



GLOBE : LATITUDES AND LONGITUDES

GEOGRAPHY

Our planet Earth is not a sphere. It is slightly flattened at the poles and bulge in the middle. To study the Earth's movement on its tilted axis and its surface, a true model of the Earth is used. Globe is a man-made accurate model of the Earth. It shows the exact shape of the Earth, directions, relative sizes and correct shapes of the oceans, continents, islands and seas. It also shows the correct location of different places. Globes are useful in understanding how days and nights are caused and how we have different seasons over the year.

Big globes are difficult to carry from one place to another. Globe-like balloons can be inflated and are handy and carried with ease. However, the globes are available in varying sizes.

A needle is fixed through the globe in a tilted manner, which is called its axis. The globe is not fixed on its axis. It can be rotated around its axis. The real Earth has no such needle. It moves around its axis which is an imaginary line.

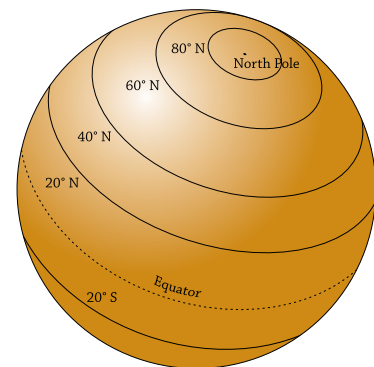


Globe

Latitudes

To locate a place on Earth we need certain points of reference and lines of reference. Two end points on the globe through which the needle passes are two poles—**North Pole** and **South Pole**. These are *two points of reference*. An *imaginary line of reference* running on the globe divides it into two equal parts. The circular line around the globe halfway between the North Pole and South Pole is known as the **Equator**. The part of the globe that lies in the north of the Equator is called **Northern Hemisphere**, and the part of the globe in the south of the Equator is known as **Southern Hemisphere**. They are both equal halves. Equator is a very important reference line to locate places on the Earth.

We can draw many circles east west around the globe running parallel to the Equator. The circles become smaller and smaller towards the Poles and the North Pole and South Pole are mere points. All these circles are called **parallels of latitude**. The Equator is the longest latitude, also called as **Great Circle**. In threedimensional geometry

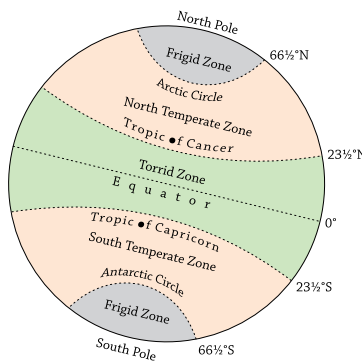


Latitudes

every point of a certain parallel of latitude joining to the centre of the Earth makes the same angle with the line joining any point of the equator with the centre of the Earth. In short, a **latitude** is defined as the angular distance of a place north or south of the Equator. There are 180 parallels of latitude, 90 to the north and 90 to the south of the Equator at an interval of 1°. North Pole and South Pole each measures 90° from the Equator. The Equator represents the zero degree latitude.

All parallels north of the Equator are called 'north latitudes' and all parallels south of the Equator are called 'south latitudes'. The value of each latitude is, therefore, followed by the word north or south. The latitudes in north are written with the letter 'N' and the latitudes in south are written with the letter 'S'. For example, Chandrapur in Maharashtra (India) is situated at 20° N latitude and Belo Horizonte in Brazil (South America) is situated at 20° S latitude.

Each degree of angular distance is divided into 60 minutes indicated by the symbol (') and each minute is subdivided into 60 seconds written as ("). This helps to give correct distance of a place from the Equator. Thus, the distance between two parallels is, always equal. The latitude of Delhi is 28°35' N.



