**LATITUDE AND LONGITUDE CALCULATIONS**

**USES OF LINE OF LATITUDE**

1. The lines of latitude in conduction with that of longitude are used to determine the exact location of places on the atlas map. Example Nigeria is located between latitude 4®N and 14®N of the equator and between longitude 3®E and 15®E of the Greenwich meridian.
2. Lines of latitudes are also used to calculate the distances between two phases on the earth surface.

*Calculation of Distance using Line of* *Latitude*

Procedures:

1. Locate the two processes involved.
2. Find the latitude difference between two places involved the formula used.
3. North- North = Subtract
4. South – South= subtract
5. North – south=Add
6. Equator – North/South = Add or Subtract
7. Multiply the Latitude difference by 111.

Example

The formula is 1® = 111km

One degree (1®) of latitude is approximately 111km on land. 111km is derived by dividing the length of equatorial circumference (40,085km) by 3600 40,085/360® = 111km. Given the member of degrees of latitude between two places, it is easy to calculate the distance between them

Example 1. Calculate the distance between the equator (Lat 0®) and Egypt (30®N)

Solution

1. Locate the two places involved Latitude of equator = 0® Latitude of Egypt = 30®N
2. The difference in latitude: 0® + 30® = 30® (Using procedure (b) iv)
3. Since 1® = 111km Therefore, 30® = 111 x 30 = 3,330km

The distance between the equator and Egypt is 3,330km

Example

Calculate the distance between South Africa (30® S) and Spain (40®N).

Solution Locate the place involved

a. Latitude of South Africa = 30® S Latitude of Spain = 40®N

b. Latitude difference = 30 S + 40N = 70 (using procedure (b) iii)

c. Since 1® = 111km Therefore, 700 = 111 x 70 = 7,770km

**USES OF LINES OF LONGITUDE**

1. The lines of longitude in conjunction with of the latitude are used to determine the exact location of places on the atlas map e.g. Nigeria is located between longitude 3E and 15E of the Greenwich Meridian.

2. The lines of longitude are also used to calculate local time between two places on the earth.

**CALCULATION OF LOCAL TIME AND LONGITUDE**

The lines of longitude are used in Geography to calculate local time of places. It is mathematical in nature and it enables people to know the reference to a particular time.

***Procedures for calculating local time***

1. PROCEDURE A: Locate the places involved in the question

2. PROCEDURE B: Find the longitude difference

3. PROCEDURE C: Convert the longitude difference to time

4. PROCEDURE D: Adjust the time according to the direction of movement (West or East).

Example 1: what will be the local time in Nigeria (longitude 15®E) when it is 5:00pm in Ethiopia (Longitude 45®E)

Solution 1. Formula for Procedure A: Locate the places involved in the question. Nigeria (15®E) - ? Ethiopia (45®E) – 5:00pm

Note: there are two lines. Nigeria has to come first before Ethiopia because the longitude increases from 0® to 180E Eastward. So, 15®E come first before 45®E

1. Formula For procedure B: to find the longitude difference is:

i. East – east = Subtract

ii. West – west = Subtract

iii. East – West = Add

iv. Greenwich Meridian (0®) – West or East = Add or Subtract

From the question, both countries, longitude are in the East (i.e. 15®E and 45®E) so we have to subtract. Therefore, the longitude difference using procedure B (i) is 45®E – 15®E = 30

1. Formula for Procedure C: to connect the longitude difference to time 360® = 24 hours

15® = 1 hour

1® = 4 minutes

From the question, the longitude difference is 30®, therefore 30® should be connected to time since 15® = 1 hour Therefore, 30®/15® = 2 hours

OR 30® x 4 min/ 60 = 120/60 = 2 hours The 30® gives us 2 hour

4. Formula for Procedure D: To adjust the time line 2 hours to direction of movement (West or East)

- East = Gain = Add

- West = Lose = Subtract

Note: if the arrow is pointing to the question mark (i.e East), you gain time and add the time to the one given in the question, but if the arrow is pointing to the question mark (i.e. West) one losses time and therefore Subtract.

