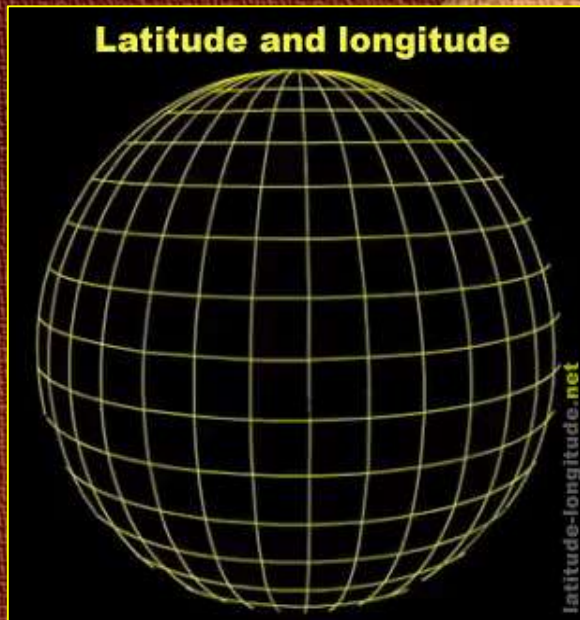




Lines of Latitude & Longitude

Lines of Latitude and Longitude help us to answer a key geographical question:
“Where am I?”



What are Lines of Latitude and Longitude?

Lines of Latitude and Longitude refer to the grid system of imaginary lines you will find on a map or globe.

PARALLELS of Latitude and **MERIDIANS** of Longitude form an invisible grid over the earth's surface and assist in pinpointing any location on Earth with great accuracy; *everywhere* has its own **unique** grid location, and this is expressed in terms of **LATITUDE and LONGITUDE COORDINATES**.

Lines of LATITUDE are the 'horizontal' lines.

They tell us whether a place is located in the **NORTHERN** or the **SOUTHERN HEMISPHERE** as well as how *far North or South* from the **EQUATOR** it is.

Lines of LONGITUDE are the 'vertical' lines.

They indicate how *far East or West* of the **PRIME MERIDIAN** a place is.

Facts about Lines of Latitude



- The **EQUATOR** is the **0° LATITUDE LINE**.
 - North of the EQUATOR is the **NORTHERN HEMISPHERE**.
 - South of the EQUATOR is the **SOUTHERN HEMISPHERE**.
- **Lines of Latitude** cross the **PRIME MERIDIAN** (longitude line) at right angles (90°).
- **Lines of Latitude** circle the globe/world in an east-west direction.
- **Lines of Latitude** are also known as **PARALLELS**.
 - *As they are parallel to the Equator and apart always at the same distance.*
- **Lines of Latitude** measure distance north or south from the equator *i.e. how far north or south a point lies from the Equator.*
- The distance between degree lines is about 69 miles (or about 110km).
 - A **DEGREE** (°) equals 60 minutes - 60'.
 - A **MINUTE** (') equals 60 seconds - 60''.

- The **NORTHERN HEMISPHERE** has latitudes between 0° (the equator) and 90°N (The North Pole).
- The **SOUTHERN HEMISPHERE** has latitudes between 0° (the equator) and 90°S (The South Pole).
- Get shorter toward the **POLES**, with only the equator, the longest; a great circle.

