

# 5 Geographers' Tools: Location Systems

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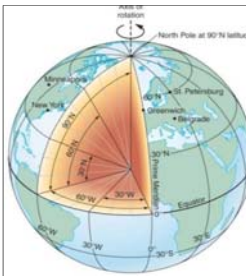
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## Location Systems

**Earth's Grid:** system of points on the surface connected by intersecting lines of latitude and longitude.

**To portray data spatially, we need a way to accurately locate places on the earth's surface.**

- This is the **GRID SYSTEM**.
  - ✓ Composed of **lines of latitude and longitude**.
    - Allows us to **see** locations, patterns, and interrelationships.
    - Allows us to **measure** distance.



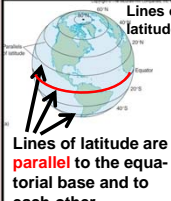

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## Latitude

❖ **LATITUDE:** Distance measured in degrees **NORTH** and **SOUTH** of the **EQUATOR**.

It is the result of geometric calculations **using the equatorial plane of the earth (the equator) as its base.** (The equator is at the center point in the movement of the sun's vertical rays on the earth's surface).

The measured angle at which a plumb line to the center of the earth intersects the earth's surface equals latitude.

**Lines of latitude are parallel to the equatorial base and to each other. They never cross nor converge.**

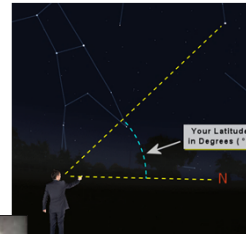
Latitude is also astronomical.

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## Latitude

❖ **Latitude is astronomical.**

You can measure the angle of the sun above the horizon or the height of the North Star at night. The angle equals latitude.

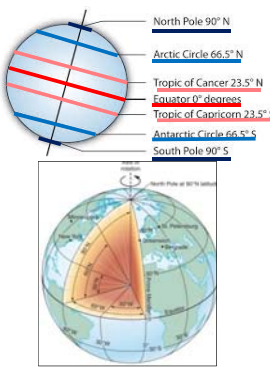


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## Latitude

**There are seven lines of latitude we need to know**  
All are based on astronomical observations.

- 90° N = North Pole**
- 66.5° N = Arctic Circle**
- 23.5° N = Tropic of Cancer**
- 0° = Equator**
- 23.5° S = Tropic of Capricorn**
- 66.5° S = Antarctic Circle**
- 90° S = South Pole**



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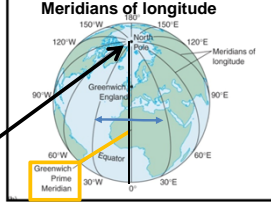
## Longitude

Meridians are **man-made** phenomena based on the geometry of circles (360°)

❖ **LONGITUDE:** Distance measured in degrees **east** and **west** of the **0° MERIDIAN**.

**The lines of longitude (called meridians) converge at the poles.**

**0° line of longitude is the Prime Meridian.** It is called the "Greenwich Meridian."



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## Longitude

Meridians of longitude are marked by first dividing the equatorial circle into 360 segments then dividing every circle of latitude into 360 segments and finally connecting all like-numbered degrees.

There two meridians we need to know:

0° = Prime Meridian  
 180° = International Date Line (IDL follows along 180° but not exactly.)

FYI: 0° and 180° are neither E or W

## Finding Longitude

To determine your longitude when on the earth's surface you need two accurate clocks.

One clock (chronometer) set for the time at 0° (the Prime Meridian or GMT) and one set locally by the angle of the sun.

*The difference in time between them indicates distance from the Prime Meridian.*

### USING A MARINE CHRONOMETER

Marine chronometers are precise, specialized clocks for finding longitude at sea. They serve as portable time standards.

Each 60 min = 15° of longitude.  
 Each 30 min = 7.5° of longitude.  
 Each 15 min = 3.75° of longitude.  
 Each 4 min = 1° of longitude.

## Latitude and Longitude

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Latitude scales points north and south of the Equator. Longitude scales points east and west of the Prime Meridian.

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## Latitude and Longitude

**Latitude + Longitude = Earth's Grid**

<https://www.youtube.com/watch?v=MMNCebVJLZ>: 5 min video "Determining Latitude and Longitude"

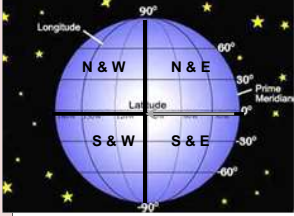
## Latitude and Longitude

We can divide the earth's grid into four quadrants:

north/west	north/east
south/west	south/east

❖ **REMEMBER:**

- Latitude is only designated **NORTH** or **SOUTH**.
- Longitude is only designated **EAST** or **WEST**.



