

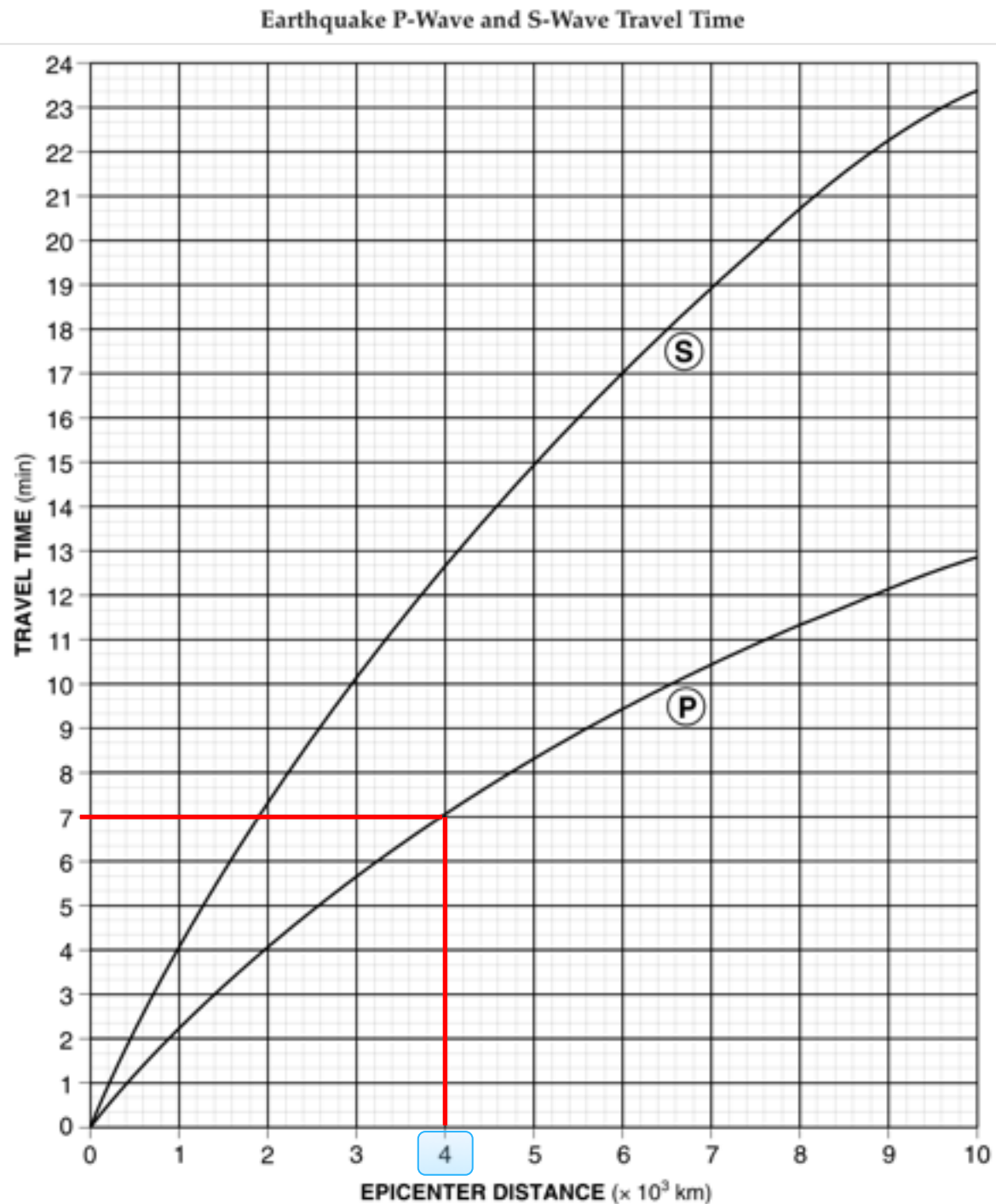
Travel Time

1) If you are asked the **travel time** of a P-wave or S-wave for a given epicenter distance:

- a) Go to the epicenter distance on the x-axis and go up to the correct curve,
- b) Go over to the y-axis and determine the travel time.

Example: How long does it take a P-wave to travel 4,000 km?

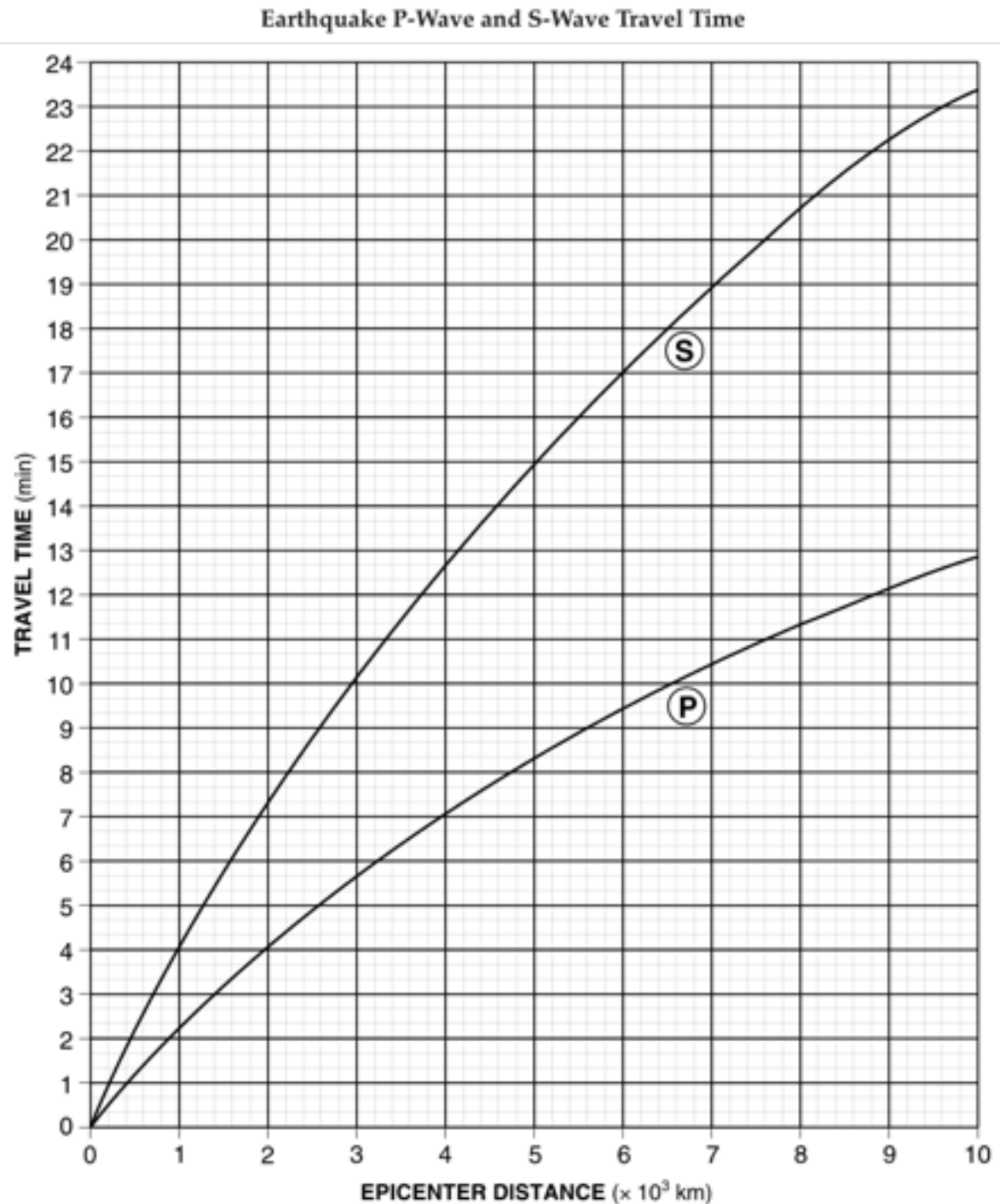
Answer: 7 minutes



1) If you are asked the **travel time** of a P-wave or S-wave for a given epicenter distance:

- a) Go to the epicenter distance on the x-axis and go up to the correct curve,
- b) Go over to the y-axis and determine the travel time.