Significant Lines of Latitude

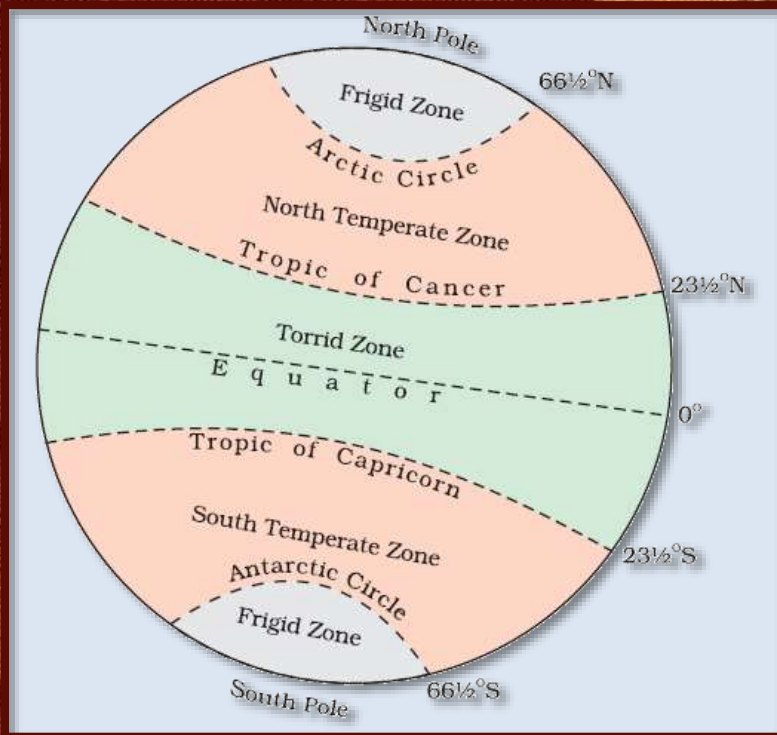
Significant LINES OF LATITUDE are:

- The Equator which is at 0° degrees.
- The Tropic of Cancer which is at $23^{\circ} 30' \text{N}$.
- The Tropic of Capricorn which is at $23^{\circ} 30' \text{S}$.



- The Arctic Circle which is at $66^{\circ} 30' \text{N}$.
- The Antarctic Circle which is at $66^{\circ} 30' \text{S}$.
- The North Pole which is at 90°N .
- The South Pole which is at 90°S .

Climate Zones



- | | |
|---------------------------|-------------|
| • The Equator | 0° degrees. |
| • The Tropic of Cancer | 23° 30'N. |
| • The Tropic of Capricorn | 23° 30'S. |
| • The Arctic Circle | 66° 30'N. |
| • The Antarctic Circle | 66° 30'S. |
| • The North Pole | 90°N. |
| • The South Pole | 90°S. |

FRIGID ZONES

Also known as the 'Polar Regions'.

North Frigid Zone:

- Lies between North Pole and Arctic Circle.

South Frigid Zone:

- Lies between South Pole and Antarctic Circle.

TEMPERATE ZONES

North Temperate Zone:

- Lies between Tropic of Cancer and Arctic Circle.

South Temperate Zone:

- Lies between Tropic of Capricorn and Antarctic Circle.

TORRID ZONE

Also known as 'The Tropics'.

- Lies between the Tropic of Cancer and Tropic of Capricorn.

Also divided into:

North Torrid Zone:

- Lies between the Equator and Tropic of Cancer

South Torrid Zone:

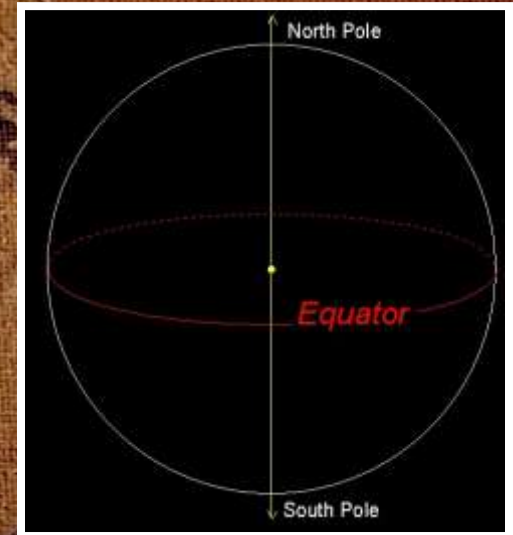
- Lies between the Equator and Tropic of Capricorn.

Significant Lines of Latitude

- The Equator -

The Equator

- **The Equator** is located at 0° (zero degrees) latitude.
- **The Equator** is 40,075.16 km long (24,901.55 miles).
- **The Equator** divides Earth into the Northern and Southern Hemispheres.
- **On the Equator**, the sun is directly overhead at NOON on the two equinoxes (@ 21st June, @21st December).
- Locations **north of the Equator** have latitudes between 0° (the equator) and 90° N (the North Pole).
- Locations **south of the equator** have latitudes between 0° (the equator) and 90° S (the South Pole).
- **On the Equator**, the length of DAY and NIGHT are equal every day of the year.
 - The DAY is always twelve hours long.
 - The NIGHT is always twelve hours long.



