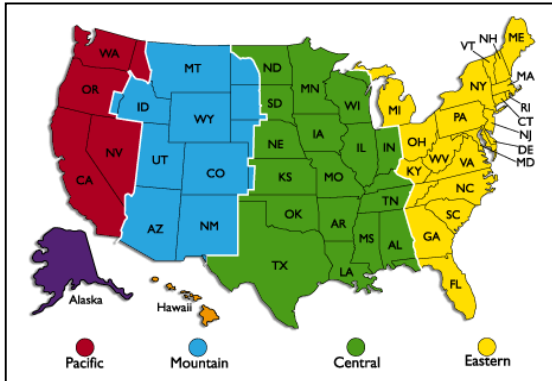


## Time Zone Math



Earth is a BIG place! In fact, it is so big that different countries see sunrise and sunset happen at very different times during the day.

If you were living in Germany, you would see sunrise at 6:00 AM, but at that same moment it would be the middle of the night in California!

(Image courtesy  
[http://gis.nwgc.gov/giss\\_2006/cd\\_contents.html](http://gis.nwgc.gov/giss_2006/cd_contents.html))

If you have ever gone on a long car or plane ride to the east or west, you will often hear people complain that they have ‘gained’ or ‘lost’ hours due to Time Zone change. Here’s how it works.

When you travel east, the Sun rises higher and higher in the sky. It is as though you are seeing the Sun as it would be at a later time in the day. When you travel west, the Sun gets lower and lower in the sky. It is as though you are seeing the Sun as it would be at an earlier time in the day.

We can make this more precise by saying that as you travel East you will gain time, and as you travel west you will lose time. The exact amount depends on how many Time Zones you travel through. The figure above shows the Time Zones across North America. During the winter, these Time Zones are called Eastern Standard Time (EST), Central Standard Time (CST), Mountain Standard Time (MST) and Pacific Standard Time (PST).

For example, when you travel westwards, your clock will ‘lose’ one hour for each Time Zone you pass through. If your watch says 12:00 Noon and you are in New York, which is in the EST Time Zone, you need to set your watch back one hour to 11:00 AM if you are traveling to Chicago in the CST Zone, two hours to 10:00 AM if you are traveling to Denver in the MST Zone, and three hours to 9:00 AM if you are raveling to San Francisco the PST Zone.

1 – A solar astronomer wants to study a flare erupting on the Sun at 12:00 PM (High Noon) at the solar observatory in Denver while taking to his colleague in New York at the same time. At what time should his colleague be ready for the phone call?

2 – A second solar astronomer in Paris, France also wants to participate in this research. If the Paris Time Zone is 4 hours ahead of EST, what time should the Paris astronomer be ready for the same call?

3 – An astronomer sees a solar flare at 2:15 PM EST. A astronomer in Hawaii decides to go out for breakfast between 8:00 and 8:30 AM HST. If Hawaii Standard Time (HST) is 3 hours earlier than the PST Zone, did the Hawaiian astronomer get to see the flare?

## Answer Key

1 – A solar astronomer wants to study a flare erupting on the Sun at 12:00 PM (High Noon) at the solar observatory in Denver while talking to his colleague in New York at the same time. At what time should his colleague be ready for the phone call?

**Answer: Denver is in the MST Zone, which is 2 hours earlier than the EST. SO, the New York astronomer needs to be ready at 12:00 + 2:00 = 14:00 which is 2:00 PM EST.**

2 – A second solar astronomer in Paris, France also wants to participate in this research. If the Paris Time Zone is 4 hours ahead of EST, what time should the Paris astronomer be ready for the same call?

**Answer: Paris is 4 hours ahead of EST, so you need to add 4 hours to 12:00 PM Noon EST to get 16:00 hours which is the same as 4:00 PM Paris Time.**

3 – An astronomer sees a solar flare at 2:15 PM EST. A astronomer in Hawaii decides to go out for breakfast between 8:00 and 8:30 AM HST. If Hawaii Standard Time (HST) is 3 hours earlier than the PST Zone, did the Hawaiian astronomer get to see the flare?

**Answer: The solar flare occurred at 2:15 PM EST. We first convert this to PST by subtracting 3 hours for the time zone change to get 11:15 AM PST. Then, continuing westwards, we subtract another 3 hours to get to the Hawaiian Time Zone, making the time 11:15 AM – 3:00 = 8:15 AM Hawaiian Time. The Hawaiian astronomer missed the flare because he was still having breakfast and not at the observatory.**