How do we locate Earthquakes?

A large earthquake has occurred somewhere in California. We need to figure out where it happened so that we can notify the 911 emergency services. We are going to use what we learned about the different speeds of shear waves (S-waves) and compressional waves (P-waves) to locate the epicenter of this earthquake.

Step 1:

On page 2 you can see 3 seismograms recorded after the earthquake event. One was recorded at Eureka, CA one in Las Vegas, NV and one in Elko, NV. On each seismogram, identify the arrival of the P-wave (the first one to arrive) and then the later arrival of the S-wave. Using the time-scale below each seismogram, determine the time between when the P-wave arrived and when the S-wave arrived. Record them in the spaces below.

	Eureka, CA	Las Vegas, NV	Elko, NV
S-P time (in seconds)			

Step 2:

The larger graph on page 3 shows the relationship between S-P delay time and the distance that the seismic waves travelled.   Use the S-P delay times you recorded above to read off the seismic wave travel distance from the plot. Record them below.

	Eureka, CA	Las Vegas, NV	Elko, NV
Distance from EQ epicenter (km)			

Step 3:

When an earthquake occurs, the seismic waves radiate equally in all directions creating a circle that expands outwards from the earthquake epicenter.   At each station where we recorded a seismogram, we know how far away the epicenter is but we do not know what direction the waves came from. But, because we have three stations, we can use a process called "triangulation" to determine the exact location of the earthquake.

