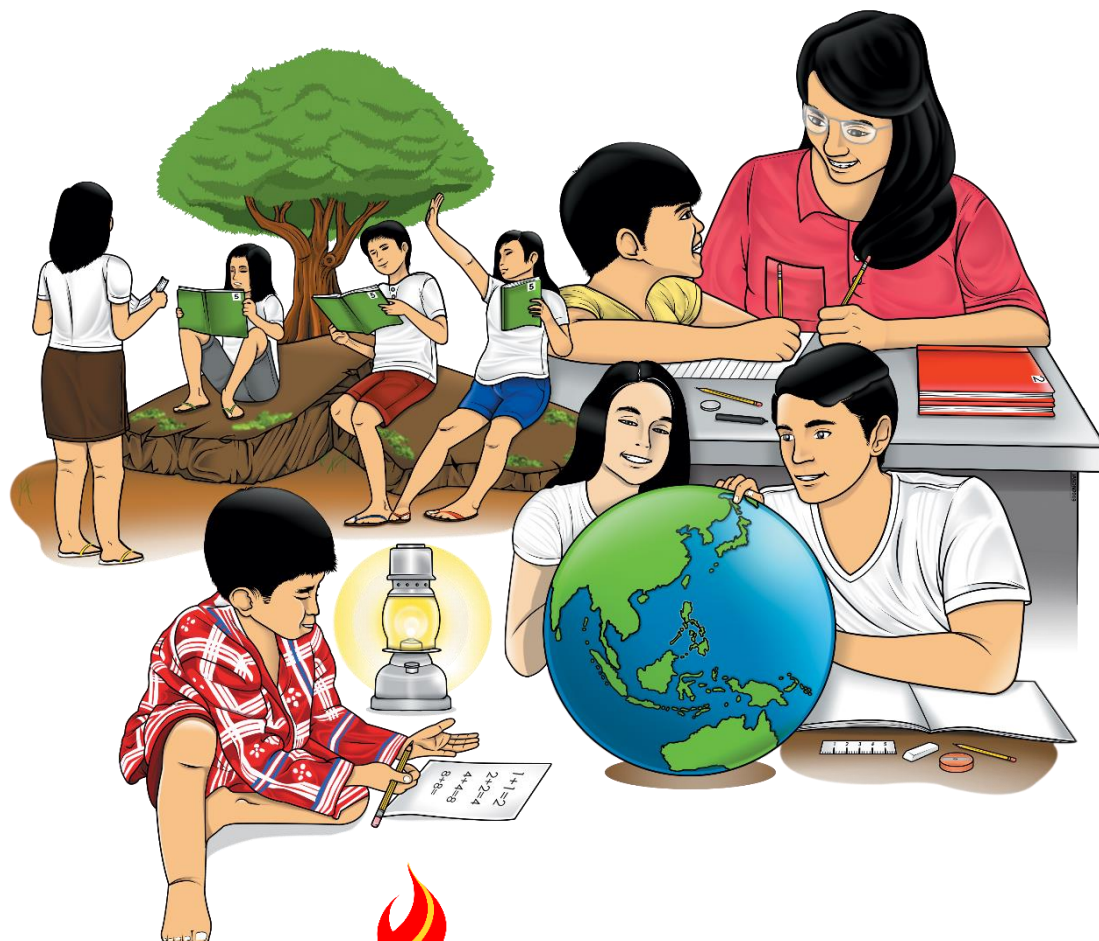


Mathematics

Quarter 3 – Module 16: Calculating Time in Different World Time Zones



Mathematics – Grade 5
Alternative Delivery Mode
Quarter 3 – Module 16: Calculating Time in Different World Time Zones
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Mathematics

Quarter 3 – Module 16: Calculating Time in Different World Time Zones

Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.



What I Need to Know

Hi, Mathletes! The International Meridian Conference was held in October 1884, in Washington, D.C. to determine a prime meridian for international use. The conference discussed the choice of a meridian to be employed as a common zero of longitude and as the standard of time reckoning throughout the world. It resulted in the recommendation of the Greenwich Meridian as the international standard for zero degrees longitude. That's when the different time zones started.

In this module you are going to learn how to calculate time in different world time zones in relation to the Philippines. To do this, we need to use the world time zone map to easily understand the time differences.

