7. International Date Line

Let's recall.

- Which meridian is used to determine World Standard Time (GMT)?
- Which meridian determines Indian Standard Time (IST)?
- What is the time difference between the GMT and the IST?

Can you tell?

We bid adieu to the year 2016 and welcomed the New Year 2017 on Saturday midnight. Similarly, other countries also welcomed the New Year. A table showing the days and time of the welcome of New Year in different countries and cities according to the Indian Standard Time is given. Observe the table and answer the following questions:

(Note: 24 Hour clock has been followed according to requirement in this chapter)

Country-city	Day	Indian Time
England- London	Sunday	05.30
Japan- Tokyo	Saturday	20.30
USA- New York	Sunday	10.30
USA- Baker Island	Sunday	17.30
Australia- Sydney	Saturday	18.30
New Zealand- Auck-land	Saturday	16.30
Samoa Island- Apia	Saturday	15.30
Tuvalu- Funafuti Island	Saturday	17.30

- Which location was the first to welcome New Year in the world? What day was it then?
- Which location bid farewell to the year 2016 the last of all?
- On which day did that location welcome 2017?
- What could be the reason behind the change in the day of Sydney and London?

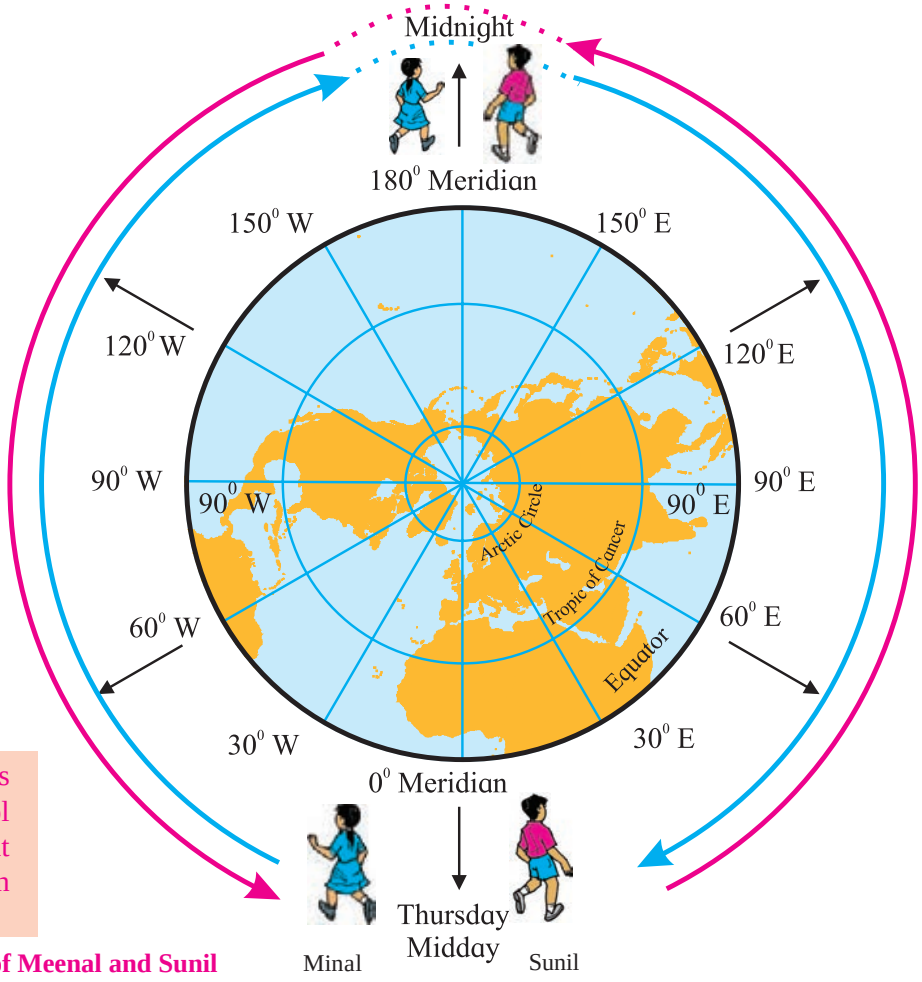
Try this.