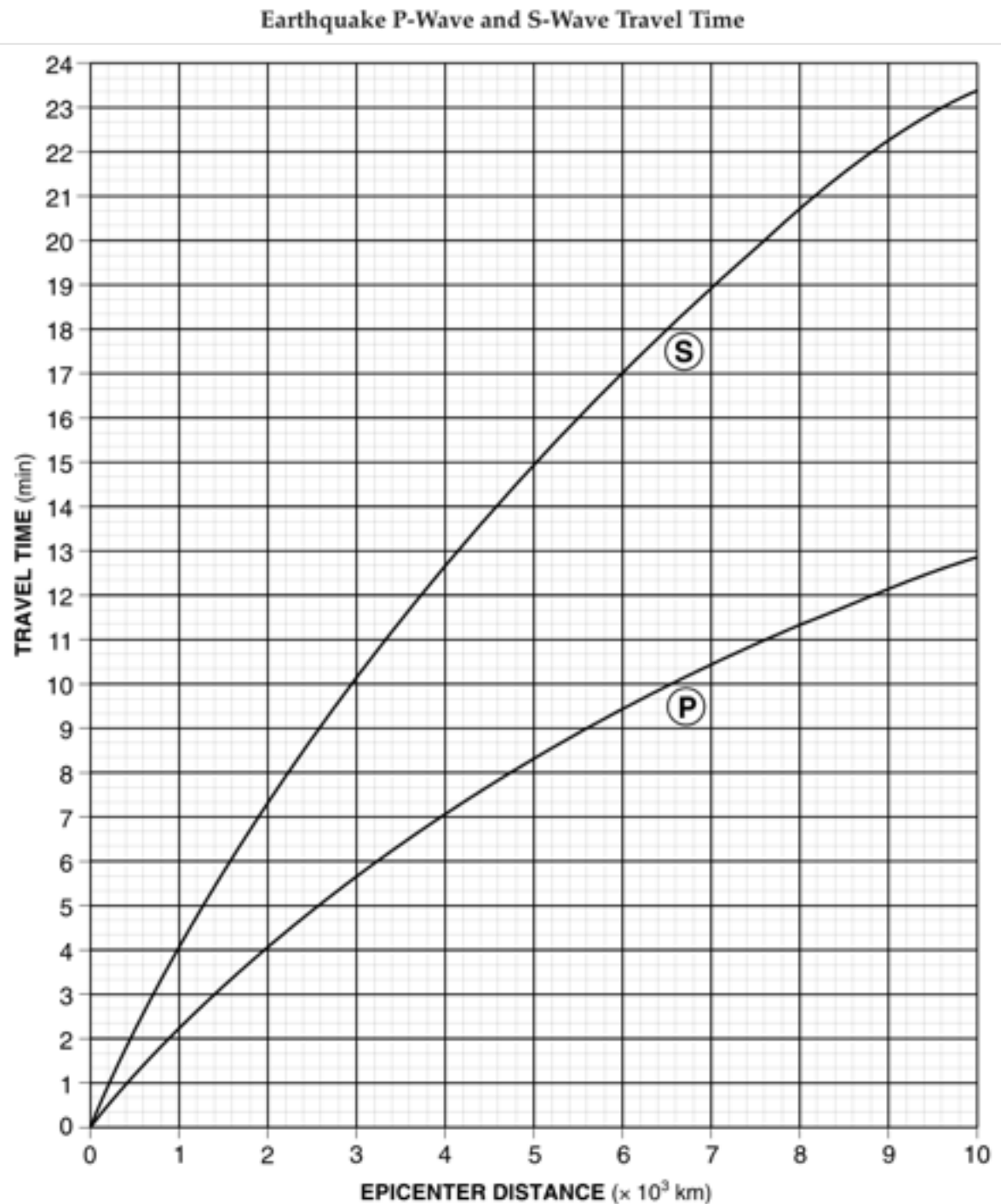
Question 1: How long does it take an S-wave to travel 4,000 km?



1) If you are asked the **travel time** of a P-wave or S-wave for a given epicenter distance:

- a) Go to the epicenter distance on the x-axis and go up to the correct curve,
- b) Go over to the y-axis and determine the travel time.

Question 2: How long does it take a P-wave to travel 8,000 km?