When you finish this module, you will be able to:

- * perform calculations with time in different time zones in relation to the Philippines,
- * calculate 12-hour and 24-hour clock times and conversions between time zones in relation to the Philippines, and
- * appreciate the importance of the world time zone map for us to easily understand the time difference.

Before you start exploring the lesson, let us check if you are familiar with calculating time in different world time zones.



What I Know

Directions: Choose the letter that corresponds to the correct answer. A score of 10 is excellent, 8-9 is very good, and a score of 5-7 is good.

1. What is the name of the imaginary lines in which time at different places on earth depend on?
 - A. Prime Meridian
 - B. Lines of Latitude
 - C. Lines of Longitude
 - D. International Date Line

2. Before the 19th century, the standard for clocks was usually inspired by the sun and star patterns. Which branch of science deals with the study of celestial bodies and their movements?
 - A. Astrology
 - B. Astronomy
 - C. Cosmetology
 - D. Meteorology

3. Which of the following shows midnight in a 24-hour clock?

A. 12:00 a.m.	C. 24:00 H
B. 12:00 H	D. 0:00 H

4. Each time zone is 15 degrees wide. What is the time difference between each time zone?

A. 1 hour	C. 6 hours
B. 4 hours	D. 12 hours

5. Which describes the current time for different areas of the world?
 - A. Time Zone
 - B. Lines of Latitude
 - C. Greenwich Meridian
 - D. International Time

6. If it is 11:30 a.m. in the Philippines, what is its equivalent time in India?

A. 14:00H	C. 9:00 a.m.
B. 2:30 p.m.	D. 9:00 p.m.

7. How many hours is the time difference between Philippine Standard Time and Buenos Aires, Argentina?

A. -11 hours	C. -12 hours
B. +11 hours	D. +12 hours

8. The rotation of the earth is related to time and different time zones in the world. How many hours would it take the earth to move 15 degrees on its axis?

A. 5	C. 1
B. 3	D. 0

9. What time would it be in Calbayog City, Philippines if it is 3:00 a.m. in Riyadh, Saudi Arabia?

A. 5:00 a.m.	C. 5:00 p.m.
B. 8:00 a.m.	D. 8:00 p.m.

10. If it is 16:00 H in Tacloban City, what time is it in San Francisco, California?

A. 12:00 a.m.	C. 12:00 noon
B. 1:00 p.m.	D. 13:00 H

Lesson

1

Calculating Time in the Different World Time Zones

Knowing the time zones is very important for communication and travel. To be able to identify and calculate time zones, you must know the terms like lines of longitude, prime meridian, and International Date Line. Understanding the different time zones and calculating time in the different world time zones is a plus skill.

Have you ever experienced a time change? Are you curious to know how time zones differ around the world? Let's explore.



What's In

Let us review. In the 24-hour clock system, time is written as the number of hours that have passed since midnight. It is not divided in 2 parts of 12 hours each, but it continues for a period of 24 hours. The 12-hour clock runs from 12 a.m. (midnight) to 12 noon, and then from 12 p.m. to 12 midnight. The 24-hour clock uses the numbers 00:00 to 23:59 (midnight is 00:00). The 24-hour clock is a time keeping convention where the day runs from midnight to midnight and is split into 24 hours.

1 a.m. → 01:00 H

2 a.m. → 02:00 H

4 a.m. → 04:00 H

To convert 12-hour clock (AM/PM) to 24-hour clock, add 12 to any hour after noon, and subtract 12 for the first hour of the day.

Example: from 1:00 p.m. to 11:59 p.m., add 12 hours;

4:45 p.m. = 16:45 H

11:30 p.m. = 23:50 H

For the first hour of the day (12 Midnight to 12:59 a.m.), subtract 12 hours.

Example: 12:35 a.m. = 0:35 H

12 Midnight = 0:00 H

Let's see if you can recall how to measure time using 12-hour and 24-hour clocks.

Answer the questions below. Give the equivalent time.

- 1) How do we write 4:30 a.m. in a 24-hour time format?
- 2) What time in 24-hour format is 12:15 p.m.?
- 3) What is the equivalent time of 17:54 H in a 12-hour clock format?
- 4) How do we write 16:30 H in a 12-hour clock format?
- 5) How is 9:15 p.m. written in a 24-hour clock format?



What's New

This module is going to guide you how to calculate time in different world time zones in relation to the Philippines.

Time zones define and establish the appropriate time within individual countries and regions.