Complete the following table to understand the time at different meridians when its 12 noon at the Prime Meridian. Different meridians have different timings at the same time. For example, if it is 12 noon at prime meridian, then it is 8 am at 60°W and 1600 hrs at 60°E. Sunil and Meenal have to note these timings. Take the help of the figure alongside. After that, discuss in the class and answer the questions. Fill the boxes in fig 7.1.

Sunil and Meenal embark on their journey to circumvent the earth from 0^0 meridian at 12 noon on Thursday. During their journey, they cross each other at 180^0 meridian and move forward. When Sunil returns back to 0^0 meridian after his journey, he thought it was Friday. When Meenal returned at 0^0 meridian, she thought it is Wednesday. Now tell:

- What is the day at 0^0 meridian at Greenwich after completing the table 'A'?
- What is the day at 0^0 meridian at Greenwich after completing the table 'B'?
- Though both were at the same place, why were they experiencing different days? How did this happen?
- How many days occurred while doing this activity? Name them.

Table ' A'			Table 'B'		
Meenal's observations			Sunil's observations		
Meridian	Day	Time	Meridian	Day	Time
0^0 Greenwich	Thursday	12 noon	0^0 Greenwich	Thursday	12 noon
30 ^{0}W	Thursday	10:00 hrs	30 ^{0} E	Thursday	14:00 hrs.
60 ^{0} W			60 ^{0} E		
90 ^{0} W			90 ^{0} E		
120 ^{0} W			120 ^{0} E		
150 ^{0} W			150 ^{0} E		
180 ^{0}			180 ^{0}		
150 ^{0} E			150 ^{0} W		
120 ^{0} E			120 ^{0} W		
90 ^{0} E			90 ^{0} W		
60 ^{0} E			60 ^{0} W		
30 ^{0} E			30 ^{0} W		
0 ^{0} Greenwich			0 ^{0} Greenwich		



Draw this figure on your school ground and carry out this activity as shown here.

Figure 7.1 : The journey of Meenal and Sunil

Think about it.

☞ Which day is correct: Wednesday in Table 'A' or Friday in Table 'B'? Why?

Geographical explanation

Earth's rotation, revolution, the sunrise, the sunset are natural phenomena. Man has studied the rotation speed, direction and shape of the earth and prepared the chronometric (time-keeping) systems for his own purpose. Considering the shape of the earth, he defined graticule on the earth. He coordinated between the time of the earth's rotation and the meridians of the graticule.The earth takes 24 hours to make one rotation. (Earth takes 24 hours to make a round of 360^0 around itself).

Earth rotates from west to east. Therefore, in terms of time the eastern part of the earth is ahead of the western part. Keeping this in mind, let's think about Sunil's journey. Sunil is moving towards the east. Therefore, the time will move ahead at different meridians. For example, at 90^0 E meridian, it will be Thursday 6 pm. Sunil moves eastwards and according to him, it will be Thursday midnight 12 at 180^0 meridian. According to him, as he continues, it will be Friday after he crosses the 180^0 meridian. At 90^0 W, it will be Friday 6 a.m. and therefore after the full round of the earth when Sunil meets Meenal at 0^0 meridian, it will be Friday afternoon 12 pm.

Now consider Meenal's journey. As she moves westwards, she will see that time is moving backward. For example, at 30^0 W, it will be 10.00 hrs in the morning on Thursday, while it will be 8 am on Thursday at 60^0 W, and it will be 12 midnight at 180^0 meridian. If Meenal continues ahead, then it will Wednesday 6 pm at 90^0 E. When she will complete her full journey and return back to 0^0 meridian, then according to her it should be Wednesday afternoon.

There is a debate between Meenal and Sunil when they meet after their respective journeys. According to Meenal, it should be Wednesday and according to Sunil, it should be Friday. Then where does Thursday go? The following method was used to come to a solution.