Important Latitudes and Heat Zones

Important Parallels of Latitude

Besides the equator (0°), the North Pole (90° N) and the South Pole (90° S), there are four important parallels of latitude :

Tropic of Cancer	23½° N
Tropic of Capricorn	23½° S
Arctic Circle	66½° N
Antarctic Circle	66½° S

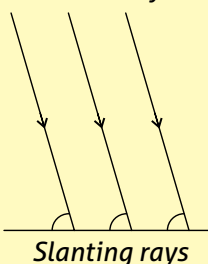
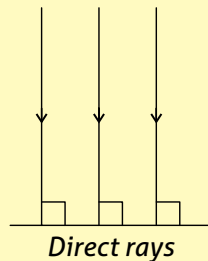
Heat Zones of the Earth

The above latitudes divide the world into following Heat Zones :

- (i) **Torrid Zone** : The mid-day Sun is *exactly overhead at least once a year on all latitudes* in between the Tropic of Cancer and the Tropic of Capricorn (the area spread in both hemispheres). In this area the Sun shines vertically *overhead* at one or the other point throughout the year. Direct rays cover a smaller area but are more bright. This area, therefore, receives the maximum heat and is called the Torrid Zone. Most deserts of the world are found in the Torrid Zone.
- (ii) **Temperate Zones** : 'Temperate' means moderate. This zone has moderate temperatures as the Sun's rays fall slanting here. Slanting rays cover more area but are less bright. The midday Sun never shines *overhead* on any latitude beyond the Tropic of Cancer and the Tropic of Capricorn. The angle of the Sun's rays goes on decreasing towards the poles. Thus, the areas bounded by the Tropic of Cancer and Arctic Circle in the Northern Hemisphere and

FACT FILE

When the rays of the Sun strike a place at 90°, they are said to be direct. When the rays strike a place at less than an angle of 90°, the rays are said to be slanting.



the Tropic of Capricorn and the Antarctic Circle in the Southern Hemisphere, have moderate temperature.

(iii) **Frigid Zones** : 'Frigid' means very cold. This zone remains cold throughout the year and especially so in winter. Areas lying between the Arctic Circle and the North Pole in the Northern Hemisphere and between the Antarctic Circle and the South Pole in the Southern Hemisphere, are frigid zones. It is because the Sun does *not rise much above the horizon*. Therefore, its rays are always very much slanting and provide less heat.

Meridians of Longitude

Longitudes or Meridians of Longitude are sets of imaginary lines drawn from pole to pole. These lines face the Sun turn by turn (on the rotating Earth). **When a particular longitude faces the Sun then the time along that longitude is 12 noon.** The word 'meridian' means midday in Latin. Unlike latitudes, which are full circles, longitudes are semi-circles equal in length. To fix the position of a place, it is not enough to describe its position on the latitude north or south. There may be thousands of places on the same latitude. To locate them precisely, we find out how far east or west these places are from a given line of reference running from the North Pole to the South Pole. Since all meridians are of equal length, it was difficult to number them. All countries decided that the count should begin from the meridian which passed through Greenwich in Britain. The British Royal Observatory is also located at Greenwich. This meridian was called the **Prime Meridian**. Its value was taken as 0° longitude.

Longitude is defined as the angular distance of a place in east or west of a fixed meridian called zero degree meridian or the **Prime meridian**. The value of a meridian is followed by degrees 'E' for east or degrees, 'W' for west. From the Prime Meridian, we count 180° eastward as well as 180° westward. It is however, interesting to note that 180° East and 180° West meridian are the same line. There are 360 meridians of longitude, 180 to the east of the Prime Meridian and 180 to the West of the Prime Meridian. The 0° and 180° meridians together make a Great Circle. It divides the earth into two equal halves, the **Eastern Hemisphere** and the **Western Hemisphere**.

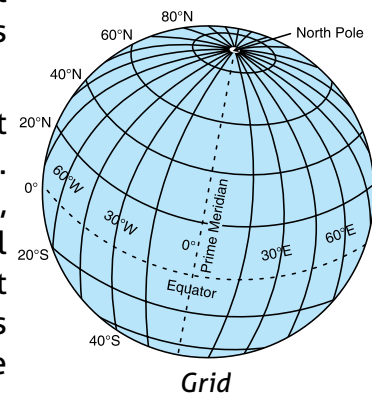
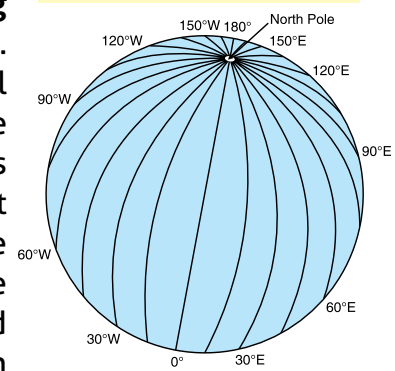
The meridians do not meet anywhere midway but only at the poles. The distance between meridians is not the same. They all converge (get closer) from the Equator towards the poles. Each longitude is also further divided into minutes (') and seconds (") like latitudes. All lines of longitudes are semicircles but two opposite lines of longitudes form a full circle also known as **Great Circle**. **All Great Circles are equal.**

Grid of Latitudes and Longitudes

Together with the parallels of latitude, meridians of longitude form a network of lines called **grid**. The intersecting lines help us to exactly locate places on Earth.