Every country may have a particular standard time zone which is convenient for its world cooperation. The time zones obey specific rules referring to geographical principles of longitude. The standard time appears to be a tool used by the whole world to facilitate the processes of people's life.

If you have been to a courier or airport, or hotels and remittance centers, you will notice that there are several clocks displaying different times. Study the clocks below and analyze the problem.



Your sister works as a nurse in one of the hospitals in Sydney, Australia. She is a front liner treating COVID-19 patients, since the pandemic started. She calls every 7:00 p.m. in the Philippines to check if your parents and other siblings are all okay.

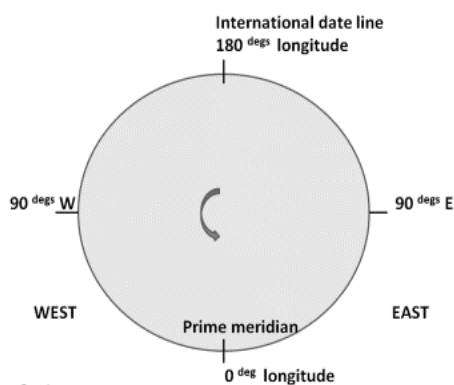
Imagine that you are living in Sydney with your sister. What time is it in Sydney when your sister makes these calls?



What Is It

Time Zones have an enormous impact on business, communication, and world management. How did it all begin?

In October 13, 1884, U.S. President Chester Alan Arthur convened the **International Meridian Conference** in Washington. It was attended by 41 delegates from 25 nations. The conference established that the meridian passing through the Royal Observatory at Greenwich would be the world's Prime Meridian. All longitude lines would be measured both east and west from it up to 180 degrees. The conference also established **Greenwich Mean Time** as a standard for astronomy and setting time zones.



Viewing a cross section of the globe from the north pole coordinates are presented

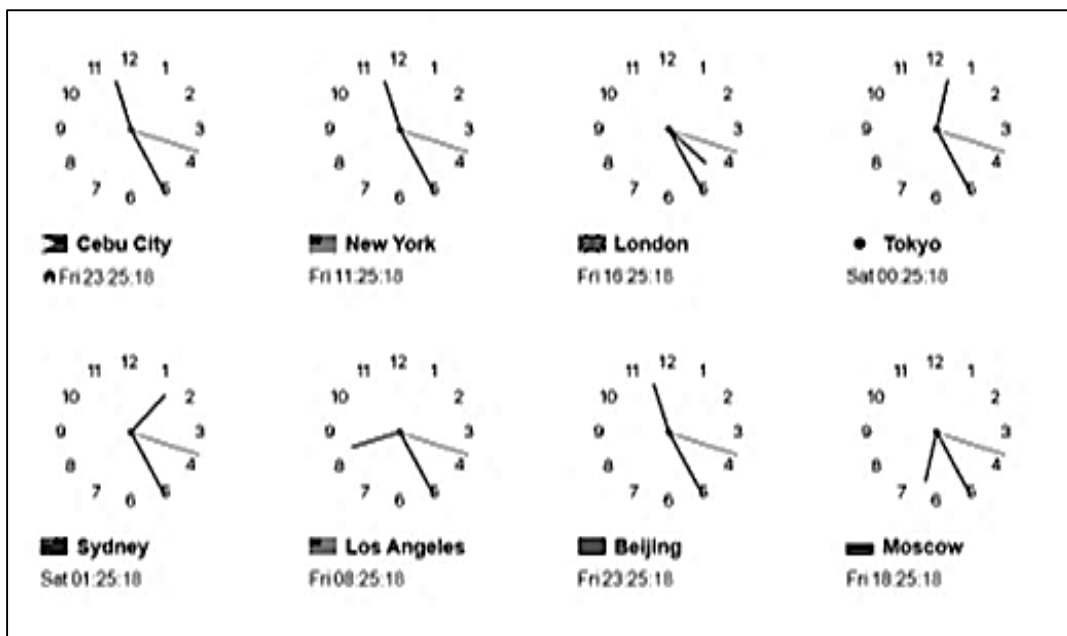
A **time zone** is a region of the globe that observes a uniform standard time for legal, commercial and social purposes. Time zones tend to follow the boundaries of countries and their subdivisions instead of strictly following longitude. Below is a time zone map showing an example of the way time zones are divided.



