

## Part A - Epicenter Determination

The epicenter of an earthquake is the point on Earth's surface at or above the earthquake's focus. In this exercise, you will determine the location of the epicenter of an earthquake that was recorded on seismograms at three different locations (Figure 1).

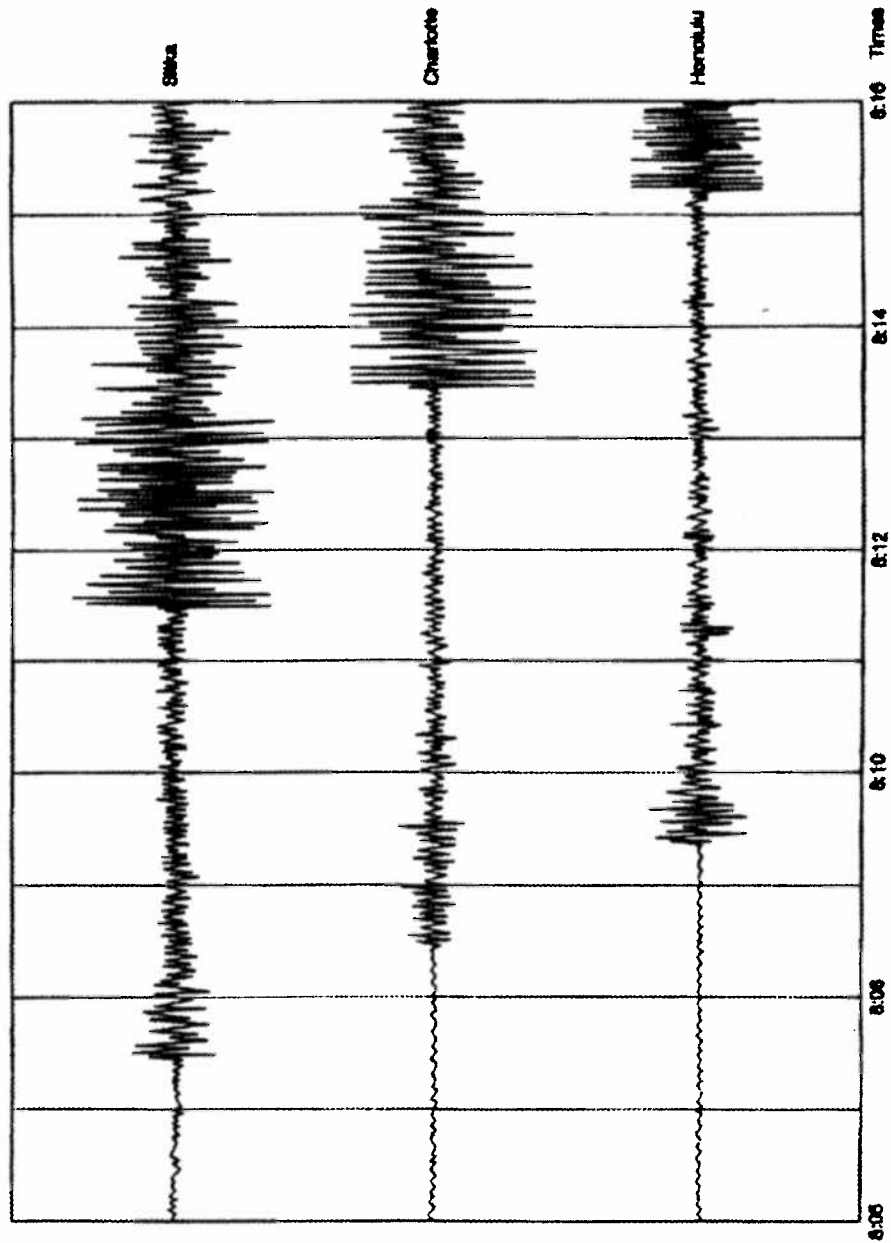
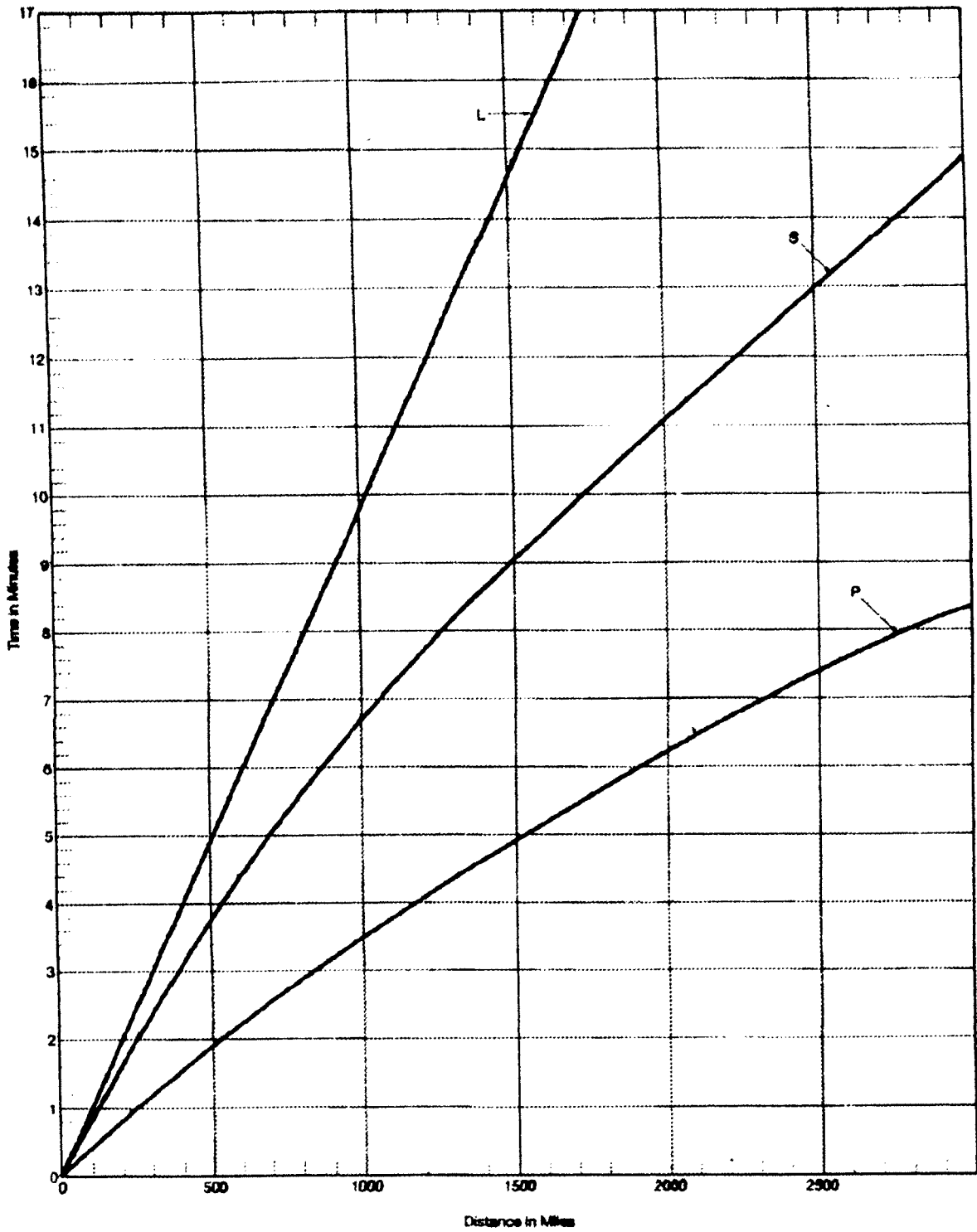