Significant Lines of Latitude

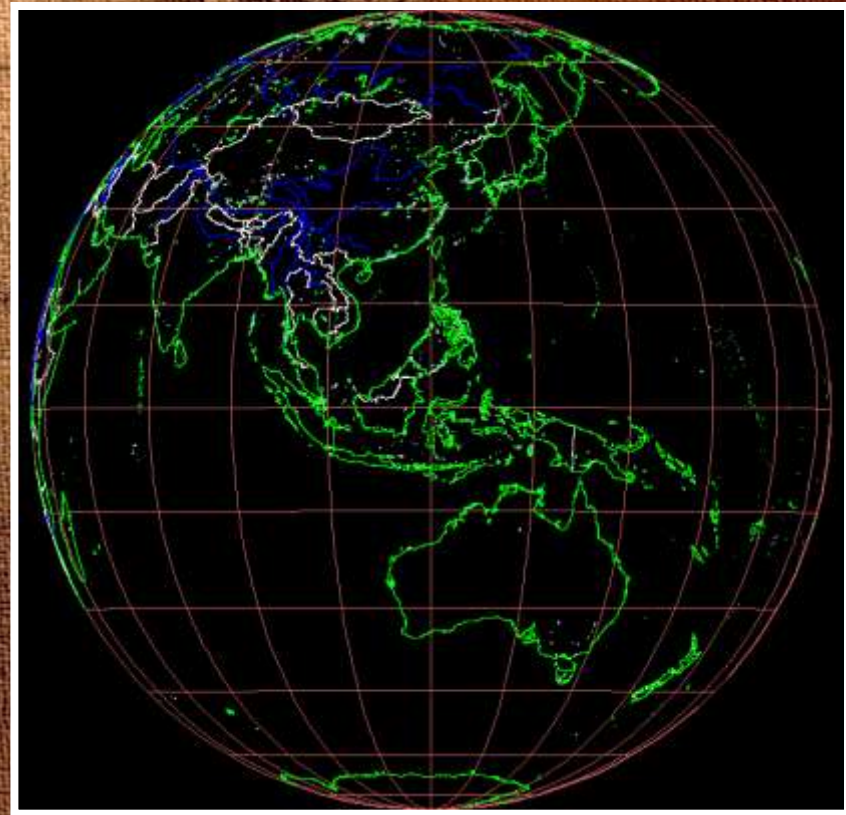
- The Tropics -

The Tropic of Cancer

- It is an imaginary **LINE OF LATITUDE** circling the Earth at approximately **23.5°N (23° 30'N)** north of the equator.
- It passes through more cities than the Tropic of Capricorn.
 - Hawaii, portions of Central America, northern Africa, the Sahara Desert and near Kolkata, India.

The Tropic of Capricorn

- It is an imaginary **LINE OF LATITUDE** circling the Earth at approximately **23.5°S (23° 30'S)** south of the equator.
- It passes mainly through water; but crosses through or is near places like Rio de Janeiro in Brazil, Madagascar and Australia.



Significant Lines of Latitude

- The Tropics -

The Tropic of Cancer and Capricorn

- The area south of the **TROPIC OF CANCER** and north of the **TROPIC OF CAPRICORN** is known as **THE TROPICS (also TORRID ZONE)** because the climate is consistently warm all year due to the sun's angle.
- When it is summer south of the **TROPIC OF CAPRICORN**, it is winter north of the **TROPIC OF CANCER**, and vice versa.



Which '1' is first?

When trying to remember which TROPIC is in the Northern Hemisphere and which in the Southern go 'alphabetically':

CANCER
comes before
CAPRICORN

In the NORTH: Tropic of Cancer
In the SOUTH: Tropic of Capricorn

Significant Lines of Latitude

-The Arctic & Antarctic Circles

The Arctic Circle

- The **ARCTIC CIRCLE**, a **line of latitude**, begins at 60° North and marks the start of the area where for at least one day each year the sun **DOES NOT** completely set (June 21) or rise (December 22).
- Animals including polar bears, reindeer, musk ox and polar hare are native to this region.
- Even though the **ARCTIC CIRCLE** and the **ANTARCTIC CIRCLE** are polar opposites, the average temperature at the north pole is higher.
- The **LINES OF LONGITUDE** that establish our time zones all converge at the pole.

