

MATHCOUNTS® Problem of the Week Archive

Time Changes – November 14, 2022

Problems & Solutions

Due to timekeeping confusion on the American railroads in the mid-19th century, a system of standard time zones was proposed. In 1918 the Standard Zone Time and Daylight Saving Time were established in the Standard Time Act. Later, the Uniform Time Act of 1966 was passed promoting the adoption of uniform time within the standard time zones. The map below shows six of the U.S. time zones.



From east to west, the time zones are Eastern Standard Time (EST), Central Standard Time (CST), Mountain Standard Time (MST), Pacific Standard Time (PST), Alaskan Standard Time (AKST) and Hawaii-Aleutian Standard Time (HST). Notice that in some cases a state can be in multiple time zones. **Over the course of Luther’s summer break he visited four of the six time zones shown. What is the minimum number of states that Luther could have visited?**

Suppose Luther visited 2 states that each “straddle” two time zones. For example, he could have visited two towns located in Oregon, one of which is in the Pacific time zone and the other of which is in the Mountain time zone. Then, if he visited Tennessee, he could also visit two different time zones – the Central time zone and the Eastern time zone. Therefore, the minimum number of states Luther could have visited is 2 states.

When Daylight Saving Time is not being observed, the time difference between neighboring time zones is -1 hour from east to west. For example, when the current time is 1 p.m. in Washington, DC the current time is 12:00 noon in Dallas, 11 a.m. in Denver and 10 a.m. in San Francisco. **If the current local time is 2:16 p.m. EST in Washington, DC, what will be the current local time (MST) 432 minutes from now in Albuquerque, NM?**

*First, let's determine how many hours are in 432 minutes by dividing $432 \div 60 = 7.2$ hours. Since $0.2(60) = 12$, we see that 432 minutes is equal to 7 hours 12 minutes. In the Eastern time zone, 7 hours 12 minutes from 2:16 p.m. EST is 9:28 p.m. EST. Since Albuquerque is in the Mountain time zone, the time difference is -2 hours. That means the local time in Albuquerque 432 minutes after 2:16 p.m. EST is **7:28 p.m. MST.***

To celebrate her birthday, Celia flew from her home in Boston, MA to visit her best friend in Los Angeles, CA. Celia took a direct flight, which departed the airport in Boston at 9:25 a.m. EST. According to the airline, the flying time from Boston to Los Angeles is $6\frac{1}{2}$ hours. At what time (PST) did Celia's flight land in Los Angeles if it arrived 10 minutes ahead of schedule?

*If Celia's flight arrived 10 minutes early, the total time to fly from Boston to Los Angeles would be reduced to 6 hours 20 minutes. In the Eastern time zone, where Boston is located, 6 hours 20 minutes after 9:25 a.m. EST is 3:45 p.m. EST. Since Celia traveled from the Eastern time zone to the Pacific time zone, the time difference is -3 hours. So, Celia's flight landed at **12:45 p.m. PST.***

The Uniform Time Act of 1966 also mandated that Daylight Saving Time be observed nationwide beginning the last Sunday in April and ending the last Sunday in October. In 1986, the federal law was amended, changing the starting date to the first Sunday in April. Again in 2007, the federal government extended Daylight Saving Time, changing the ending date to the first Sunday in November. In each time zone, Daylight Saving Time begins at 2:00 a.m. on the first Sunday in April, at which time 1 hour is "lost," and 2:00 a.m. EST becomes 3:00 a.m. EDT (Eastern Daylight Time). Similarly, CST becomes CDT, MST becomes MDT, etc. When Daylight Saving Time ends at 2:00 a.m. on the first Sunday in November in each time zone, 1 hour is "gained." **Lauryn works in Seattle, WA and is attending a conference in Miami, FL. Lauryn took a direct flight that left Seattle on November 5, 2022 at 10:40 p.m. PDT and arrived in Miami on November 6, 2022 at 6:15 a.m. EST. If Daylight Saving Time ended and standard time resumed at 2:00 a.m., Sunday, November 6th, how many minutes did Lauryn's flight from Seattle to Miami take?**

Since Lauryn's flight started during Daylight Saving Time and ended during standard time, we first will convert 6:15 a.m. EST to 7:15 a.m. EDT. Lauryn traveled from the Pacific to the Eastern time zone, which makes the time difference $+3$ hours. Converting to PDT, we see that when the current time is 7:15 a.m. EDT, it is 4:15 a.m. PDT. Now, we determine the number of minutes from 10:40 p.m. to 4:15 a.m. the next morning. From 10:40 p.m. to 3:40 a.m. is 5 hours. Then, from 3:40 a.m. to 4:15 a.m. is 35 minutes. That means her flight was 5 hours and 35 minutes. Converting 5 hours to minutes, we get $5 \times 60 = 300$ minutes. That means Lauryn's flight from Seattle to Miami was $300 + 35 = 335$ minutes.

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To celebrate her birthday, Celia flew from her home in Boston, MA to visit her best friend in Los Angeles, CA. Celia took a direct flight, which departed the airport in Boston at 9:25 a.m. EST. According to the airline, the flying time from Boston to Los Angeles is 6½ hours. At what time (PST) did Celia’s flight land in Los Angeles if it arrived 10 minutes ahead of schedule?

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