Different times at different places in the world are caused by the movement of the Earth, 15 degrees longitude every hour. Since there are 24 hours in a day, there are 24 standard time zones. Note that $24 \text{ hours} \times 15^\circ = 360^\circ$. Time zones are counted from the Prime Meridian or at 0° longitude. Each time zone is counted at 15° intervals and extends $7\frac{1}{2}^\circ$ to the left and to the right of a central meridian.

For example, if it is 11:25 p.m. in the Philippines, it is also 11:25 p.m. in the places $7\frac{1}{2}^\circ$ to the left and right of the Philippines. If it is 8:25 a.m. in Los Angeles, it is also 8:25 a.m. in the places $7\frac{1}{2}^\circ$ to the left and to the right of Los Angeles.

Suppose today is Friday and the time is 11:25 p.m. (23:15 H) in Cebu City. It is also Friday in New York City but the time is 11:25 a.m. In another time zone, it is Saturday, 00:25 H, in Tokyo, Japan, while in Los Angeles, California it is still Friday, 8:25 a.m. Why is this so? Study the clocks below.



To see the relationship of time in certain places to the time in the Philippines, take a look at the table below and note that (+) means **ahead** and (-) means **behind**. Use this table in identifying the time in a particular place as how it is related to the time in our country.

Cities/Countries	Difference from Philippine Standard Time (PST)	Example
Manila, Philippines	PST	Saturday, 03:00 H
Buenos Aires, Argentina	-11	Friday, 16:00 H
Madrid, Spain	-7	Friday, 20:00 H
Canberra, Australia	+3	Saturday, 06:00 H
London, England	-8	Friday, 19:00 H
Beijing, China	SAME	Saturday, 03:00 H
Cairo, Egypt	-6	Friday, 21:00 H
Milan, Italy	-7	Friday, 20:00 H
Athens, Greece	-6	Friday, 21:00 H
New Delhi, India	-2:30	Saturday, 00:30 H
Singapore, Singapore	SAME	Saturday, 03:00 H
Tokyo, Japan	+1	Saturday, 04:00 H
Ontario, Canada	-13	Friday, 14:00 H
Paris, France	-7	Friday, 20:00 H
Honolulu, Hawaii	-18	Friday, 09:00 H
Sydney, Australia	+3	Saturday, 05:00 H
Vientiane, Laos	-1	Saturday, 02:00 H
Wellington, New Zealand	+5	Saturday, 08:00 H
Warsaw, Poland	-7	Friday, 20:00 H
Moscow, Russia	-5	Friday, 22:00 H
New York, USA	-13	Friday, 14:00 H
Riyadh, Saudi Arabia	-5	Friday, 22:00 H
Caracas, Venezuela	-12	Friday, 15:30 H
Washington, USA	-13	Friday, 14:00 H
Hanoi, Vietnam	-1	Saturday, 02:00 H
Oregon, USA	-16	Friday, 11:00 H

Example 1:

Let's consider the problem presented earlier.

Your sister works as a nurse in one of the hospitals in Sydney, Australia. She is a front liner treating COVID-19 patients since the pandemic started. She calls every 7:00 p.m. in the Philippines to check if your parents and other siblings are all okay.

Imagine that you are living in Sydney with your sister. What time is it in Sydney when your sister makes these calls?

Understand:

- a. What is asked?

We need to know the time in Sydney when it is 7:00 p.m. here in the Philippines.

- b. What are the given facts?

The time in the Philippines is 3 hours **behind** that of Sydney. Your sister calls every 7:00 p.m. in the Philippines.

Plan:

Add 3 hours to 7:00 p.m.

Solve:

Simply, add $3 + 7 = 10$. Therefore, the time in Sydney is 10:00 p.m. when it is 7:00 p.m. here in the Philippines.

Example 2:

Maria is a public school teacher in Calbayog City. For extra income, she teaches language and communication subjects online. Her clients are mostly non-English speaking students based in Japan. What time should she go online if her first session starts at 8:00 p. m. in Japan?

Understand:

- a. What is asked?

What time it is in the Philippines when it is 8:00 p. m. in Japan

- b. Given facts:

Japan's time is 1 hour ahead of the Philippines. Maria needs to go online at 8:00 p.m. in Japan.

Plan:

Subtract 1 hour to 8:00 p.m.

Solve:

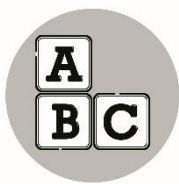
$8 - 1 = 7$. Therefore, Maria goes online for her class when it is 7:00 p.m. here in the Philippines.