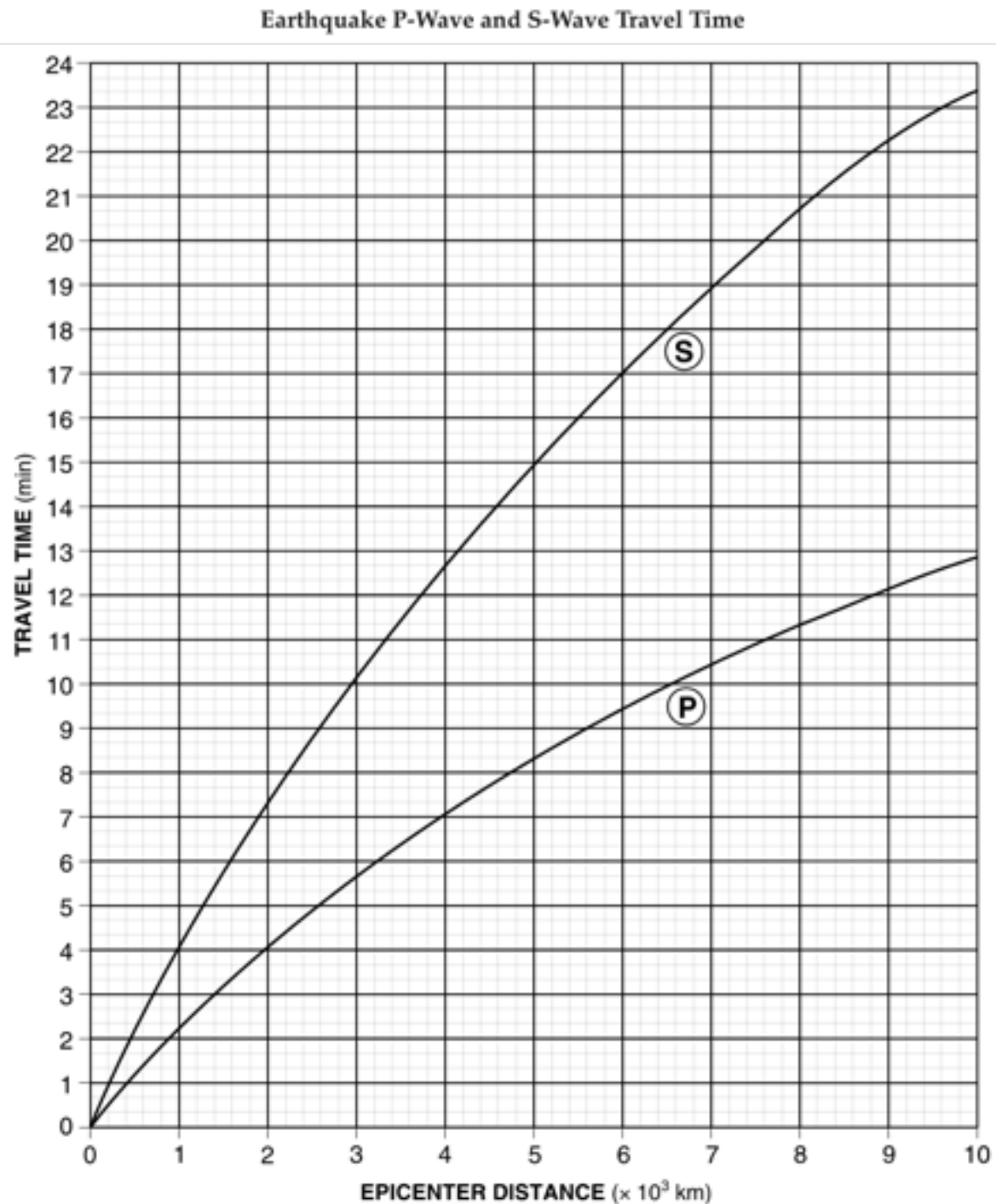


1) If you are asked the **travel time** of a P-wave or S-wave for a given epicenter distance:

a) Go to the epicenter distance on the x-axis and go up to the correct curve,

b) Go over to the y-axis and determine the travel time.

Question 3: How long does it take an S-wave to travel 8,000 km?



Epicenter Distance with Travel Time

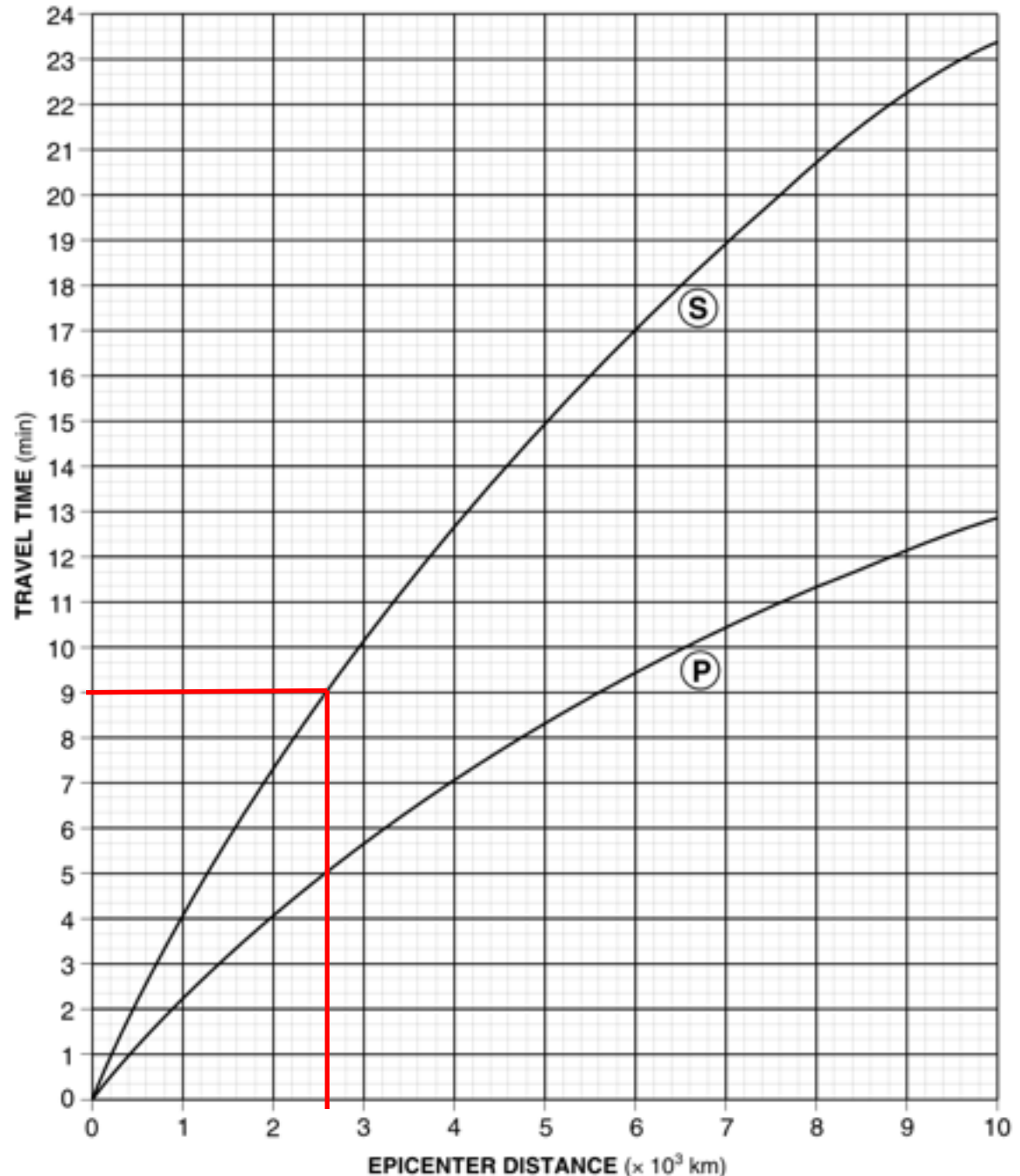
Earthquake P-Wave and S-Wave Travel Time

epicenter distance a P-wave or S-wave traveled for a given travel time:

- Go to the travel time on the y-axis and go over to the correct curve,
- Go down to the x-axis to determine the epicenter distance.

Example: How far can an S-wave travel in 9 minutes?