The Antarctic Circle

- The **ANTARCTIC CIRCLE** is a line of latitude circling the Earth at $66^{\circ}30'$ South.
- The Sun **DOES NOT** set (December 21-22) or rise (June 21 or 22).
- It separates the South Frigid Zone (Polar Region) from the South Temperate Zone (area between the Antarctic Circle and the Tropic of Capricorn).

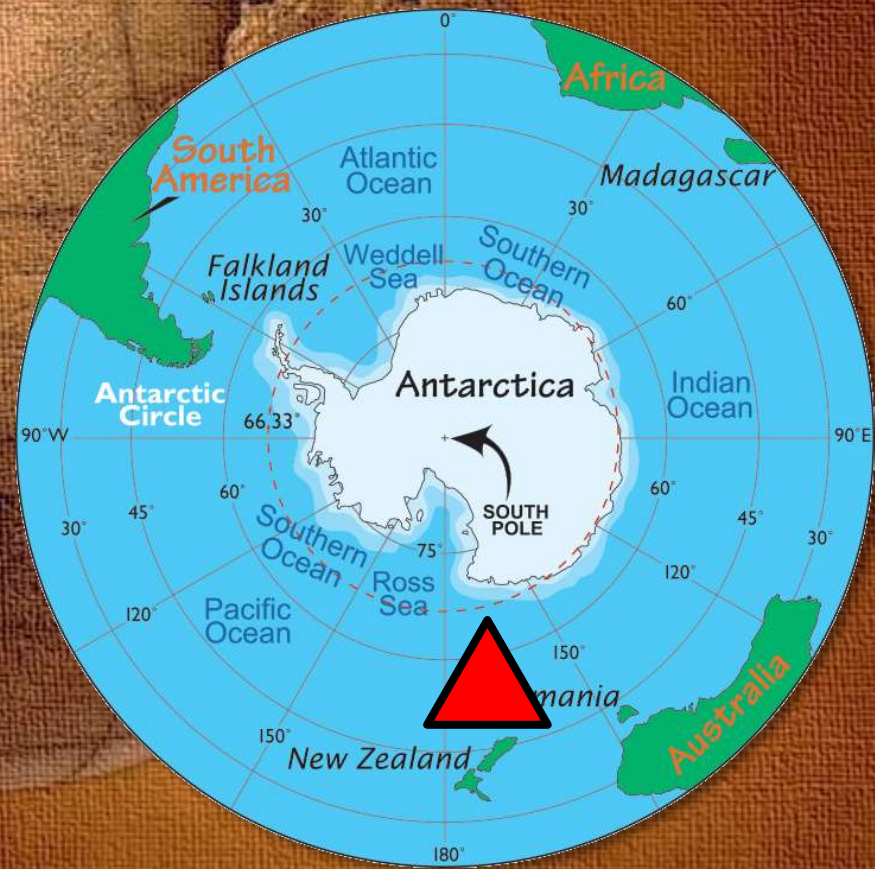
The Arctic and Antarctic Circle

- The Arctic Circle and the Antarctic Circle vary in location slightly because of minor fluctuations in Earth's axial tilt over time.
- The **ARCTIC CIRCLE** and the **ANTARCTIC CIRCLE** are also referred to as the '**POLAR CIRCLES**'.

Significant Lines of Latitude

-The Arctic & Antarctic Circles

- indicated by the red circular-dashed line -



Significant Lines of Latitude

-The North and South Poles -

The North Pole

- There is no land at the North Pole; the nearest land is around 700 miles away - but it is covered in a thick layer of ice around 6 to 9 feet thick.
- When you are standing on the North Pole, any direction you point is South!
- All the lines of longitude meet at the North Pole.
- During the summer the sun is always up. The sun rises in March and sets in September.
- The **MAGNETIC NORTH POLE** is different from the **TRUE NORTH POLE**.