Figure 1: Seismograms recorded at three different locations for the same earthquake.



**Figure 2:** Travel-time curves for P-waves, S-waves, and L-waves.

S wave arrival—P wave arrival

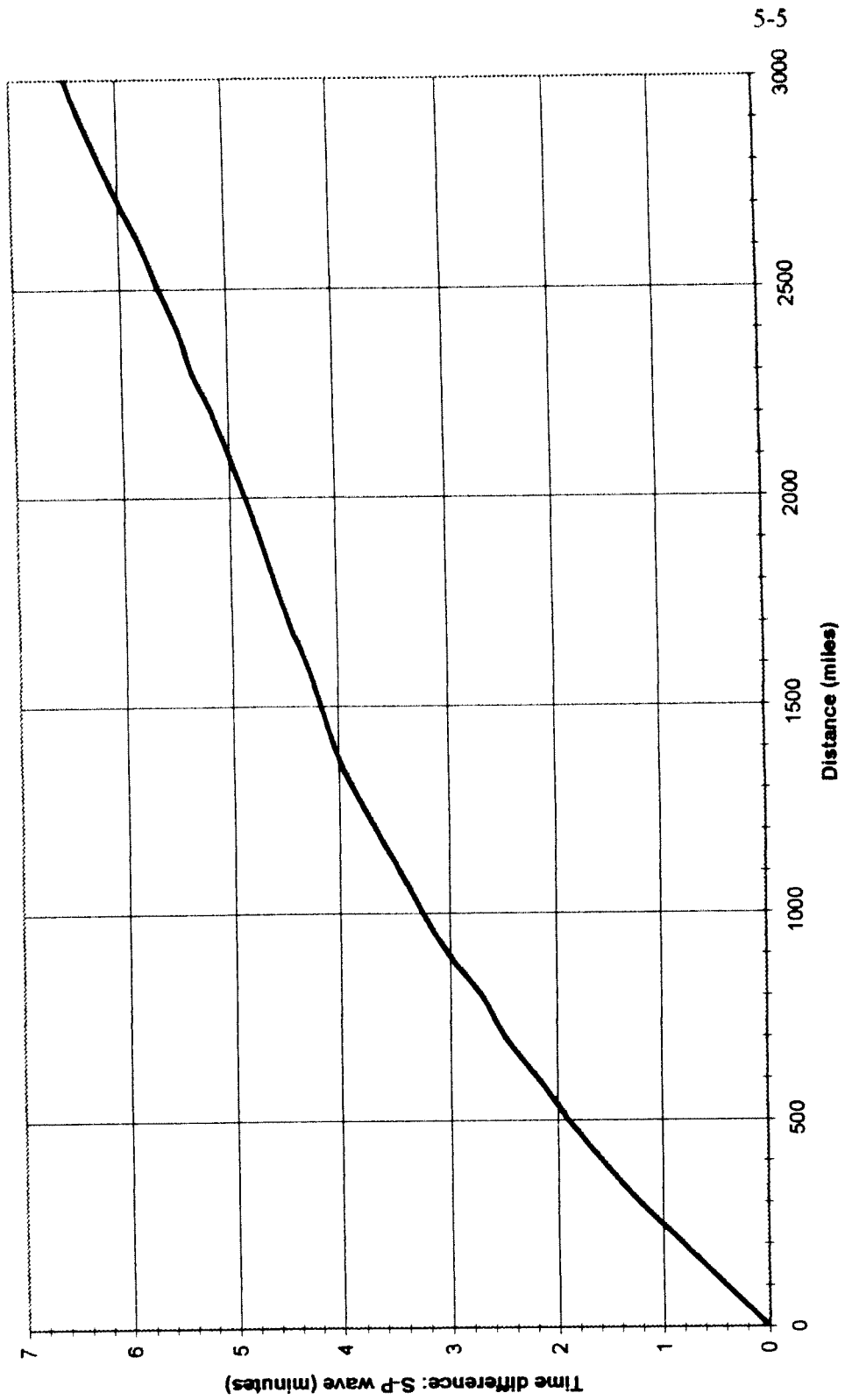


Figure 3: Travel-time graph to determine the distance to the epicenter.

1. Estimate to the **nearest tenth of a minute (NOT seconds)**, the times of the **first arrival** of the P-waves and S-waves at each station in Figure 1. Times show it arrived after 8 AM. Record this in Table 1, below Subtract P-wave arrival time from the S-wave arrival time to determine the difference in travel time of P-wave and S-wave in minutes and tenths of minutes.

**Table 1: Arrival times at seismic stations**

<b>Location of seismic station</b>	<b>First P-wave Arrival (time as hour: minute.tenths)</b>	<b>First S-wave Arrival (time as hour: minute.tenths)</b>	<b>Difference in travel time between S &amp; P</b>
Sitka, AK			
Charlotte, NC			
Honolulu, HI			