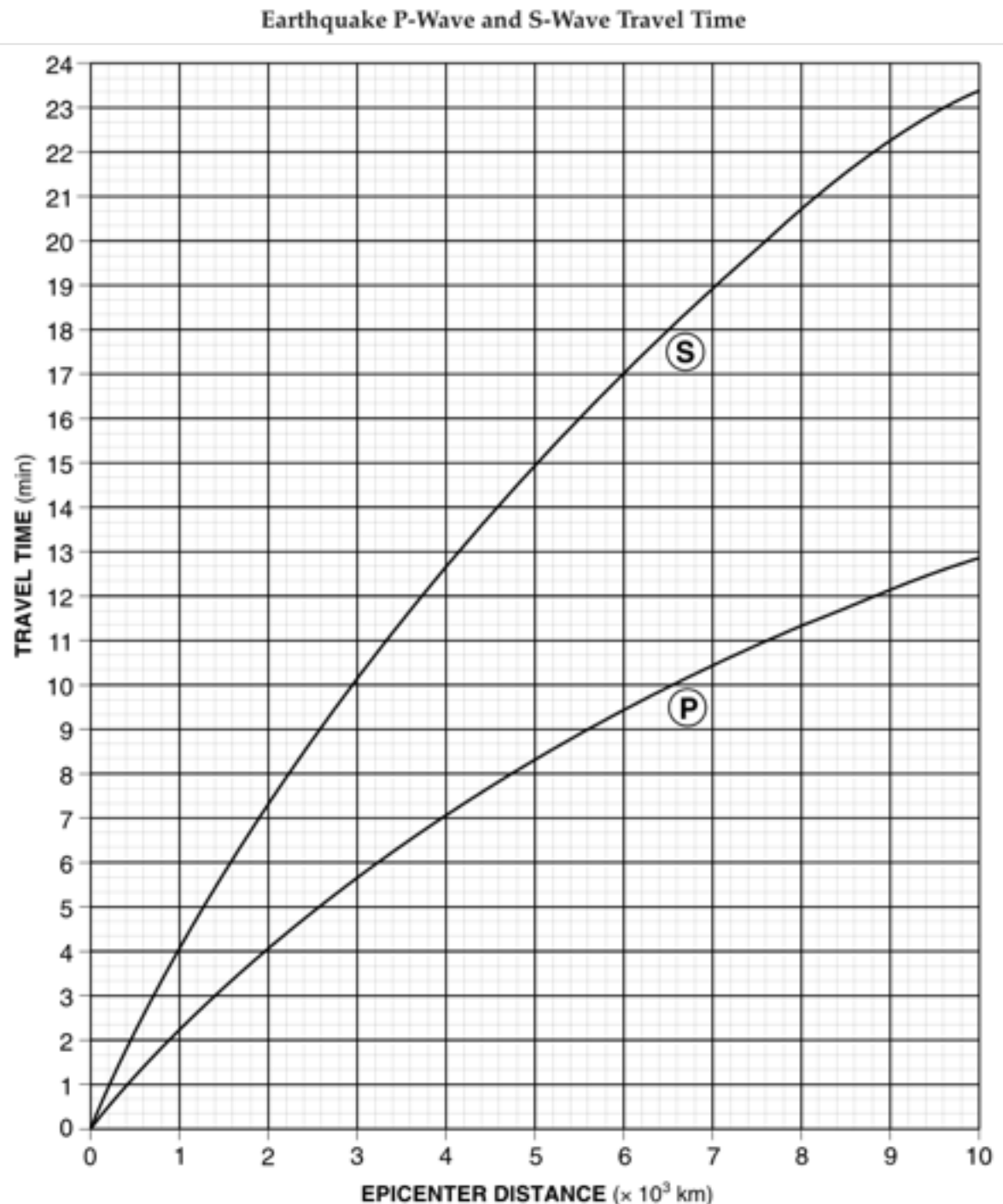
Answer: 2,600 km



2) If you are asked for the **epicenter distance** a P-wave or S-wave traveled for a given travel time:

- Go to the travel time on the y-axis and go over to the correct curve,
- Go down to the x-axis to determine the epicenter distance.

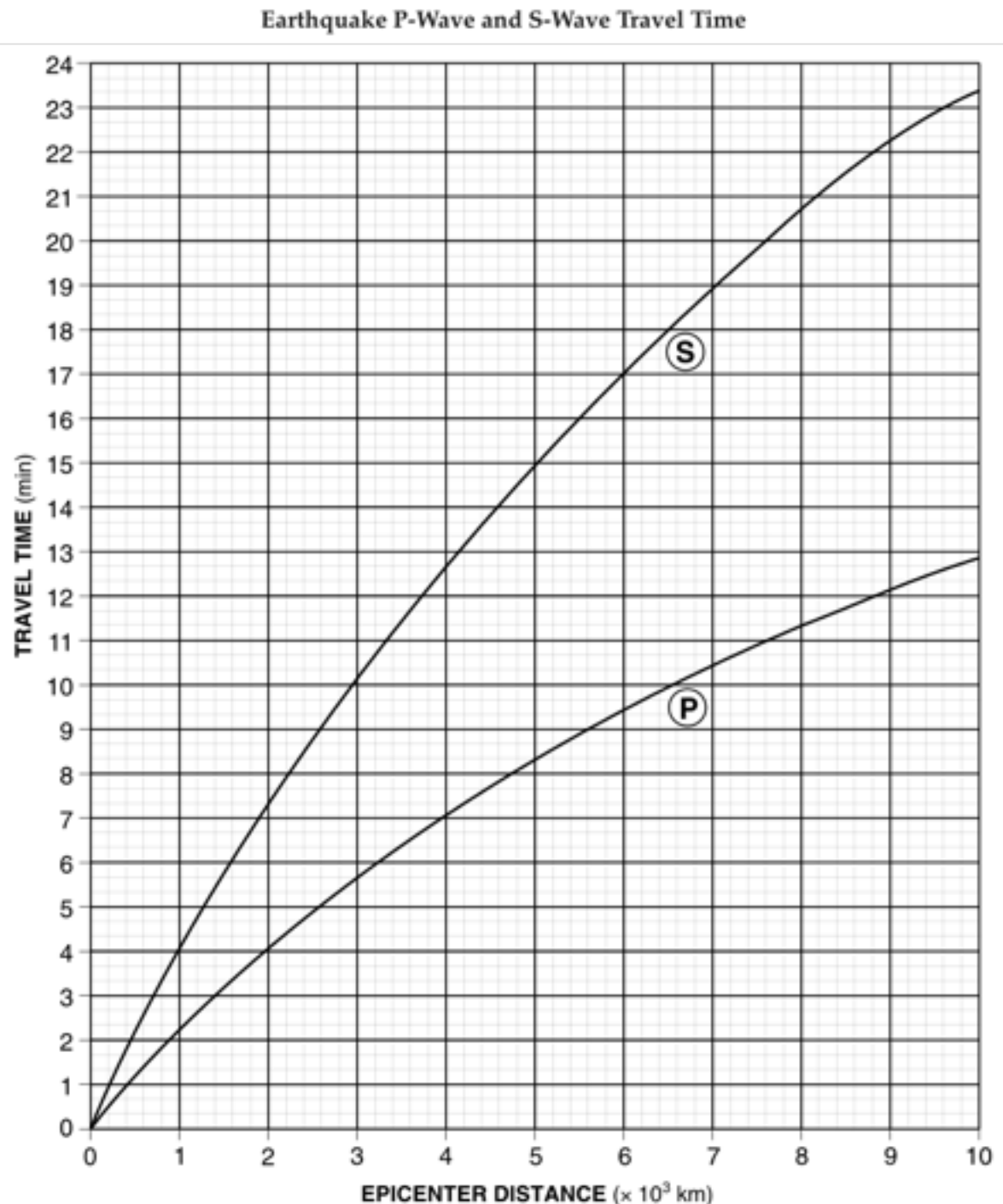
Question 4: How far can an P-wave travel in 9 minutes?



2) If you are asked for the **epicenter distance** a P-wave or S-wave traveled for a given travel time:

- Go to the travel time on the y-axis and go over to the correct curve,
- Go down to the x-axis to determine the epicenter distance.