Now, try to answer the next one by yourself.

Example 3:

Jessica has been living in Canada for more than 10 years. Her mother is flying to Ontario to visit her. The time in the Philippines is 13 hours ahead of Ontario. The trip from the Philippines to Canada takes 14 hours and 30 minutes. If her mom's flight departs from the Ninoy Aquino International Airport at 8:00 a.m., at what time will the airplane arrive at the airport in Ontario?

Congratulations for reaching this part of the lesson. You are now ready to do the activities below.



What's More

Activity 1: My Time Is Precious!

Directions: For each given time in the Philippines, determine the equivalent time in the given country. Express your answer both in 12-hour and 24-hour clock formats.

Philippine Time (PST)		What time is it in:	24-hour clock	12-hour clock
1.	2:30 H	Buenos Aires, Argentina		
2.	5:15 am	Canberra, Australia		
3.	12:45 am	Athens, Greece		
4.	15:20 H	Tokyo, Japan		
5.	8:30 pm	Washington, USA		

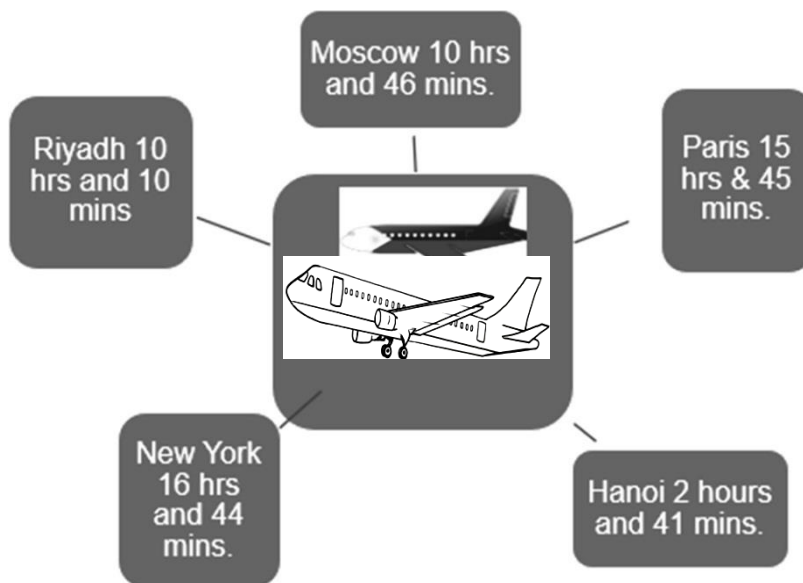
Activity 2: Give Me More Time!

Directions: Fill out the table below. Tell the time of the following countries based on the Philippine Standard Time. If it is Tuesday, 6:00 a.m. in the Philippines, what time and day is it in the following countries?

Countries	Time and Day
1. Paris	
2. London	
3. Singapore	
4. Australia	
5. Washington	

Activity 3: Let's Travel the World!

Directions: Work out the time that you will land in each of these cities if you fly from the Philippines. You will need to know how long the flight takes and the time adjustment as a result of the time zones. The travel time from the Philippines to each city is given in the diagram. Use the time zone map to help you fill out the table.



Destination	Departs at (PST)	Time Difference from PST	Time of Arrival (PST 24-hour clock)	Time of Arrival (PST 12-hour clock)
Riyadh	06:00 H			
Paris	08:00 H			
Moscow	22:00 H			
Hanoi	09:30 H			
New York	14:00 H			

Destination	Departs at (PST)	Travel Time	Time of Arrival in the City (24-hour clock)	Time of Arrival in the City (12-hour clock)
Riyadh	06:00 H			
Paris	08:00 H			
Moscow	22:00 H			
Hanoi	09:30 H			
New York	14:00 H			



What I Have Learned

Directions: Summarize what you have learned in this module. Write the correct answers in the blanks.

- 1-3. To calculate time in different world time zones with reference to a particular time in the Philippines, we need to use the _____ _____
_____ map to easily understand their time difference.
- 4-6. The _____ _____
_____ established that the meridian passing through the Royal Observatory at Greenwich would be the world's Prime Meridian.
7. The different times at different places in the world are caused by the movement of the Earth, _____degrees longitude in every hour.
- 8-9. In calculating time difference, (+) means _____ and ___ means behind.
10. There are 24 hours in a day, and there are _____ standard time zones.

