0° , $5-40^{\circ}N$, $75^{\circ}W$

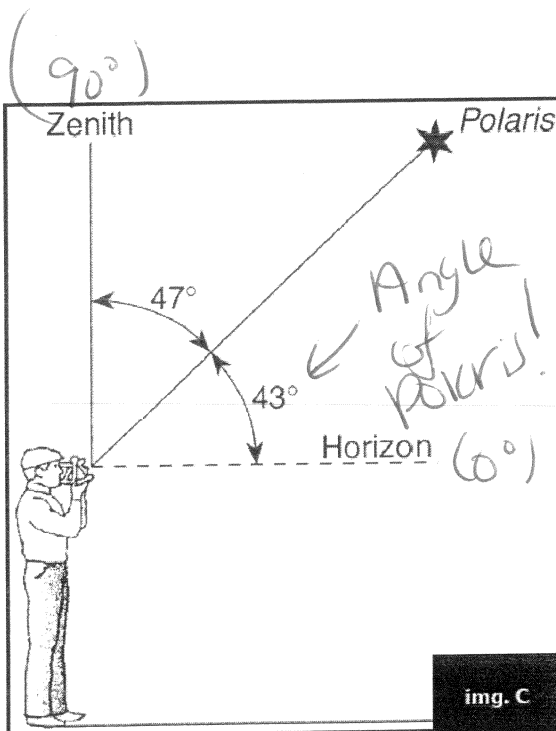
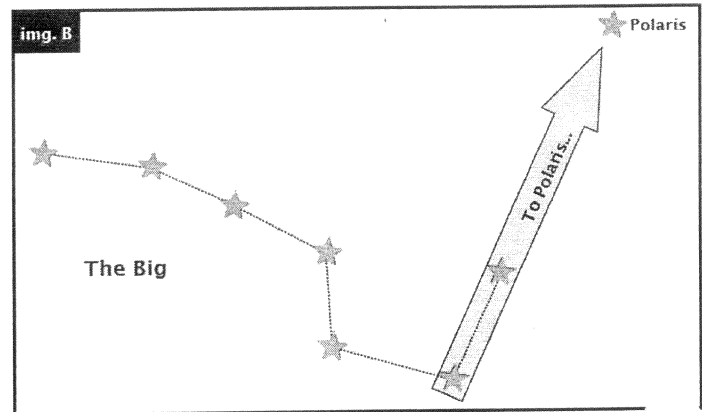
- A. $45^{\circ}S$, $105^{\circ}W$
- B. 0° , $60^{\circ}E$, $65^{\circ}N$, $13^{\circ}W$
- C. $15^{\circ}N$, $18^{\circ}W$
- D. $18-20^{\circ}N$, $15-17^{\circ}W$
- E. $65^{\circ}N$, $13^{\circ}W$
- F. $30^{\circ}N$, $167^{\circ}E$

How to Determine your Latitude?

If you stand at the North Pole and look directly up above your head, you will see a star called **Polaris**, or **the North Star** (img. A). This star is visible from any location in the Northern Hemisphere, though it will be visible at different heights in the sky depending on where you are. **If you measure the angle between the horizon and Polaris, that angle will be**



equal to your latitude. Before you can do this, you must be able to locate Polaris amongst the many stars visible in the night sky. In order to do this, you must locate the constellation **Ursa Major**, also known as **the Big Dipper**. This constellation “points” directly to Polaris (img. B). Once you find Polaris, you need to use an instrument called an **astrolabe** (img. C) to measure the angle between the horizon and Polaris. This angle is equal to your latitude.



Look at the image on the left. This man is using an astrolabe to measure the angle between the horizon and Polaris, which, in this example, is equal to 43° . Notice, the angle between Polaris and the observer's **zenith** (the point directly above the observers head) is also shown. This number is irrelevant and meaningless. The latitude of this observer is 43° N. It must be north because this technique does not work in the Southern Hemisphere as Polaris is not visible south of the equator.

KEY IDEA
YOUR LATITUDE IS EQUAL TO THE ALTITUDE OF POLARIS IN THE NORTHERN

21. What is the altitude of Polaris here in Mamaroneck (approx. 42°N)? 42°

22. What happens to the altitude of Polaris as you move north in the northern hemisphere?
It \uparrow (higher angle)

23. What happens to the altitude of Polaris as you move south in the northern hemisphere?
It \downarrow (lower angle)

24. What happens to the altitude of Polaris as you move due west from Thornwood, NY to Chicago?
Nothing

25. If the altitude of Polaris in Mamaroneck is 42° tonight, what will it's altitude be tomorrow night?
 42° / No movement by Polaris at all!

26. How does Polaris appear to change position during the night? It does not

27. How do stars near Polaris appear to change position during the night? They rotate around it in "circles"

28. What is the altitude of Polaris at the North Pole? 90°

29. What is the altitude of Polaris at the equator? 0°

30. If you cannot see Polaris on a clear night, state something concerning your position on the Earth's surface?
You must be in the Southern Hemisphere!