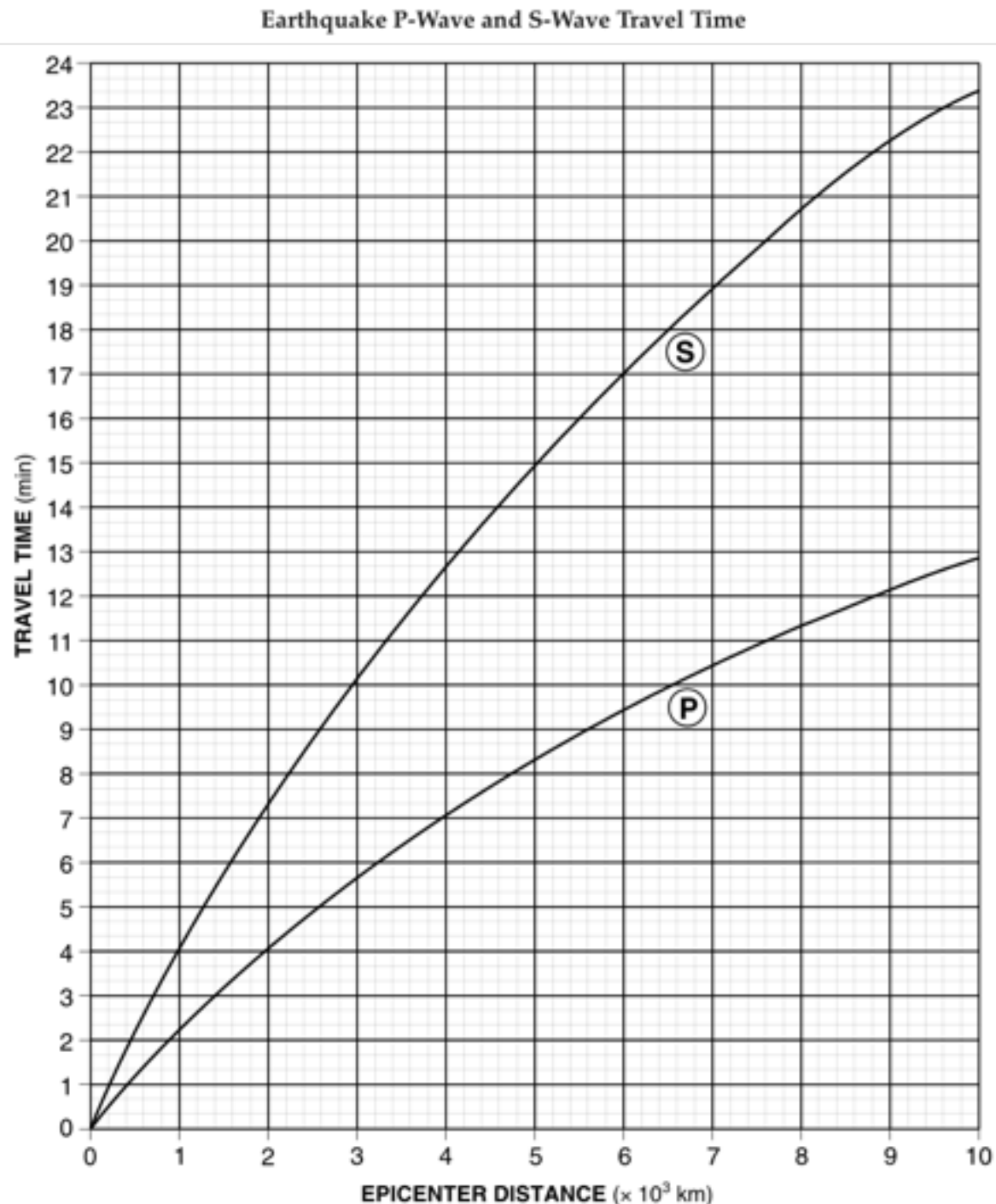
Question 5: How far can an S-wave travel in 6 minutes 40 seconds?



2) If you are asked for the **epicenter distance** a P-wave or S-wave traveled for a given travel time:

- a) Go to the travel time on the y-axis and go over to the correct curve,
- b) Go down to the x-axis to determine the epicenter distance.

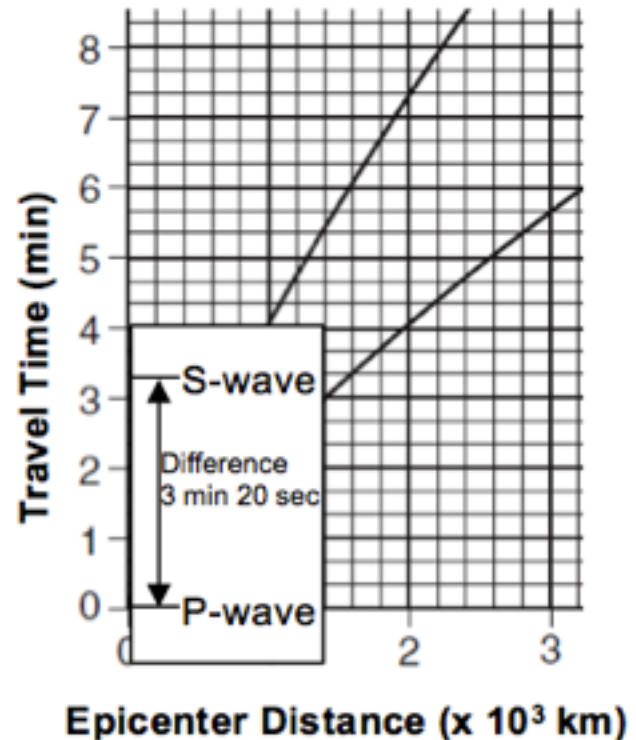
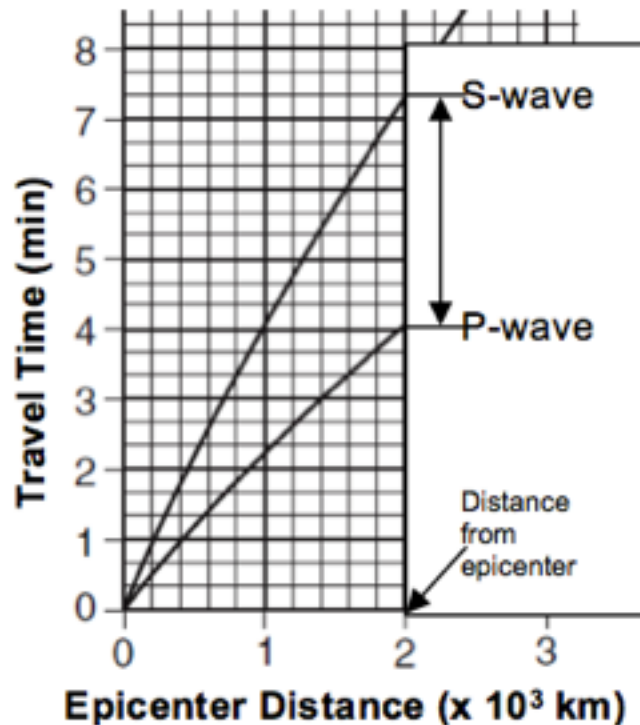
Question 6: How far can a P-wave travel in 6 minutes 40 seconds?