Solution to the confusion of days:

When you cross the 180^0 meridian, some precautions need to be taken. Meridian of 180^0 is reached after 12 hours from Prime Meridian, if you go from east or west. Accordingly, an adjustment or change in day and time is made. According to the convention, the start (and end) of a date is considered to be at 180^0 meridian. Therefore, the following points were taken into consideration while drawing the International Date Line. (IDL)

(1) The direction of travel

(2) The current day and date

While travelling from Japan to America, we need to consider the existing day and date even after crossing the IDL. For example, if it is Thursday 25th December, then Thursday 25th December only should be considered.

On the contrary, while going from America to Japan, and crossing the IDL, one needs to add a day to the date. So if it is Thursday, 25th December then it will be Friday, 26th December. It will be clear from the following example and fig 7.2

- Shyamrao left for America (which lies to the east of the IDL) from Japan (from the west of the IDL) on 1^{st} at 1 pm on Monday. After travelling for 24 hours in a flight, he reached America and saw the date there. It was Monday 1^{st}, 1 pm in the afternoon.
- Shyamrao left for Japan (to the West of IDL) from America (from the East of IDL) on Friday 5^{th} at 12 noon. He reached Japan after 24 hours flight and the date was Saturday 6^{th} 12 noon.

We can consider that with reference to the IDL, the day on the Earth starts in the West and ends in the East. It is one and the same day only at 12 'o'clock midnight at the 180^0 meridian. For the countries lying to the east of it i.e. the USA, Chile, etc., it is the end of the day while for the countries lying to the east of it i.e. Japan, Australia, etc. it is the start of a new day.

Now a question may come to your mind, that why don't the dates change with respect to 180^0 meridian then? Why is the IDL required?

Do you know ?

The flight by American plane UA-840 awakens our curiosity. This plane left Shanghai (China) on 1st January 2017 and crossed the Pacific Ocean to reach the western coast of America at San Francisco on 31st Dec 2016. The reverse change in date in relation the IDL is evident.

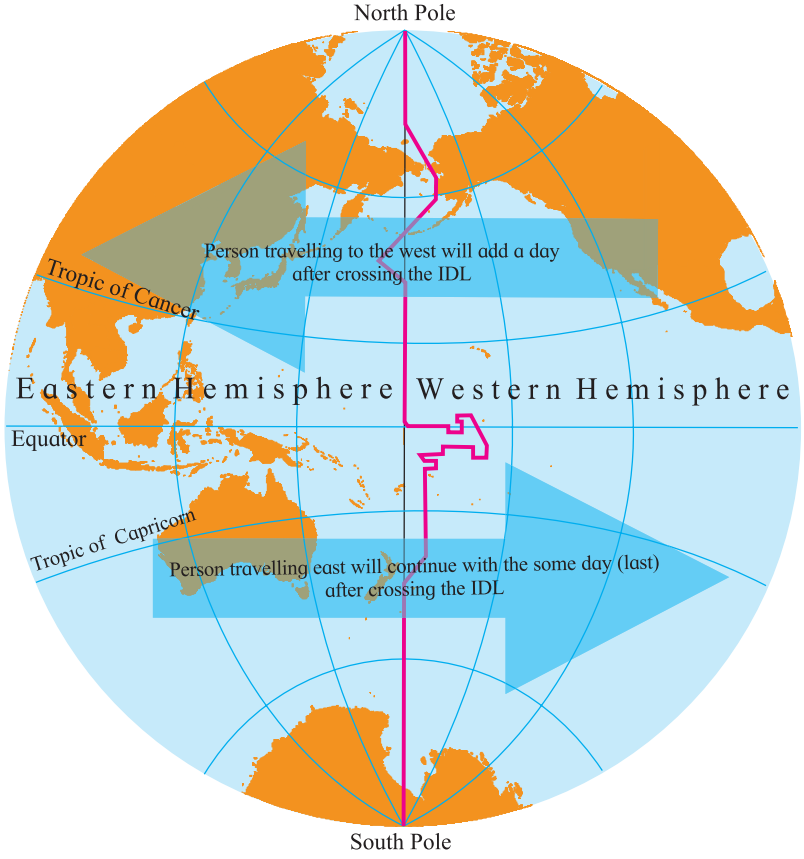


Figure 7.2 : International Date Line

International date line :

Our 24-hour day starts at 12 midnight. Because of the earth's rotation, midnight occurs at different times at different places.