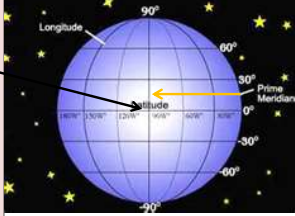
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## Reading Latitude and Longitude

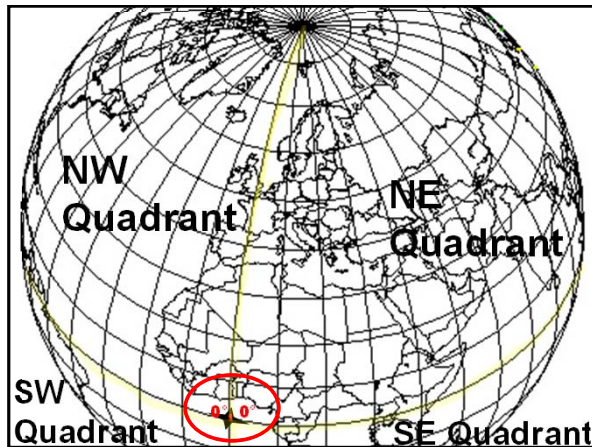
When locating places on the earth, we start where the base lines of latitude and longitude cross:

0°, 0°

- First we count lines north or south of the **equator**.
- Then we count lines east or west of the **prime meridian**.



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## TIME

❖ The longitude of a location is determined by time differential.

You need to know the difference between "local" or "sun" time and "prime meridian time (GMT)."

NOTE: It is the same time (hour of the day) along any meridian from the North Pole to the South Pole.

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## TIME ZONES

❖ **Standard Time Zone:** an area of the earth that is **15° of longitude wide** (360° ÷ 24 hrs of one rotation = 15°/hr), where all clocks are set when **solar noon** occurs at the zone's center meridian.

- ✓ Time zones are based on calculating longitude.
- ✓ Concept created in 1884 by US railroad companies for scheduling purposes.

**Each 15° of longitude = 1 hour of time.**

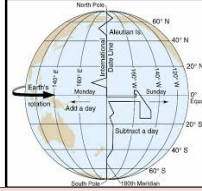
- Each 7.5° of longitude = 30 minutes.
- Each 3.75° of longitude = 15 minutes.
- Each 1° of longitude = 4 minutes.

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## TIME ZONES

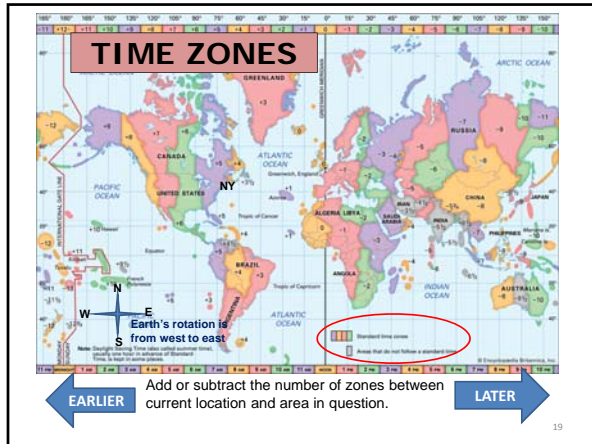
❖ There are 24 world standard time zones, each 15° wide.

- Numerous off-standard zones (half hour, multi-hour, sun) created by governments.
- Over 30 irregular-shaped zones due to political borders.



❖ The **International Date Line** generally follows the **180° meridian** – but not exactly in order to keep political units in the same date. **When the line is crossed the date changes**, e.g., 3 PM Tuesday becomes 3 PM Wednesday, or vice versa, depending on direction of movement.

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### GPS Dependence

### Global Positioning System

- ❖ An array of 24 satellites orbits 12,500 miles above the earth.
- Need at least 3 satellites to fix a location of latitude, longitude and elevation.

visible sat = 12

### EXTRA CREDIT

Extra Credit Atlas Exercise for Exam I is available on the home page.

Submit answers using the blue Scantron sheet by Feb. 23, 2018.

Once you have completed the exercise transfer the answers to the blue Scantron sheet using a #2 pencil. Completely erase all mistakes and stray marks.

### NEXT

## Parts of Maps