Excellent job! Two more activities to answer and you're done with this module.



What I Can Do

Directions: Read the problem carefully. Answer the questions that follow.

Tony lives in Japan. His brother Andrei lives in the Philippines. Their grandmother is in India and wants both boys to call her at 2 p.m. in Japan and Philippines times.

- a. What time in India will Tony call?
- b. What time in India will Andrei call?



Assessment

Directions: Choose the letter that corresponds to the correct answer. For your solutions you can use an extra sheet of paper. A score of 10 is excellent, 8-9 is very good, and a score of 5-7 is good.

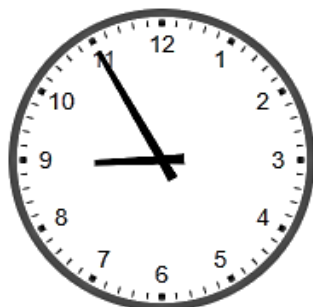
1. On which of the following do the times at different places on earth depend?
 - A. Imaginary lines
 - B. Lines of Latitude
 - C. Lines of Longitude
 - D. International Date Line
2. Before the 19th century, which inspired the standard for clocks?
 - A. Planets
 - B. Constellation
 - C. Sun and star
 - D. Prime Meridian
3. Which of the following shows the time of midnight in a 24-hour clock?
 - A. 12:00 a.m.
 - B. 12:00 H
 - C. 24:00 H
 - D. 0:00 H
4. How wide in degrees is each time zone?
 - A. 12
 - B. 15
 - C. 24
 - D. 180
5. What occurred on October 13, 1884 in Washington D.C., USA?
 - A. Time Zone Meeting
 - B. Greenwich Meridian
 - C. International Meridian Conference
 - D. International Time
6. If it is 15:30 H in the Philippines, what is its equivalent time in New Delhi, India?
 - A. 1:30 a.m.
 - B. 2:00 p.m.
 - C. 13:00 H
 - D. 14:00 H

7. How many hours is the time difference between Philippine Standard Time and Taiwan, Taipei?
- A. -2 hours
B. +1 hour
C. +2 hours
D. same time
8. Which movement of the earth is related to time and different time zones?
- A. orbit
B. rotation
C. revolution
D. circumference
9. What time would it be in Cebu City if it is 1:00 a.m. in Athens, Greece?
- A. 6:00 a.m.
B. 7:00 p.m.
C. 7:00 a.m.
D. 6:00 p.m.
- 10) If your cousin lives in Oregon, USA, and he says that at 12:00 noon his favorite cooking show will be aired live on TV, what is its equivalent time in the Philippines?
- A. 4:00 p.m. the same day
B. 4:00 a.m. the next day
C. 4:00 a.m. the same day
D. 4:00 p.m. the next day

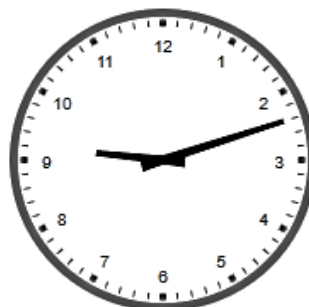


Additional Activities

Directions: Analyze the clocks below. The clock on the left side is set in the Philippine Standard Time (PST) at 8:55 a.m. and the clock on the right side is from other cities/countries time zone, which is 9:12 p.m. How much time has passed from the first clock to the second clock? What is the time difference? Name at least 5 cities/countries that has the said time difference when compared to PST.



8:55 a.m.



9:12 p.m.



Answer Key

What I know

1. C
2. B
3. D
4. A
5. A
6. C
7. A
8. C
9. B
10. A

WHAT'S IN

1. 4:30 H
2. 12:15 H
3. 5:54 p.m.
4. 4:30 p.m.
5. 21:15 H

What's New

Departure: 8:00 AM (08:00H). Travel time: 14 hours and 30 minutes
 8:00H + 14:30H = 22:30H
 Ontario, Canada is 13 hours behind the Philippines (PST)
 22:30H - 13:00H = 9:30H (9:30 AM)
 Jessica's mother will arrive at Ontario at 9:30 AM

WHAT I HAVE LEARNED

- 1-3. world time zone
- 4-6. International Meridian Conference
7. 15
- 8-9. ahead, (-)
10. 24