As the earth is spherical in shape, every place has a place to its east. then at what location to the east does the day start on the earth? To get an answer to many questions like this, representatives of many nations got together, under the leadership of American professor Davidson in the year 1884 and decided on the International Date Line. The line was drawn opposite to the Greenwich Prime Meridian .i.e. with reference to the 180^0 meridian. It is an international convention to change the day and time while crossing this line.

An attempt has been made to make the IDL pass through the Pacific Ocean completely. Had it passed through land or some islands, the people there would have had to follow different dates and timings because dates would have been different on their eastern and western parts. Also, it would have been difficult to know when one crosses the IDL on land and when the date changes on the calendar. Therefore, the IDL is not a straight line like the 180^0 meridian. At places, it turns east while at other places, it turns west. See fig 7.2. . The IDL has been changed as and when required. The last change was made in 2011. Nevertheless, maximum part of the IDL coincides with the 180^0 meridian.

The importance of IDL:

The IDL brings coordination between international airlines, transportation services, economic and trade activities. The IDL has been carved out of necessity of coordinating time and date. It is also important in today's modern era and rapidly happening global developments. We can keep a track of all the calculations of day and time accurately with the help

of IDL in case of global transportation esp. with respect to airways. It is only because of the IDL that the schedules of the traffic worldwide are organised properly.

Examine a ticket of UA 876 Boeing 787-9 Dreamliner closely and find the answers to the following questions:

Can you tell?

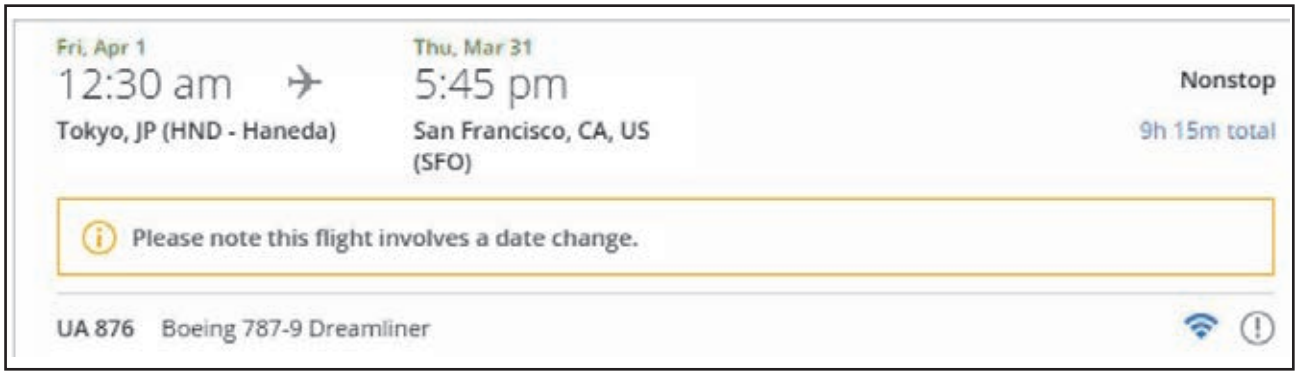
- From which country will the plane take off and where will it go?
- What is the duration of the flight?
- What is the day, date and time given at the starting point and destination of the flight?
- What special note is given on the air ticket?
- What could be the reason behind giving such a note?
- During this flight, will the plane cross the IDL? If yes, then from which direction to which direction?
- What did you understand by reading the ticket?

Use your brain power!

You are travelling from Kamchatka Peninsula (in the northern hemisphere) to New Zealand (in the southern hemisphere) along the IDL. It is Monday, 22nd June in northern hemisphere. What will the day and date be in the southern hemisphere?