The South Pole

- The South Pole has a desert climate. Air humidity is near zero. *However, high winds can cause the blowing of snowfall, and the accumulation of snow amounts to about 20 cm per year.*
- It almost never gets above 0° C in Antarctica; the highest recorded temperature is 7° F (-13.8° C).
- During the South Pole Winter (late March to late September) it is dark all the time.
- In the summer, it is light 24 hours a day, although the sun is very low in the sky.

The North and South Poles

- The North Pole is located at 90° north - or at a 90° angle from the equator. The South Pole lies at 90° south – or at 90° angle from the equator. Both are technically **POINTS** but are considered **LATITUDES** for geographical purposes.

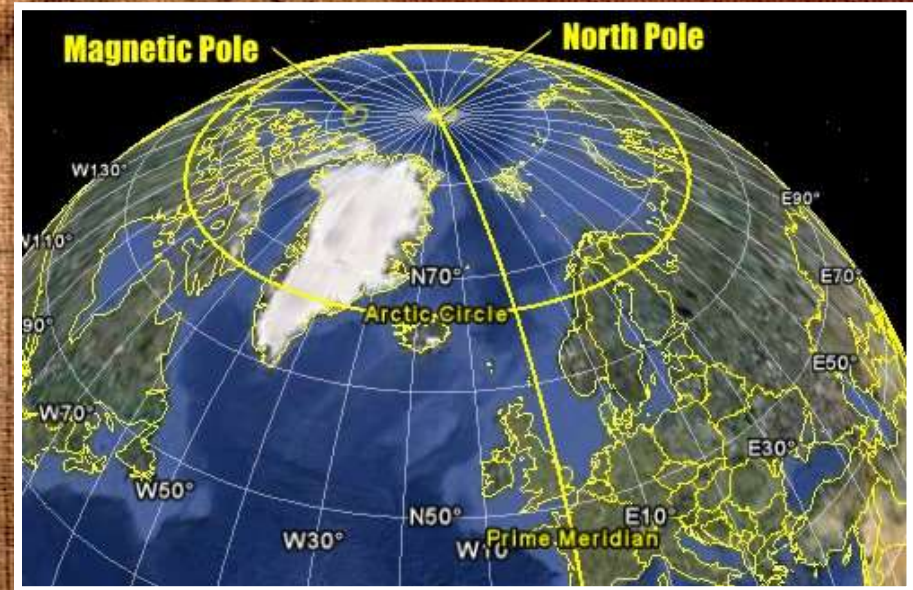
The Three (3) Norths

The 'Three (3) Norths' are:

- True North also known as **GEOGRAPHIC NORTH**.
- Grid North
- Magnetic North

True North:

This is the point at which the **EARTH** rotates which we call **NORTH POLE**.



Grid North:

As the **EARTH** is a sphere it is not easy to make a flat map. **NORTH** on the **GRID** is in a slightly different direction on each map.

Magnetic North:

This is what your **COMPASS** points to. Your compass needle is a magnet that lines itself up with the **EARTH'S MAGNETIC FIELD**. *Magnetic North* is in a different place to the rotation point. The *Magnetic North* moves slightly each year.

Facts about Lines of Longitude



- LINES OF LONGITUDE are also known as MERIDIANS OF LONGITUDE.
- LINES OF LONGITUDE follow a North-South direction.
- LINES OF LONGITUDE unlike LINES OF LATITUDE *do not* have the same distance from each other.
- LINES OF LONGITUDE measure distance east or west of the PRIME MERIDIAN.
- LINES OF LONGITUDE are the farthest apart at the equator.
- LINES OF LONGITUDE intercept at the North Pole and the South Pole.
- LINES OF LONGITUDE cross the Equator at right angles.
- LINES OF LONGITUDE are equal in length.
- LINES OF LONGITUDE are halves of great circles.

- The 0° LINE OF LONGITUDE is the PRIME MERIDIAN also known as the MERIDIAN OF GREENWICH.
- The PRIME MERIDIAN or MERIDIAN OF GREENWICH passes at GREENWICH in England.
- To the EAST the earth is divided from 0° to 180°E.
- To the WEST the earth is divided from 0° to 180°W.
- The INTERNATIONAL DATELINE (IDL) is a LINE OF LONGITUDE located at about 180° East or West of the PRIME MERIDIAN; it demarcates (separates) one calendar day from the next.