Fact File

In India the Tropic of Cancer almost passes halfway between the Himalayas and the Indian Ocean. Thus, South India entirely lies in the Torrid Zone. That is why, South India is so hot. But North India lies in the North Temperate Zone. Therefore, the weather of North India is moderate, i.e. less hot and less cold.



A part of the grid is given in figure. 2.7 in enlarged form. It shows where India, our country is located in Northern and Eastern Hemisphere. The latitude of India is between $8^{\circ} 4' N$ and $37^{\circ} 6' N$ and longitude between $68^{\circ} 7' E$ and $97^{\circ} 25' E$. The location of Delhi is $28^{\circ} 38' N$ and $77^{\circ} 12' E$; Location of Kolkata is $22^{\circ} 34' N$ and $88^{\circ} 24' E$; Location of Chennai is $13^{\circ} 04' N$ and $80^{\circ} 17' E$. Location of Mumbai is $18^{\circ} 55' N$ and $72^{\circ} 54' E$. Similarly, we can find the location of other cities.



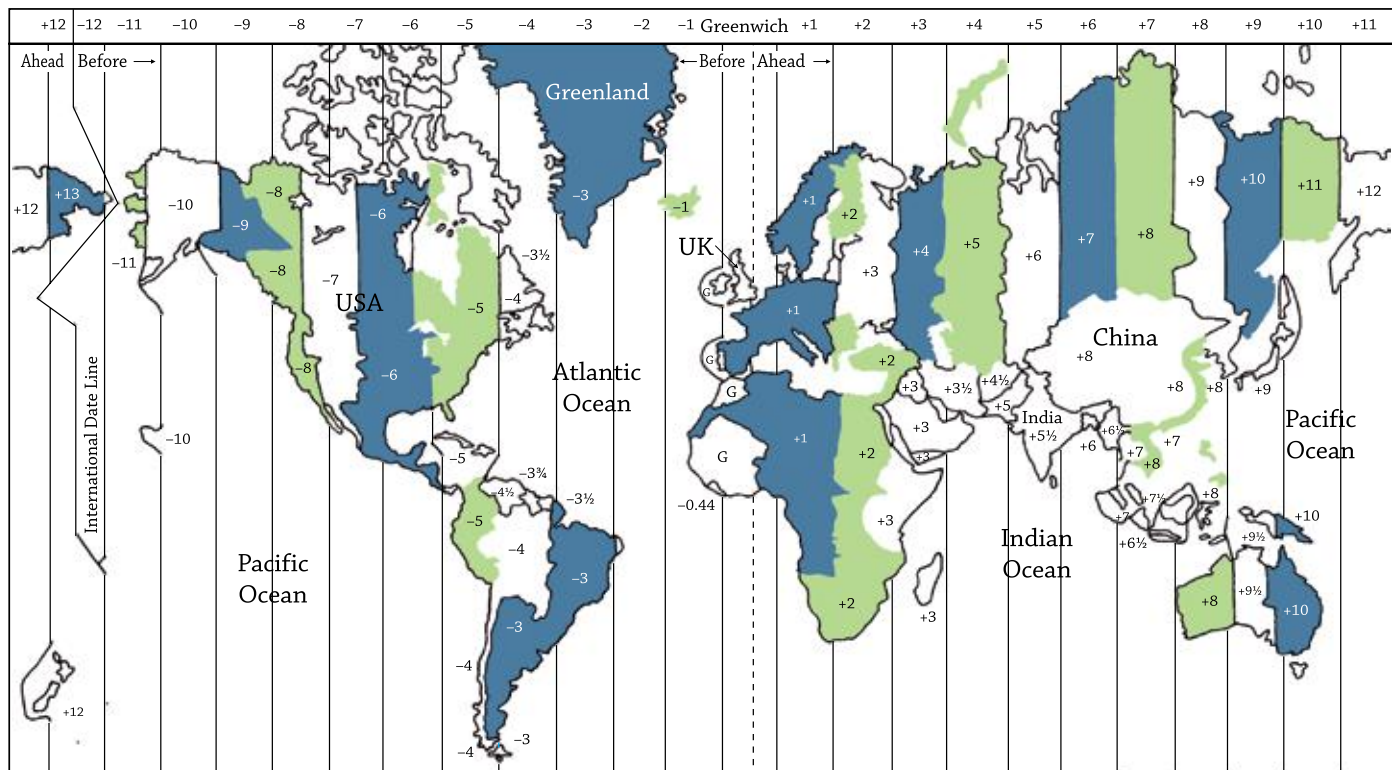
India-Geographic Grid

In other words, to locate Delhi approximately draw the lines $28^{\circ} N$ and $77^{\circ} E$ and find out the point where these two lines cut each other. That point will be the location of Delhi.

Longitude and Time

When the Prime Meridian of Greenwich has the Sun at the highest point in the sky, all the places along this meridian will have midday or 12 noon. As the Earth rotates from west to east, those places east of Greenwich will be ahead of Greenwich time and those to the west will be behind it. The rate of difference can be calculated as follows.

As the Earth rotates from west to east once in about 24 hours, with reference to the Sun, it takes 24 hours for every longitude to pass through 360 degrees (the circumference of the globe is equivalent to 360 degrees). In other words, the



Local time Zones of the World and Standard time zones of the Countries