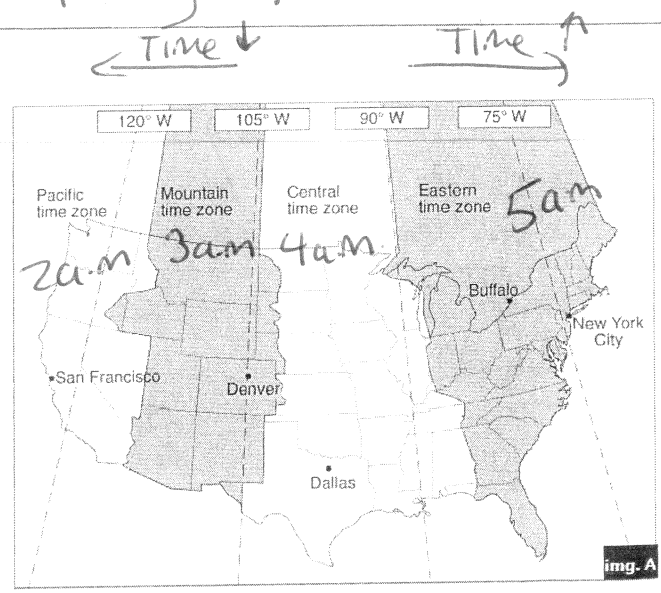
31. If you are facing Polaris, which compass direction is at your back? South

32. If you are facing Polaris, which compass direction is to your left? West

33. Where is the altitude of Polaris the maximum? N. pole; 90°

How to Determine your Longitude?

The Earth is not sitting still, it is both **rotating** on it's axis and **revolving** around the Sun. It takes one **day** (23 hours, 56 minutes and 4 seconds) to complete a rotation and one **year** (365.26 days) to complete one revolution. One rotation is equal to one complete spin, or 360° . If it takes us about 24 hours to **spin 360°** , we know that we are spinning at a rate of **$15^{\circ}/\text{hour}$** . Because of this, locations on Earth that are 15° of longitude apart, also have a time difference of one hour. This is the basis of our system of **time zones** (img. A). As a result, we can use time to help us to determine our longitude.



* Earth rotates from West \rightarrow East!

Step 1: Determine when it is solar noon at your location by waiting until the Sun reaches its highest point in the sky.

Step 2: Identify how many hours difference there is between solar noon at your location and the time at the Prime Meridian. To do this, you need a **chronometer**, a type of very accurate clock (see left).

Step 3: Multiply the number of hours between the time where you are and the time at the Prime Meridian by 15° .

Step 4: If the time where you are is **less** than the time at the Prime Meridian, you are **west** of the Prime Meridian. If the time where you are is **later** than the time at the Prime Meridian, you are **east** of the Prime Meridian.

"If time is less, you are west, if time did increase, you are east"

Example...

You are sailing on a ship and have lost your way. You have determined your latitude to be 35°N by observing Polaris last night. Now you need to calculate your longitude. You observe the Sun to be directly overhead. At that instant, your chronometer reads 4:00 pm (the time at the Prime Meridian). What is your longitude?

There is a 4 hr. difference between your time and Prime Meridian time.

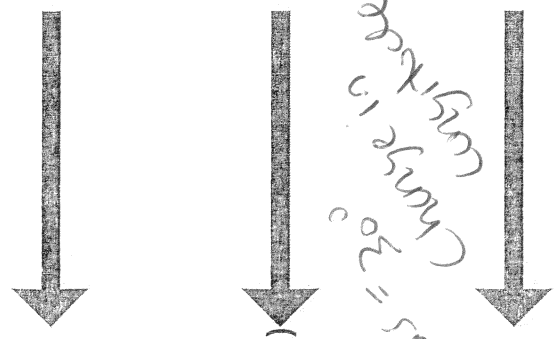
Four hours $\times 15^\circ = 60^\circ$. Since your time is less, you are west.

Your longitude is 60°W .

1. Your time is 2:00 pm, Prime Meridian time is 10:00 am. What is your longitude? 60°E
2. Your time is 9:00 am, Prime Meridian time is 3:00 pm. What is your longitude? 90°W
4 hrs $\times 15^\circ/\text{hr} = 60^\circ$; Time is \uparrow , so you are East
3. Your time is 5:00 pm, Prime Meridian time is 4:00 pm. What is your longitude? 15°E
6 $\times 15^\circ/\text{hr} = 90^\circ$; time is less, you are west!
4. Your time is 9:00 pm, Prime Meridian time is 2:00 pm. What is your longitude? 105°E
1 $\times 15^\circ/\text{hr} = 15^\circ$
5. It is 2:00 pm at the Prime Meridian and you are located at 30°W longitude. What time is it where you are?
12 p.m. *30 $^\circ$ difference / $15^\circ/\text{hr} = 2$ hr difference; since west, time is less!*
6. It is 2:00 pm at the Prime Meridian and you are located at 45°E longitude. What time is it where you are?
5 p.m. *45 $^\circ$ / $15^\circ/\text{hr} = 3$ hrs; since East, time did \uparrow (by 3 hrs)*
7. It is 10:00 am at the Prime Meridian and you are located at 60°W longitude. What time is it where you are?
6 a.m.
8. It is 10:00 am at the Prime Meridian and you are located at 90°E longitude. What time is it where you are?
4 p.m.