Give it a try.

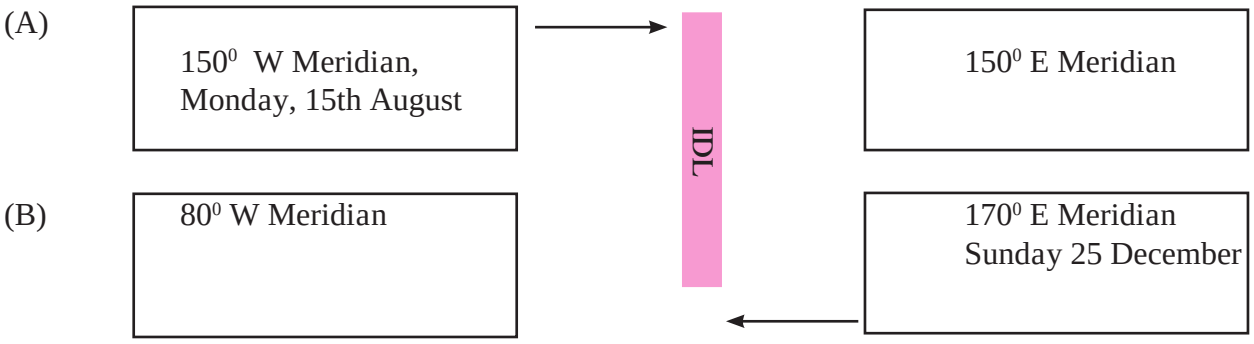
You are now aware of the changes required to be made while crossing the IDL. Now redo the activity given on Page 59. Tell us the changes that you will have to make while crossing the IDL i.e. 180^0 meridian. Your travel will start on Sunday, 21st May 2016 at 10 a.m.



International Date Line

Exercise

Q 1. Two boxes in different hemispheres are given in the following diagram. The IDL passes through both the boxes. In one box, the meridian, day and date is given. Find the day and date for the other box.



Q 2. Select the correct option :

(1) While crossing the IDL, a person will have to add one day when travelling from
- (a) East to West
- (b) West to East
- (c) South to North
- (d) North to South

(2) If it is Wednesday 10 a.m. at 15^0 E meridian, then what will be the time at IDL?
- (a) Wednesday 6 a.m.
- (b) Wednesday 9 p.m.
- (c) Thursday 2 p.m.
- (d) Thursday 6 p.m.

(3) According to the international convention, at which meridian does the day and date change occurs?
- (a) 0^0 (b) 90^0 E
- (c) 90^0 W (d) 180^0

(4) At which direction of the IDL does a new day start immediately?
- (a) East (b) West
- (c) North (d) South

(5) IDL brings coordination in which of the following?
- (a) GPS system
- (b) Defence departments
- (c) Transportation schedules
- (d) Determining the hemisphere

Q 3. Give geographical reasons

(1) IDL is proving to be very useful in today's times

(2) The day starts in Pacific Ocean on the earth

Q 4. Write in brief:

(1) What considerations have been made while deciding the IDL?

(2) While crossing the IDL, what changes will you make?

(3) Why is the IDL not a straight line like the 180^0 meridian?

(4) Why doesn't the IDL pass through land?

(5) Why is the IDL considered with respect to the 180^0 meridian only?

Q 5. Using an atlas, tell in which of the following routes the IDL will be crossed and show them on the map.