Sun covers $360 \div 24 = 15^\circ$ of longitudes in 1 hour. Thus, it takes $60 \div 15$ minutes to pass over each degree of longitude. Thus, when it is 12 noon at Greenwich, the time at 15° east of Greenwich will be 1 hour ahead (+1) of Greenwich time, i.e., 1 p.m. But at 15° west of Greenwich the time will be before Greenwich time by one hour (-1), i.e. 11 a.m. Similarly, at 180° , it will be midnight when it is 12 noon at Greenwich. Greenwich time is also called Greenwich Mean Time (GMT).

The local time of a place is 12 noon when the midday Sun is right above it. Thus, the **local time** is the time of a place according to the midday Sun. It changes with the rotation of the Earth. However, all the places on a given meridian of longitude have the same local time.

Standard Time

As the local time differs by 4 minutes at every longitude, it would create a lot of confusion for any country as a whole as it would stretch up to several longitudes. Therefore, each country selects a central/mean meridian called its **standard meridian** and the local time of this meridian is used as the **standard time** for the entire country.

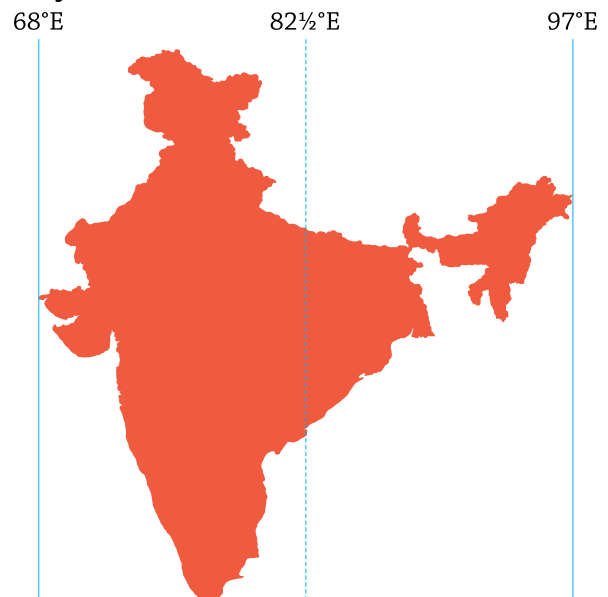
First the whole world was divided into 24 time zones based on the longitude. Each time zone covering 15° longitude will have the same time. Countries having a great longitudinal extent, have adopted more than one standard times. For example, in Russia, there are as many as eleven standard times. U.S.A. has five standard times.

Our country India has a difference of about 30 degrees of longitude between the westernmost ($68^\circ 7'E$) and eastern most ($97^\circ 25' E$) longitudes. In between these two longitudes, the central longitude $82\frac{1}{2}^\circ E$ ($82^\circ 30' E$) is treated as the **Indian standard meridian**. The local time at this meridian is taken as the standard time for the whole country. It is known as the **Indian Standard Time (IST)**.