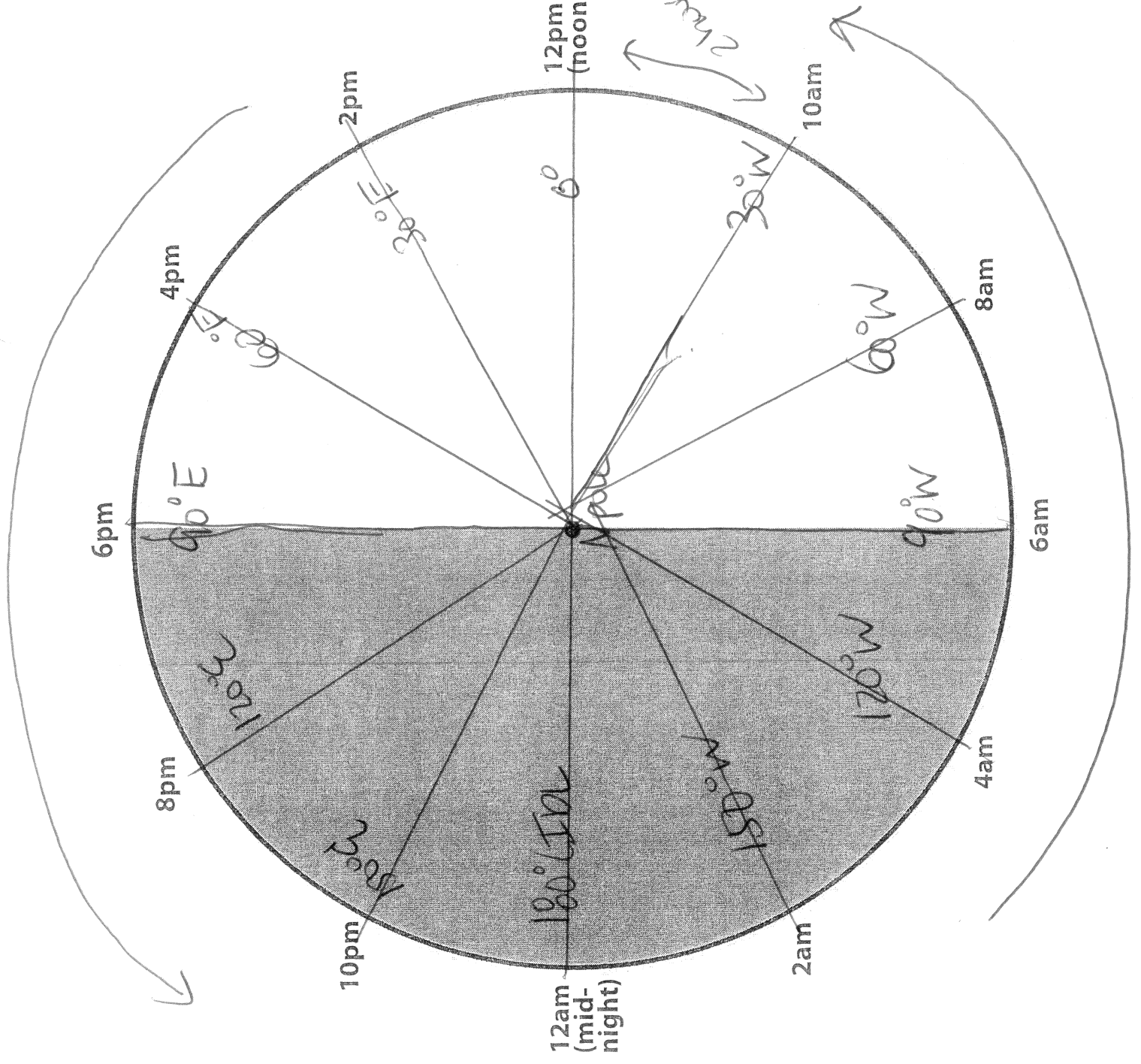
Earth rotates
 Counterclockwise
 from a top-down
 view

SUN



Change in
 length of
 days = 30°

15° longitude = 1 hr
 time
 difference!



Name _____

NYS Latitude and Longitude

$1^\circ = 60'$!

↑ degree ↑ minutes

NYS Latitude and Longitude Map in Reference Table (pg. 3)

Location	Latitude (degrees and minutes)	Longitude (degrees and minutes)
Mount Marcy	44° 5' N	74° 55' W
Buffalo	42° 45' N	78° 55' W
Plattsburgh	44° 40' N	73° 30' W
Slide Mtn.	42° N	74° 20' W
Massena	45° N	74° 55' W
Binghamton	42° 5' N	75° 55' W
Kingston	41° 55' N	73° 55' W or 74°

Latitude	Longitude	Location
42° 30' N	76° 30' W	Ithaca
43° 15' N	77° 30' W	Rochester
43° N	75° 15' W	UTICA
43° 30' N	76° 30' W	Oswego
43° 15' N	79° W	Niagara Falls