(1) Mumbai- London- New York- Los Angeles- Tokyo

(2) Delhi- Kolkata- Singapore- Melbourne

(3) Kolkata- Hong Kong- Tokyo- San Francisco

(4) Chennai-Singapore- Tokyo- Sydney- Santiago

(5) Delhi-London-New York

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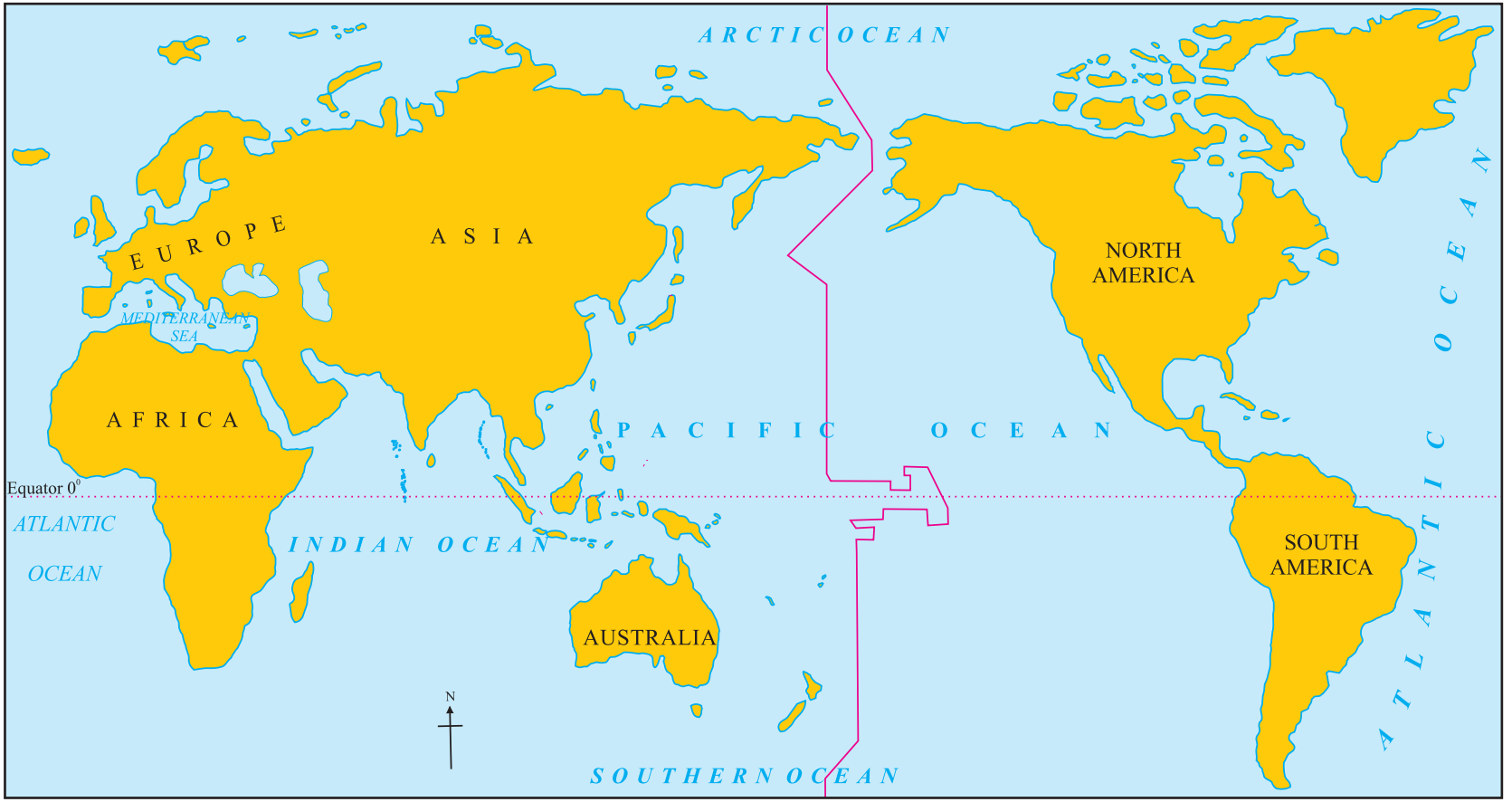
ARCTIC OCEAN
EUROPE
ASIA
NORTH AMERICA
MEDITERRANEAN SEA
AFRICA
PACIFIC OCEAN
ATLANTIC OCEAN
Equator 0°
ATLANTIC OCEAN
INDIAN OCEAN
SOUTH AMERICA
AUSTRALIA
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SOUTHERN OCEAN

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