Difference In Arrival Time

5) If you are asked to determine the **difference in arrival time** between P-waves and S-waves:

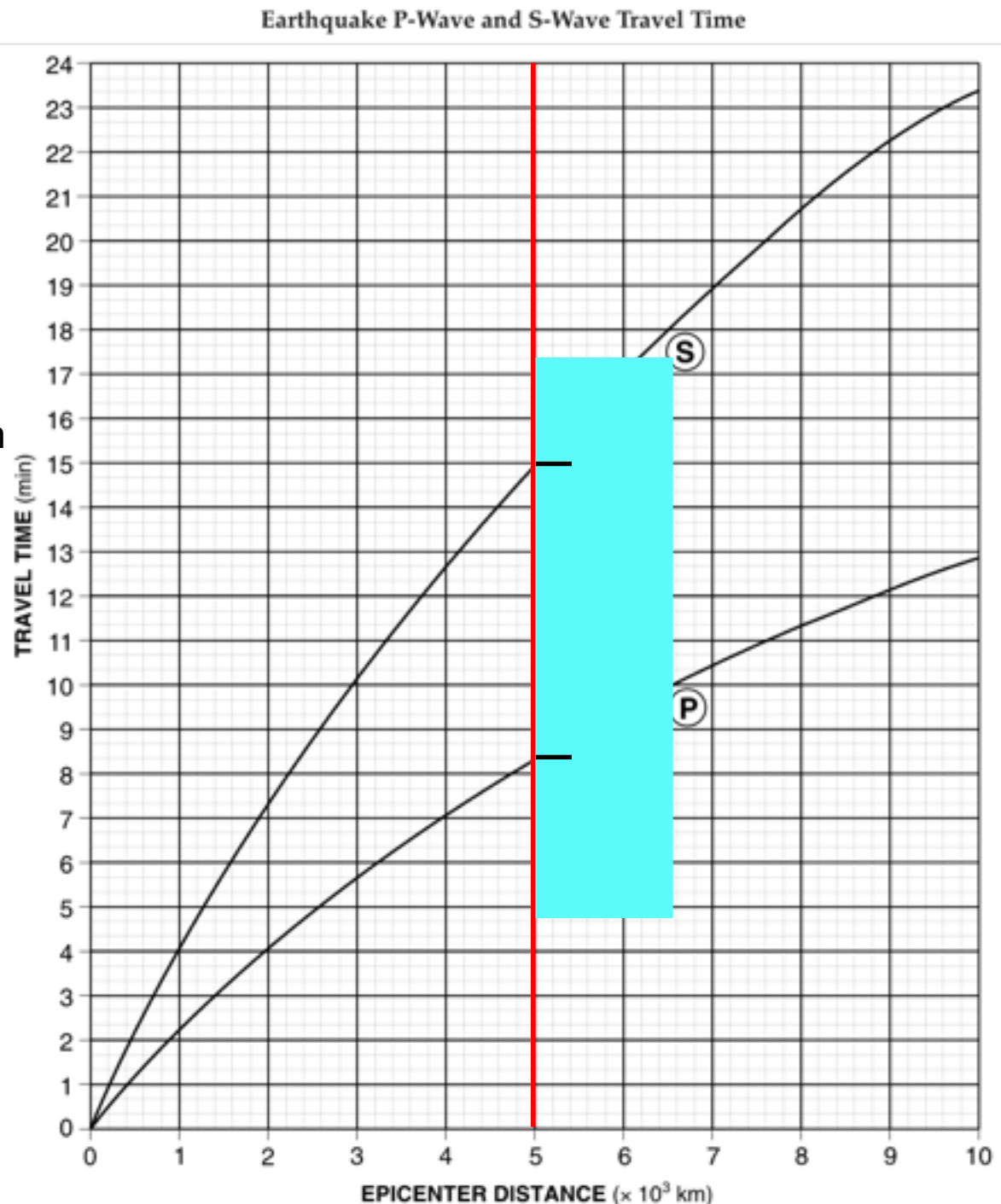
- Line up a piece of scrap paper vertically on the epicenter distance given.
- Mark the locations where the P-wave and S-wave intersect your scrap paper.
- Line up the scrap paper on the y-axis with one point on the 0 minute mark.
- The second mark will indicate the difference in arrival time.



5) If you are asked to determine the **difference in arrival time** between P-waves and S-waves:

- Line up a piece of scrap paper vertically on the epicenter distance given.
- Mark the locations where the P-wave and S-wave intersect your scrap paper.
- Line up the scrap paper on the y-axis with one point on the 0 minute mark.
- The second mark will indicate the difference in arrival time.

Example: An epicenter station is 5,000 km away. How long after the first P-wave did the first S-wave arrive?



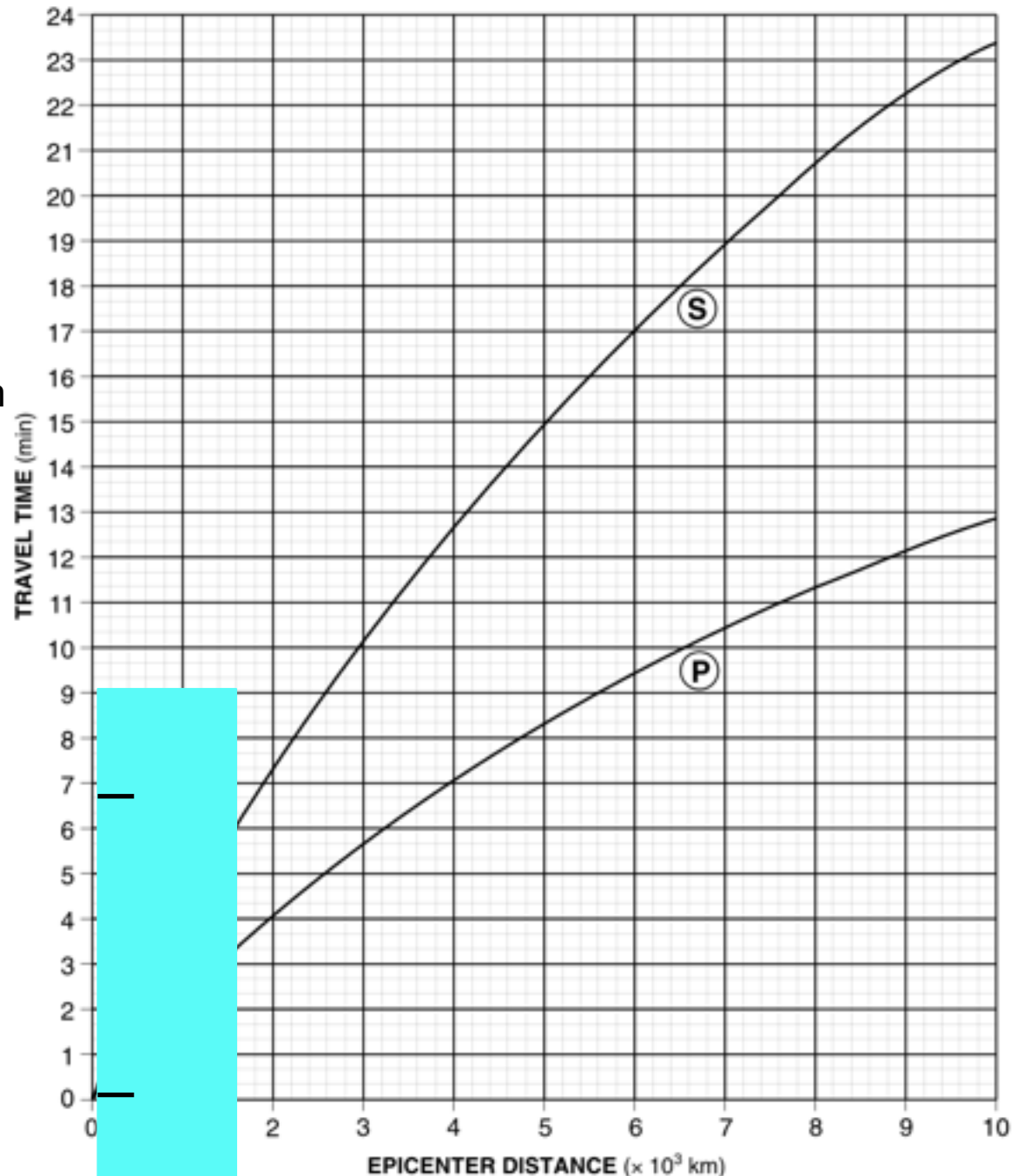
5) If you are asked to determine the **difference in arrival time** between P-waves and S-waves:

- Line up a piece of scrap paper vertically on the epicenter distance given.
- Mark the locations where the P-wave and S-wave intersect your scrap paper.
- Line up the scrap paper on the y-axis with one point on the 0 minute mark.
- The second mark will indicate the difference in arrival time.

Example: An epicenter station is 5,000 km away. How long after the first P-wave did the first S-wave arrive?

Answer: 6 min 40 sec

Earthquake P-Wave and S-Wave Travel Time

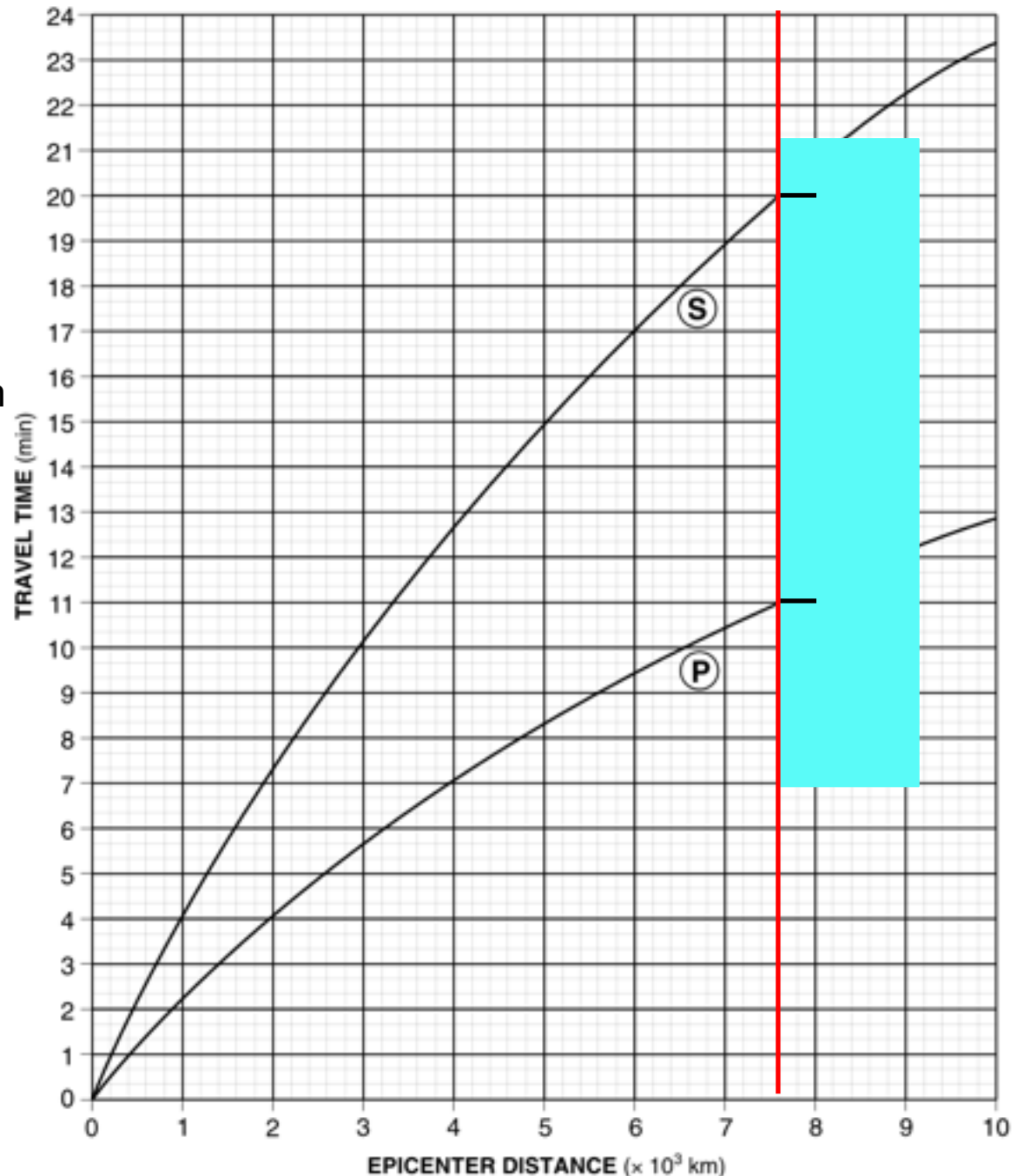


5) If you are asked to determine the **difference in arrival time** between P-waves and S-waves:

- Line up a piece of scrap paper vertically on the epicenter distance given.
- Mark the locations where the P-wave and S-wave intersect your scrap paper.
- Line up the scrap paper on the y-axis with one point on the 0 minute mark.
- The second mark will indicate the difference in arrival time.

Question 6: An epicenter station is 7,600 km away. How long after the first P-wave did the first S-wave arrive?