In Pakistan $75^\circ E$ is considered its standard meridian. Thus, Indian standard time is $\frac{1}{2}$ hour ahead of Pakistan. Similarly, Bangladesh has its standard time $\frac{1}{2}$ hour ahead of India. Sri Lanka has the same standard time as India. When it is 12 noon in India, it is 11.30 a.m. in Pakistan and 12 : 30 p.m. in Bangladesh.

India is located east of Greenwich (England) at $82^\circ 30' E$. So it is $82\frac{1}{2} \div 15 = 5\frac{1}{2}$ hours ahead of Greenwich Mean time. When it is 12 noon in England, it is 5 : 30 p.m. in India.

The meridian with 180° longitude ($180^\circ E$ or $180^\circ W$) is called **International Date line**. When you cross this line from west to east you decrease your date by 1 day. But when you cross this line from east to west you increase your date by 1 day. This line is drawn in a zigzag manner on maps avoiding islands.



Indian standard meridian

 **Key Words**

- » Equator : circular line around the globe halfway between the poles.
- » Hemisphere : one-half of the Earth.
- » Tropic of Cancer : parallel of latitude at $23\frac{1}{2}^{\circ}$ north of the Equator.
- » Tropic of Capricorn : parallel of latitude at $23\frac{1}{2}^{\circ}$ south of the Equator.
- » Arctic Circle : parallel of latitude at $66\frac{1}{2}^{\circ}$ north of the Equator.
- » Antarctic Circle : parallel of latitude at $66\frac{1}{2}^{\circ}$ south of the Equator.
- » Latitude : the angular distance of a place north or south of the Equator.
- » Longitude or Meridian : the angular distance of a place east or west of the Equator.
- » Prime Meridian : the meridian or the semi-circle with 0° longitude.
- » Grid : the network of latitudes and longitudes crossing each other, drawn on the globe to locate places.
- » Local Time : the time of a place according to the midday Sun.
- » Standard Time : local time of the central/mean meridian of the whole country (the time agreed for the whole country as linked to GMT).
- » International Date Line : the meridian with 180° longitude.

SUMMARY

- ▶ The Poles are the tips or ends of the Earth's axis.
- ▶ The axis of the Earth is an imaginary line going through the Earth on which the Earth rotates.
- ▶ The circular line around the globe halfway between the North Pole and South Pole is known as the Equator.
- ▶ The latitude of a place is the angular distance of a place north or south of the Equator.
- ▶ Latitudes are imaginary parallel lines drawn from the Equator towards the poles at an interval of one degree.
- ▶ Some important Latitudes help us to divide the Earth's surface into different Heat Zones—Torrid Zone, Temperate Zones and Frigid zones.
- ▶ The longitude of a place is the angular distance of a place east or west of the Prime Meridian (0°)
- ▶ Longitudes are semi-circles of equal lengths.
- ▶ The imaginary parallels of latitude and meridians of longitude cross each other to form the grid.
- ▶ The grid helps in locating a place on the globe.
- ▶ The local time is the time of a place according to the midday sun.
- ▶ Local time differs by 4 minutes at every longitude, it would create a lot of confusion for any country as a whole as it would stretch up to several longitudes.
- ▶ Each country selects a central/mean meridian called its standard meridian and the local time of this meridian is used as the standard time for the entire country.
- ▶ When you cross the International Date Line westward or eastward a whole day is gained or lost.

Exercise Time**A. Tick (✓) the only correct choice amongst the following :**

1. The total number of latitudes on the globe is :
 - a. 360
 - b. 180
 - c. 90
 - d. 45
2. The North Pole lies at :
 - a. 0° N
 - b. $23\frac{1}{2}^{\circ}$ N
 - c. $66\frac{1}{2}^{\circ}$ N
 - d. 90° N



3. The total number of meridians on the globe is :
a. 90 b. 180 c. 360 d. 0
4. This is 5½ hours ahead of G.M.T. :
a. I.S.T. b. Pakistan Standard Time
c. Bangladesh Standard Time d. British Standard Time
5. The Indian Standard Time is calculated according to :
a. 15° E b. 15° W c. 75° E d. 82½° E

B. Fill in the blanks :

1. The imaginary parallel lines on the globe are called _____.
2. The frigid zones are the _____ areas of the Earth.
3. The 0° Meridian passing through the Greenwich Observatory is called _____.
4. If GMT is 12 noon it will be in _____ India.
5. The distance between the longitudes decreases towards the _____.