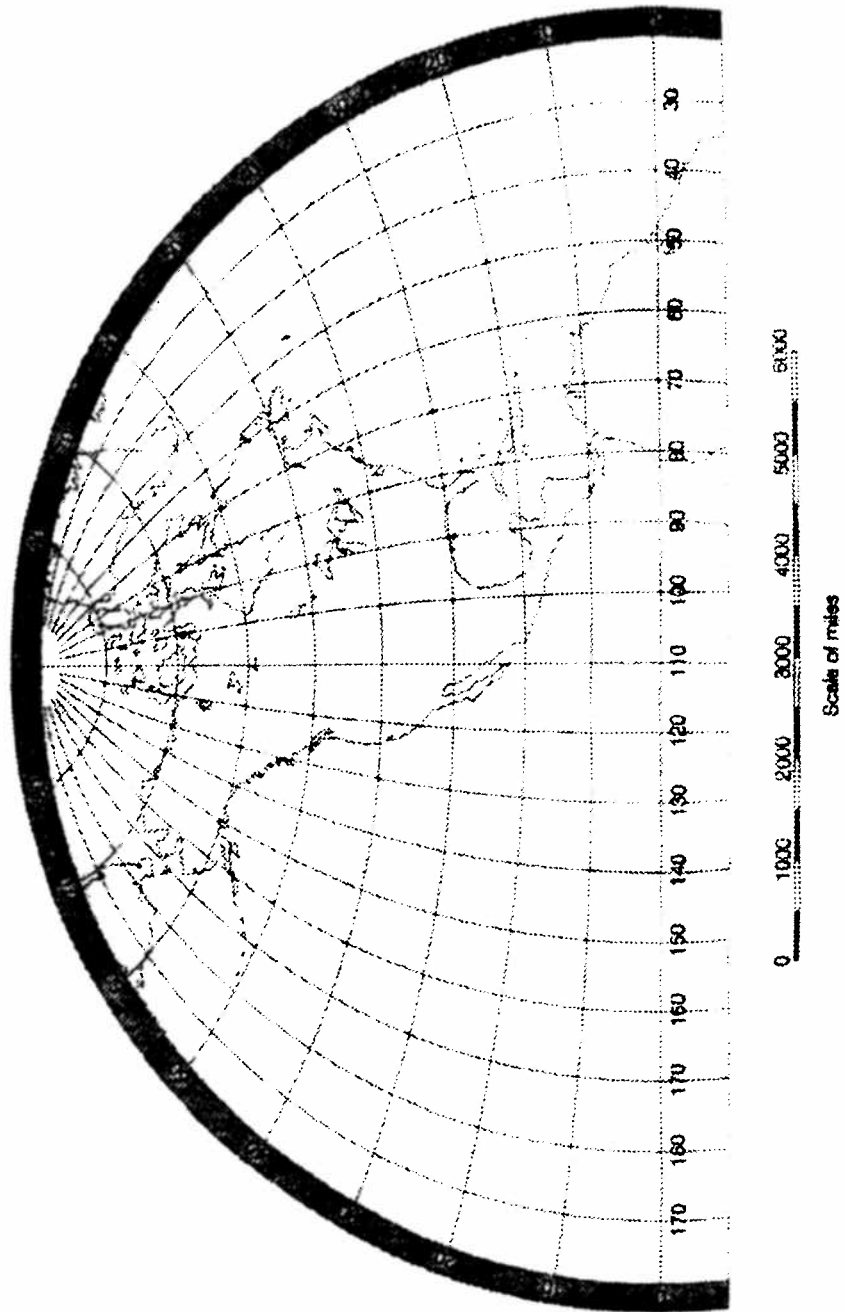
2. Using the S-minus-P times and the travel-time curve (Figure 3), estimate the distances from the focus that correspond to these values. Record these in Table 2, below.

**Table 2: Distance of focus to seismic station**

<b>Location</b>	<b>Distance (miles)</b>
Sitka, AK	
Charlotte, NC	
Honolulu, HI	

3. Find the earthquake's epicenter using the distances you just obtained.
- a. Locate and mark the three seismic stations on the world map, Figure 3 (page 5-7):

Sitka, AK: 57° N latitude, 135° W longitude  
 Charlotte, NC: 35° N latitude, 81° W longitude  
 Honolulu, HI: 21° N latitude, 158° W longitude



**Figure 4:** Map of Earth, for use in plotting data and locating the earthquake's epicenter.

- b. Use a drafting compass to draw a circle around each seismic station. Make the radius of the circle equal to the distance between the station and the epicenter that you determined above. Use the scale for the world map to set this radius on the drafting compass. The circles you draw should intersect at one point, which is the epicenter. (If the three circles do not intersect at a unique point, choose a point equidistant between the three circles.) The location of the epicenter is:

Latitude \_\_\_\_\_ Longitude \_\_\_\_\_

4. What is the **origin time** of the earthquake? That is, at what time did the earthquake occur? Using data from a single station, and Figure 2 or 3 to find out how long it takes to arrive, and the distance determined from epicenter to quake. Note the station, and show your calculations.
5. What time would you estimate did the L-waves from this earthquake begin to arrive at the **Sitka** station? (Use Figure 2)