WHAT CAN I DO

1. 10:30 am
2. 11:30 am

Assessment

1. C
2. C
3. D
4. B
5. C
6. C
7. D
8. B
9. C
10. B

Additional Activities

The difference is roughly 12 hours (12 hours and 17 minutes).
 Cities with 12-hour difference from the Philippines
These are just sample answers, there can be many more

1. Connecticut, USA
2. Delaware, USA
3. Georgia, USA
4. Florida, USA
5. Santiago, Chile

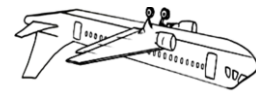
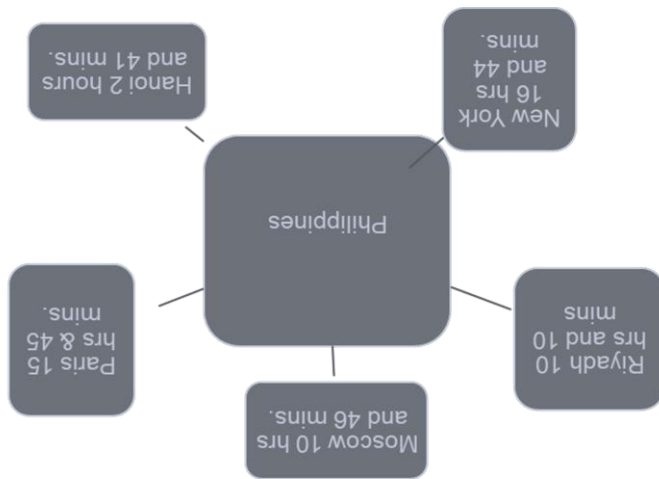
What's more
Activity 1

24-hour		
12-hour		
1. 14:30H a day before	2:30 pm a day before	
2. 8:15 H	8:15 am	
3. 18:45H a day before	6:45 pm a day before	
4. 16:20 H	4:20 pm	
5. 7:30H	7:30 am	

Activity 2

Countries	Time
1. Paris	Monday, 11:00 pm
2. London	Monday, 10:00 pm
3. Singapore	Tuesday, 6:00 am
4. Australia	Tuesday, 9:00 am
5. Washington	Monday, 5:00 pm

Activity 3



Destination	Departs at (PST)	Travel Time	Time of Arrival in the City (24-hour clock)	Time of Arrival in the City (12-hour clock)
Riyadh	06:00 H	10 h 10 min	11:10 H	11:10 a.m.
Paris	08:00 H	15 h 45 min	16:45 H	4:45 p.m.
Moscow	22:00 H	10 h 46 min	3:46 H next day	3:46 a.m. next day
Hanoi	09:30 H	2 h 41 min	11:11 H	11:11 a.m.
New York	14:00 H	16 h 44 min	17:44 H	5:44 p.m.

Destination	Departs at (PST)	Time Difference from PST	Time of Arrival (PST 24-hour clock)	Time of Arrival (PST 12-hour clock)
Riyadh	06:00 H	-5	16:10 H	4:10 p.m.
Paris	08:00 H	-7	23:45 H	11:45 p.m.
Moscow	22:00 H	-5	8:46 H next day	8:46 a.m. next day
Hanoi	09:30 H	-1	12:11 H	12:11 p.m.
New York	14:00 H	-13	6:44 H next day	6:44 a.m. next day

References

- 24timezones. "The Supreme Guide to World Time Zones." World Time Zones: Supreme Guide. 24timezones, April 24, 2020.
<https://24timezones.com/world-time-zones#gref>.
- Alfred, Randy. "Oct. 13, 1884: Greenwich Resolves Subprime Meridian Crisis." Wired. Conde Nast, June 4, 2017.
<https://www.wired.com/2010/10/1013greenwich-prime-meridian/>.
- Mathematics Grade 5 Teachers Guide. *21st Century Mathematics Textbook Grade 5*
- "Study.com." Accessed October 19, 2020.
<https://study.com/academy/lesson/identifying-calculating-time-zones.html>.
- "The Greenwich Meridian." The Greenwich Meridian - where east meets west: International Meridian Conference (1884). Accessed October 19, 2020.
<http://www.thegreenwichmeridian.org/tgm/articles.php?article=10>.
- "What Is a Time Zone," October 15, 2015.
<https://www.worldtimeserver.com/learn/what-is-a-time-zone/>.

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