From Example 1, the arrow is pointing to the question mark (i.e West), therefore we have to subtract. 5:00 pm – 2 hours = 3: 00 pm

***Calculation of Longitude***

This is just like the calculation of local time except that the whole procedure revised.

1. Procedure A: Locate the places involved

2. Procedure B: Find the difference

3. Procedure C: convert the time difference to longitude

4. Procedure D: adjust the longitude to the direction of movement (West or East)

Example 1: What is the longitude of a town X whose time is 12:00 noon when Greenwich meantime is 6:00pm

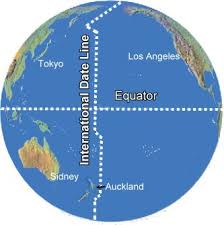
1. Procedure A Town X? ------------- 12:00 noon Longitude (0®) ------------- 6:00 pm Note: Town X has to come first because you get 12:00 noon before 6:00 pm

2. Procedure B Find the time difference 12:00 noon – 6:00 pm = 6 hrs

3. Procedure C Convert 6 hrs to longitude Since 15® = 1 hours Therefore, 6 hrs = 6 x 15® = 90®

4. Procedure D Since the arrow is pointing to the question mark (i.e. west), therefore the 90® is to the west which is 90®W. The longitude of town X = 90®W

**INTERNATIONAL DATA LINE, GREEN WICH MEAN TIME, STANDARD TIME AND WORLD TIME ZONES.**

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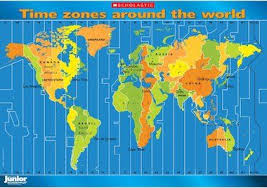
**INTERNATIONAL DATA LINE**: International dateline is where the date changes by exactly one day (24 hours) when it is crosses. There is a difference of one whole day (24 hours) on both sides of longitude 180®. So, the 180® meridian represents theoretically, a date line. Any traveller going East gains one full day on crossing the longitude 180® and a traveller going West losses a full day on crossing longitude 180®. The international dateline is not straight for it avoids cutting across islands to prevent confusion in days and dates in the tiny islands.

GREENWICH MEAN TIME (GMT): this is the time at the Greenwich meridian (longitude 0®). It is also called the WORLD TIME. All countries in world take or adjust their time from the GMT cities on longitude 0® which, therefore, observe GMT are London (Britain) and Accra (China).

For Example, if the GMT in London or Accra is 4:00 pm, Nigeria local time will be 5:00 pm. In other words, Nigeria is one hour ahead of their GMT.

**STANDARD TIME**: Standard time is the time generally adopted by country. It is usually taken from the central meridian of that country the need for standard time is to eliminate differences in local time between one town and others within the same country. Otherwise, it will result in changing time from one town to another. For example, Nigeria has accepted to use meridian 15®E which is one hours ahead of GMT. With this all towns in Nigeria observe the same time i.e. one hour ahead of GMT.

**WORLD TIME ZONES**

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This is the division of the world into twenty four (24)) time zones, each of which differs from the next zone by 15® in longitude or 1 hour in time. The local time of the central meridian for each zone is applied to that zone which is called time zone. All places located on the same time zone have the same time. For every 15® movement across the longitude West of the GMT (Greenwich Mean Time) an hour is lost, while to the East, an hour is gained. Some countries adhere to this division but others cannot, due to their irregular size and location e.g. North America is very large. It has five standard time zone while former U.S.S.R has eleven standard time zones.

**LOCAL** TIME: local time is the situation in which time varies for every degree of longitude. This means that as soon as longitude changes, time changes as well. Local time varies from one longitude to another at the rate of 4 mins per degree of longitude.

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| **LOCAL TIME** | **STANDARD TIME** |
| Local time varies from one longitude to another at the rate of 4 minutes per degree of longitude. | Standard time varies from one time zone to another on hourly basis of 15® longitude to 1 hour |
| Local time varies from one place within a time zone | It maintains the central time for time zone in which they are |
| Local time varies irregularly from longitude to longitude within each time zone | Standard time falls with 24 time zones |
| Local time does not associate with Greenwich Mean Time | Standard time is associate with Greenwich Mean Time |