Lines of Latitude & Longitude

Where in the world is **Athens**?

Most people would answer Athens is the capital city of Greece.

Others may query...

Athens, Greece or Athens, Ohio, USA?



Athens is the capital and largest city of Greece. It dominates the Attica region and is one of the world's oldest cities. with its recorded history spanning around 3,400 years.

37.9794500° N, 23.7162200° E

Athens, Greece - Coordinates in decimal degrees

37°58'46" N, 23°42'58" E

Athens, Greece - Geographical Coordinates



Athens is a city in and the county seat of Athens County, Ohio, United States. It is located along the Hocking River in the south eastern part of Ohio.

39.3292400° N, -82.1012600° W

Athens, Ohio - Coordinates in decimal degrees

39°19'45" N, 82°06'04" W

Athens, Ohio - Geographical Coordinates

Which 1 goes 1st?

When deciding which goes first:
Latitude or Longitude; think **a l p h a b e t i c a l l y**.

Latitude

Longitude

Both begin with the letter 'L'; but.....
look at the second letter in each word...
'A' comes before 'O' in the Alphabet.

Therefore, when in doubt:
The **LATITUDE** coordinates are written first,
followed by the **LONGITUDE** coordinates.

The interception of a latitude line and a longitude line allow us to precisely pinpoint and locate any specific place.

Lines of Longitude:

Prime Meridian & International Date Line

- The **PRIME MERIDIAN** is the line of 0° longitude.
- The **PRIME MERIDIAN** is the starting point for measuring distance both east and west around the EARTH.
- The **PRIME MERIDIAN** is arbitrary; that is any longitude/meridian line could have been chosen.
- US President Chester Arthur at an international convention with representatives from 25 countries agreed to pick a single, standard meridian; they chose the **LONGITUDE/MERIDIAN** passing through the Royal Observatory in Greenwich, England.
- The **GREENWICH MEAN TIME MERIDIAN** became the official international standard of time in 1884.
- The **PRIME MERIDIAN** also helps establish the **INTERNATIONAL DATE LINE**.
- The **EARTH'S LONGITUDE** measures 360° ; the **PRIME MERIDIAN** is at 0° longitude - half way point is 180° longitude - this **180° MERIDIAN/LONGITUDE LINE** is commonly known as the **INTERNATIONAL DATE LINE (IDL)**.
- When passing the **INTERNATIONAL DATE LINE** you either add a day when going west or subtract a day when going east.

Lines of Longitude:

Prime Meridian & International Date Line

- The **PRIME MERIDIAN** and the **INTERNATIONAL DATE LINE** divide the **EARTH** into eastern and western hemispheres in much the same way as the **EQUATOR** divides the **EARTH** into northern and southern hemispheres.
- The **EASTERN Hemisphere** is **EAST** of the **PRIME MERIDIAN** and **WEST** of the **INTERNATIONAL DATE LINE**.
 - *Asia, Australia and most of Africa are part of the eastern hemisphere.*
- The **WESTERN Hemisphere** is **WEST** of the **PRIME MERIDIAN** and **EAST** of the **INTERNATIONAL DATE LINE**.
 - *The Americas, the western part of the British Isles (including Ireland and Wales) and the north western part of Africa are in the western hemisphere.*
- The **PRIME MERIDIAN** also sets **UTC (Coordinated Universal Time)**.

Note:

- *UTC never changes for daylight savings.*
- *UTC is the STANDARD OF TIME worldwide NOT a TIME ZONE. (officially: 1972)*
- *All countries and regions measure their time zones according to UTC.*
- *There are 24 TIME ZONES in the world.*

Prime Meridian



At the Royal Observatory in Greenwich, England, a brass strip marks zero degrees longitude. The Western Hemisphere is on one side, the Eastern Hemisphere is on the other.