C. Match the following :

- | | |
|----------------------------|----------------|
| 1. North Pole | a. 66½° S |
| 2. Equator | b. 90° N |
| 3. Antarctic Circle | c. 180° W or E |
| 4. Tropic of Cancer | d. 0° |
| 5. International Date Line | e. 23½° N |

D. Write true (T) or False (F) against the following statements in given brackets :

1. The distance between two parallels of latitude is not the same.
2. Each meridian of longitude is a semi-circle.
3. Places on the same meridian will have noon at the same time.
4. The Equator passes through the Greenwich Observatory near London.
5. The Earth rotates 360° in a day.



E. Define the following terms :

- | | | |
|-----------------|--------------------------|---------------------------|
| 1. Equator | 2. Parallels of Latitude | 3. Temperate Zones |
| 4. Frigid Zones | 5. Prime Meridian | 6. Meridians of Longitude |
| 7. Grid | 8. Standard Time | 9. Local Time |

F. Identify the following :


1. The line of latitude which divides the earth into two hemispheres _____
2. The angular distance of a place north or south of the Equator _____
3. The point in the Northern Hemisphere of the globe where all meridians converge _____
4. The line of longitude which passes through Greenwich Observatory in England _____
5. The meridian with 0° longitude _____

G. Differentiate between :

- | | |
|---------------------------------|--------------------------------|
| 1. Latitudes and Longitudes | 2. Torrid Zone and Frigid Zone |
| 3. Local Time and Standard Time | 4. Prime Meridian and Equator |

H. Answer in one word or one phrase :

1. Name the two points of reference meant to locate places on the globe.

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2. Name the Heat Zone that lies between Tropic of Cancer and Tropic of Capricorn.
 3. What is the longitude of the International Date Line ?
 4. What is the grid on the surface of the globe ?
 5. What is the time of a place according to the midday Sun called ?
 6. What is the name of the longest latitude ?
 7. What is the shape of the longitudes ?

I. Answer these questions briefly :

1. What are called Parallels of Latitude ?
2. State the chief characteristics of the Torrid Zone.
3. What is meant by longitude ?
4. Name the important latitudes of the Earth.
5. What is the prime meridian ? Where is it situated ?
6. Why are most deserts found in the torrid zone ?
7. How are time zones determined ?
8. Why does the torrid zone receive maximum amount of heat ?
9. How much Bangladesh has its standard time ahead of India and why ?
10. What is known as International Date Line ? State its importance.

J. Answer these questions in detail :

1. Name the three heat zones of the earth and dividing lines of each.
2. How are latitudes and longitudes helpful to us ?
3. What is the relationship between longitude and time ?
4. What do you understand by local time ? How is it related to longitudes ?
5. Why do we use the Standard Time ? State how Indian Standard Time is fixed ?

PROJECT WORK

1. Take the political map of the world. Identify some famous cities on that map. Find their latitudes and longitudes.
2. Draw a diagram of the globe showing the Earth's axis, Poles, Equator, Tropics of Cancer and Capricorn, Arctic Circle and Antarctic Circle.
3. If it is 12 noon at London, find out the time at
 - a. New Delhi
 - b. New York (U.S.A.)
 - c. Paris (France)
 - d. China
4. To find the difference in the time of sunrise at two places :

The sun rises in the east and sets in the west. This apparent movement is caused by the rotation of the earth from west to east. Thus, the places east of a given longitude will have the sunrise first. Take the case of Kolkata and Mumbai, Kolkata lies to the east of Mumbai so it will have sunrise first. Earth takes 24 hours to cover 360° longitude. It means 360° longitudes are covered in 24×60 minutes or 1° longitude is covered in 4 minutes. Now there is a difference of $88^{\circ} 24' - 72^{\circ} 54' = 15^{\circ} 30'$ longitudes between Kolkata and Mumbai. Time difference for $15^{\circ} 30'$ longitude = $15\frac{1}{2} \times 4 = 62$ minutes. Thus, the Sun will rise 62 minutes later at Mumbai than Kolkata.