To do this, we need to trace a circle around each seismic station that has a radius equal to the distance of the earthquake epicenter from that station (recorded in step 2). The three circles you trace should only intersect each other in one place, indicating the earthquake epicenter. Follow the instructions on page 4 to trace the circles, and find the epicenter. Good luck!
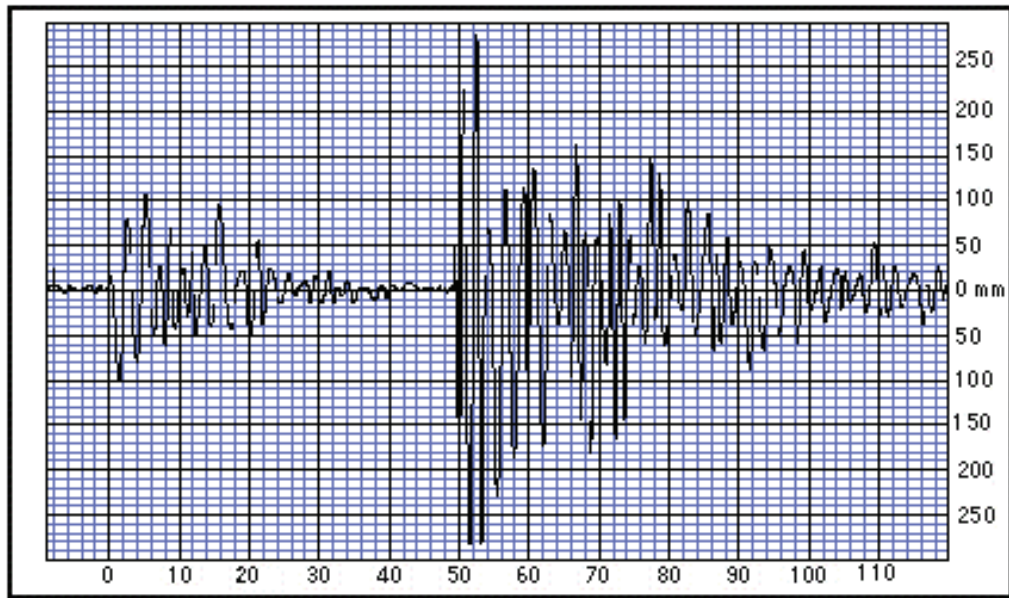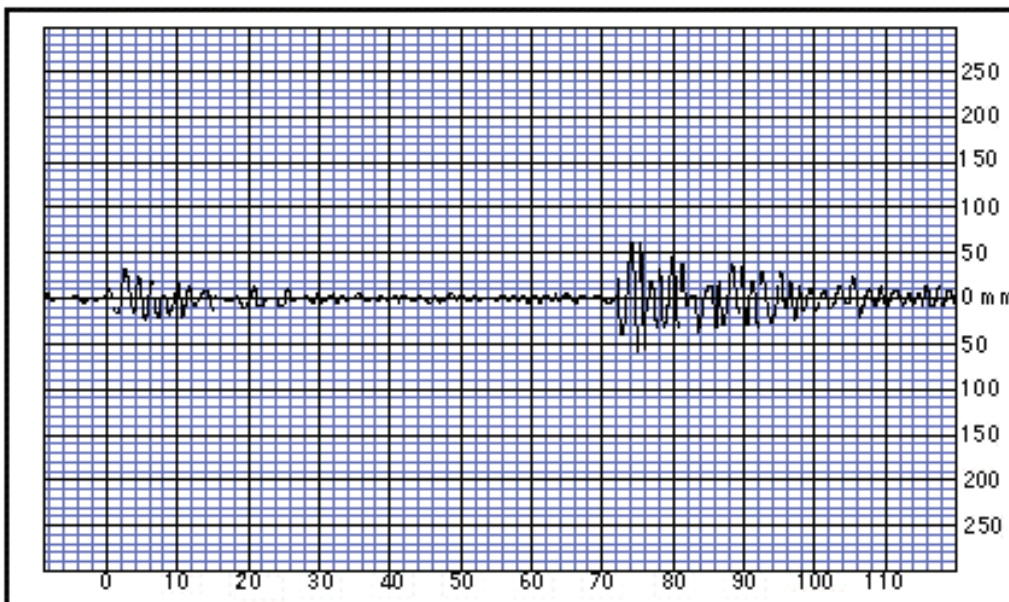
Eureka, CA — Time (seconds)
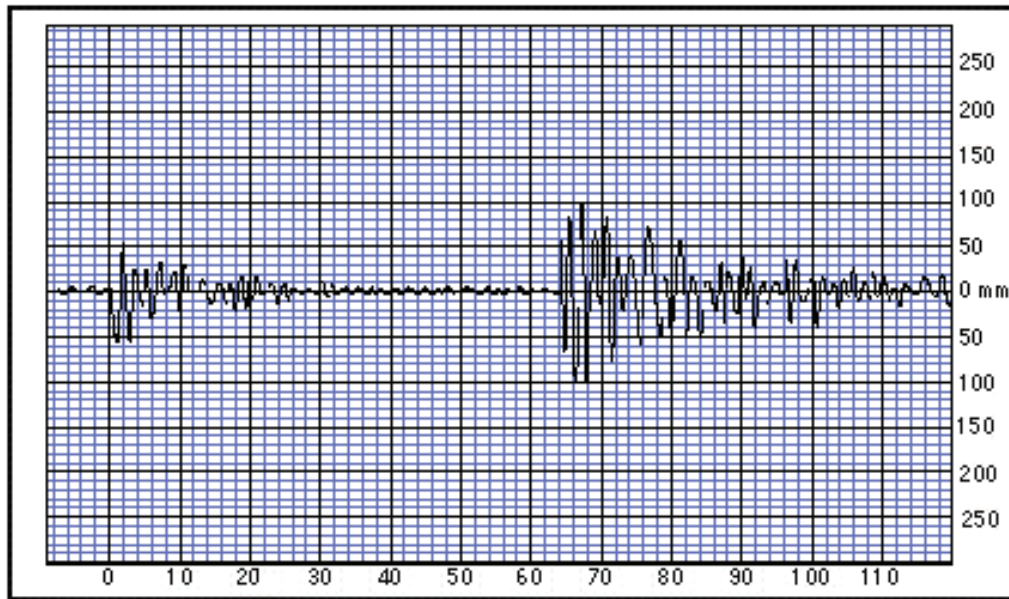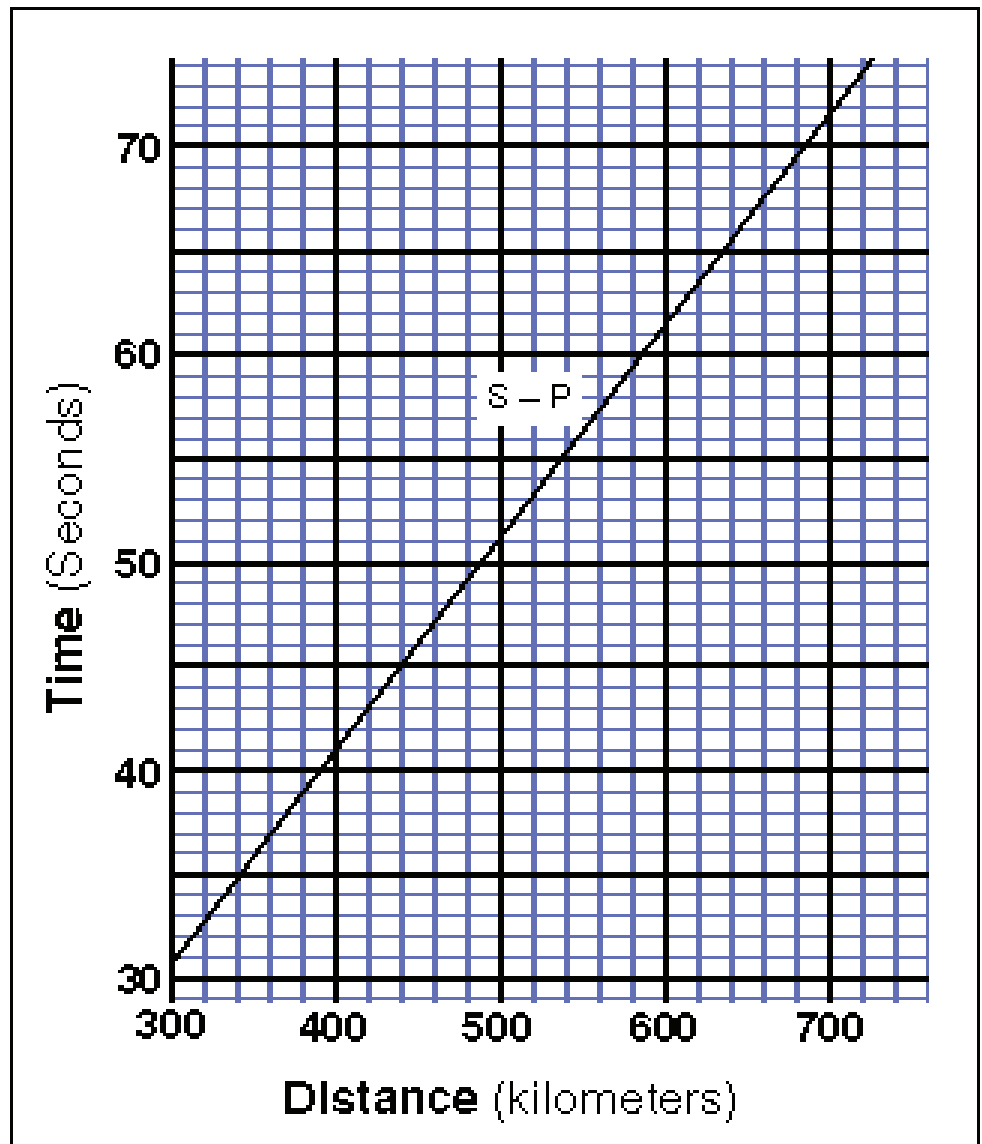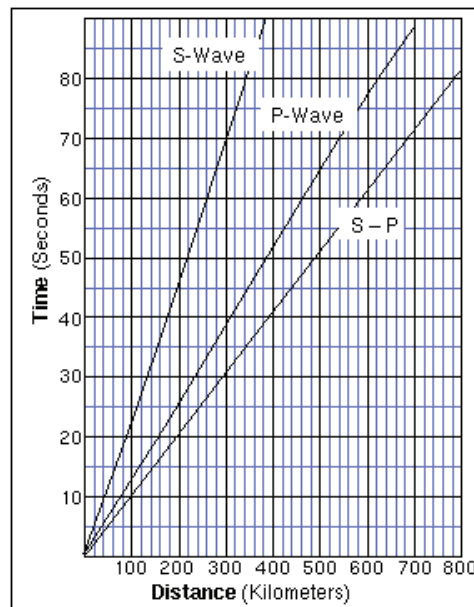
Las Vegas, NV — Time (seconds)

Elko, NV — Time (seconds)

Graph of the delay between the P-wave arrival and the S-wave arrival

(Use this one to calculate the distance between the EQ epicenter and the seismic station)

Graph showing the travel times of P-waves, S-waves, and of the delay between the two types of waves.

Scale Bar

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0  40 80 120    200           400           600           800
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Kilometers

Instructions:

1) Find the three cities where the seismograms were recorded (Eureka, CA   Las Vegas, NV   Elko, NV).

2) Use the scale bar to set your compass to the distance between a seismic station and the earthquake epicenter.

3) Place the needle-point of the compass on the city, and trace a circle (or part of a circle) with the compass.

4) Repeat steps 2-3 for each of the three cities where seismograms were recorded.

5) Where do the circles intersect?   Where did the earthquake occur?