Photograph by Bruce Dale

Prime Meridian



This 24-hour clock displays Greenwich Mean Time (GMT), upon which the International Time Zone system is based. With the annual publication of the "Nautical Almanac" by the British in 1767, navigators using a marine chronometer and sextant could find their longitude in relation to the Greenwich meridian. Map and chart makers soon began to base their calculations on Greenwich, which remains the prime meridian today.

Photograph by Jodi Cobb

GMT or UTC?



The Royal Observatory at Greenwich, London



The Greenwich Meridian, London

GMT:

- Greenwich Mean Time; is a TIME ZONE.
- Prior to 1972 GMT was A TIME STANDARD; after 1972 GMT became a TIME ZONE.
- Shares the same current time with UTC.
- The TIME ZONE is presently in use during 'standard time' (non-daylight saving time) in Europe, Africa, Antarctica, North America.

UTC:

- Coordinated Universal Time; is NOT A TIME ZONE.
- It is A TIME STANDARD that is the basis for civil time and time zones worldwide.
 - e.g.
 - Australian Central Daylight Time (ACDT): UTC +10:30
 - Australian Central Standard Time (ACST): UTC +9:30

Coordinated Universal Time in English and Temps universel coordonné in French, was abbreviated UTC as a compromise between CUT and TUC in English and French, respectively.

Equinoxes: Seasonal Time

Note: *The Vernal (Spring) Equinox in the Northern Hemisphere is the Autumnal (Fall) Equinox in the Southern Hemisphere and vice versa.**

- Equinoxes occur twice a year.
- The name is derived from the LATIN: 'aequus' (equal) and 'nox' (night) because at the EQUINOX the night and day are nearly equally long.
- EQUINOXES do not always occur on the same day each year; generally six (6) hours later each year with a jump of a day. Why does this occur?
 - The EARTH takes approximately 365.25 days to orbit the Sun.
 - ❖ We calculate our year as having 365 days.
 - ❖ **A LEAP YEAR** occurs each four (4) years making our 365 day year 366 in order to make up for the four (4) missing quarters.
- The two (2) EQUINOXES are:
 - The Autumn one: **AUTUMNAL EQUINOX**
 - The Spring one: **VERNAL EQUINOX**
- **AUTUMNAL EQUINOX*** is the first day of the autumn season when the sun passes the EQUATOR moving from the Northern to the Southern Hemisphere. (visa versa)
- During the **AUTUMNAL EQUINOX*** the North Pole begins to tilt away from the sun.
- **VERNAL EQUINOX*** is the first day of the Spring season when the sun passes the equator moving from the Southern to the Northern Hemisphere. (visa versa)
- During the **VERNAL EQUINOX*** the North Pole begins to lean toward the sun again.

Solstices: Seasonal Time

Note: *Solstices are opposite on either side of the equator, so the winter solstice in the northern hemisphere is the summer solstice in the southern hemisphere and vice versa.*

- **SOLSTICES** occur when the sun is at its greatest distance from the equator.
- **SOLSTICES** occur twice a year.
- **SOLSTICE** derives from two Latin words: 'sol' meaning "sun" and 'sistere' meaning "to cause to stand still".
 - *The perception that the "sun stands still" comes from the shadow on the sundial changing minimally on and near the solstices.*
- There are two Solstices:
 - The Winter Solstice also known as 'Yule'.
 - The Summer Solstice also known as 'Litha'.
- The **WINTER SOLSTICE** occurs on or near the 21st of December or 21st of June, depending on the Hemisphere.
 - *In the southern hemisphere, the Winter solstice is in June when in the northern hemisphere it is the Summer Solstice.*
- The **SUMMER SOLSTICE** occurs on or near the 21st of December or 21st of June, depending on the Hemisphere.
 - *In the southern hemisphere, the Summer Solstice is in December when in the northern hemisphere it is the Winter Solstice.*

Resources & Webography

- ❖ [ASTR 1210 \(O'Connell\) Study Guide](#)
- ❖ [Equinoxes](#)
- ❖ [Geography Glossary](#)
- ❖ [Prime Meridian](#)
- ❖ [Time and Date: Equinoxes](#)
- ❖ [The Equator, Hemispheres, Tropic of Cancer, and Tropic of Capricorn](#)
- ❖ [What is Latitude and Longitude?](#)

Assembled by: A. Ballas