Earthquake P-Wave and S-Wave Travel Time

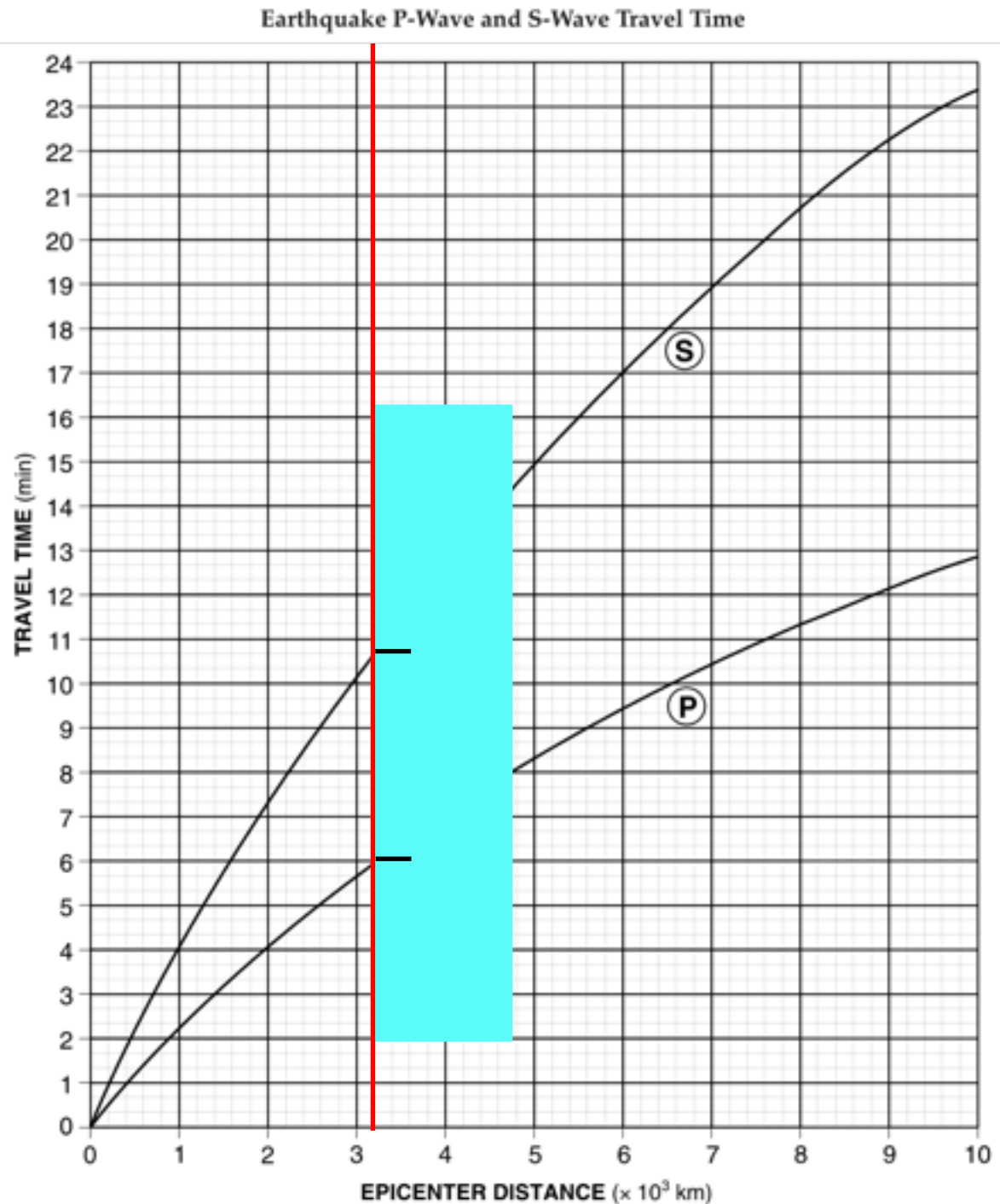


Arrival Time of P & S Wave

6) If you are asked to determine the arrival time of the S-wave and given a clock time for the arrival of the P-wave:

- Find difference in arrival time between P-wave and S-wave at the given epicenter distance.
- Add the difference in arrival time to the clock time of the P-wave.

Example: A P-wave arrived at a seismic station 3,200 km away at 06:10:00. What time did the first S-wave arrive at this station?



Earthquake P-Wave and S-Wave Travel Time

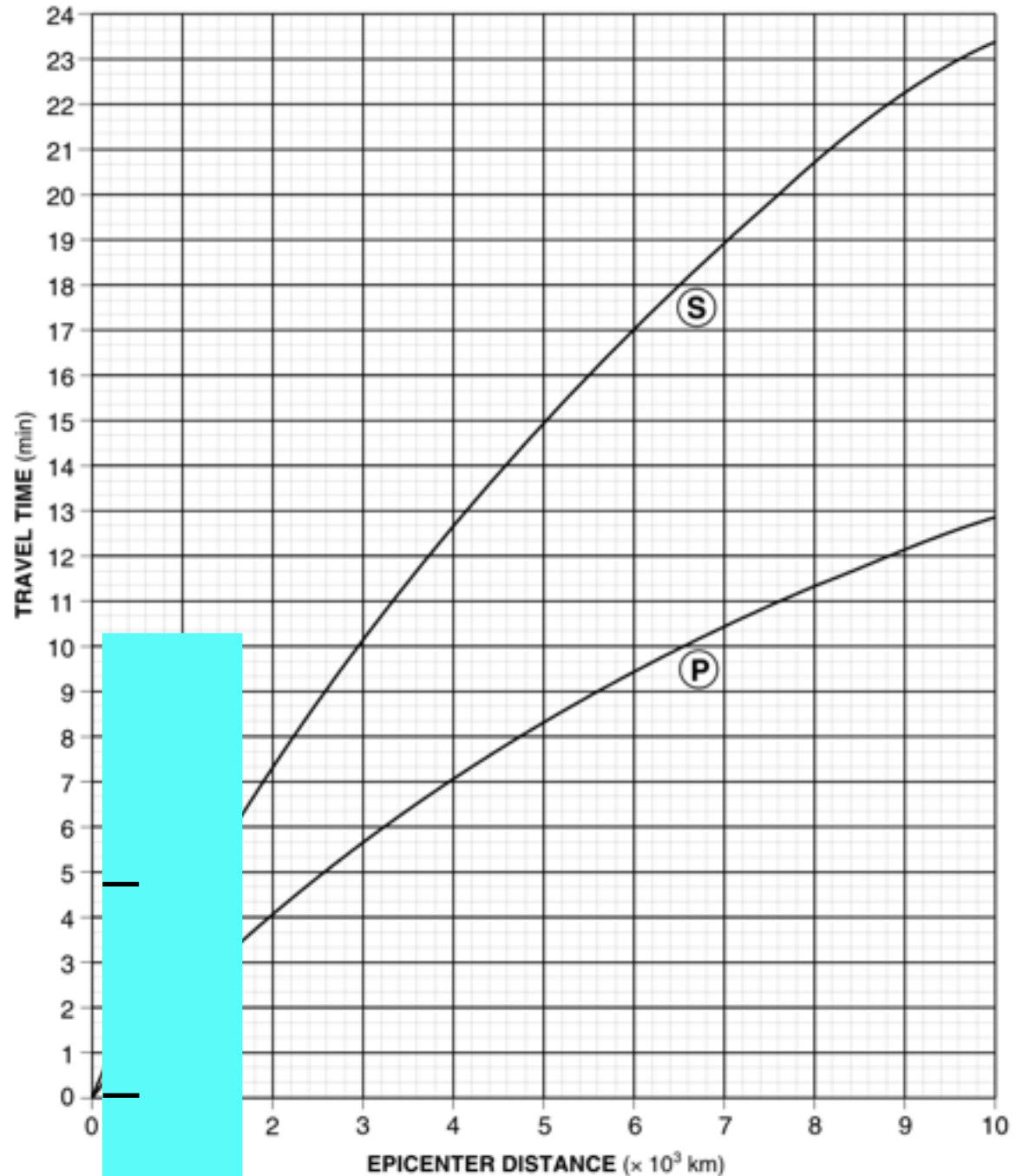
6) If you are asked to determine the arrival time of the S-wave and given a clock time for the arrival of the P-wave:

- Find difference in arrival time between P-wave and S-wave at the given epicenter distance.
- Add the difference in arrival time to the clock time of the P-wave.

Example: A P-wave arrived at a seismic station 3,200 km away at 06:10:00. What time did the first S-wave arrive at this station?

06:10:00
+ 00:04:40

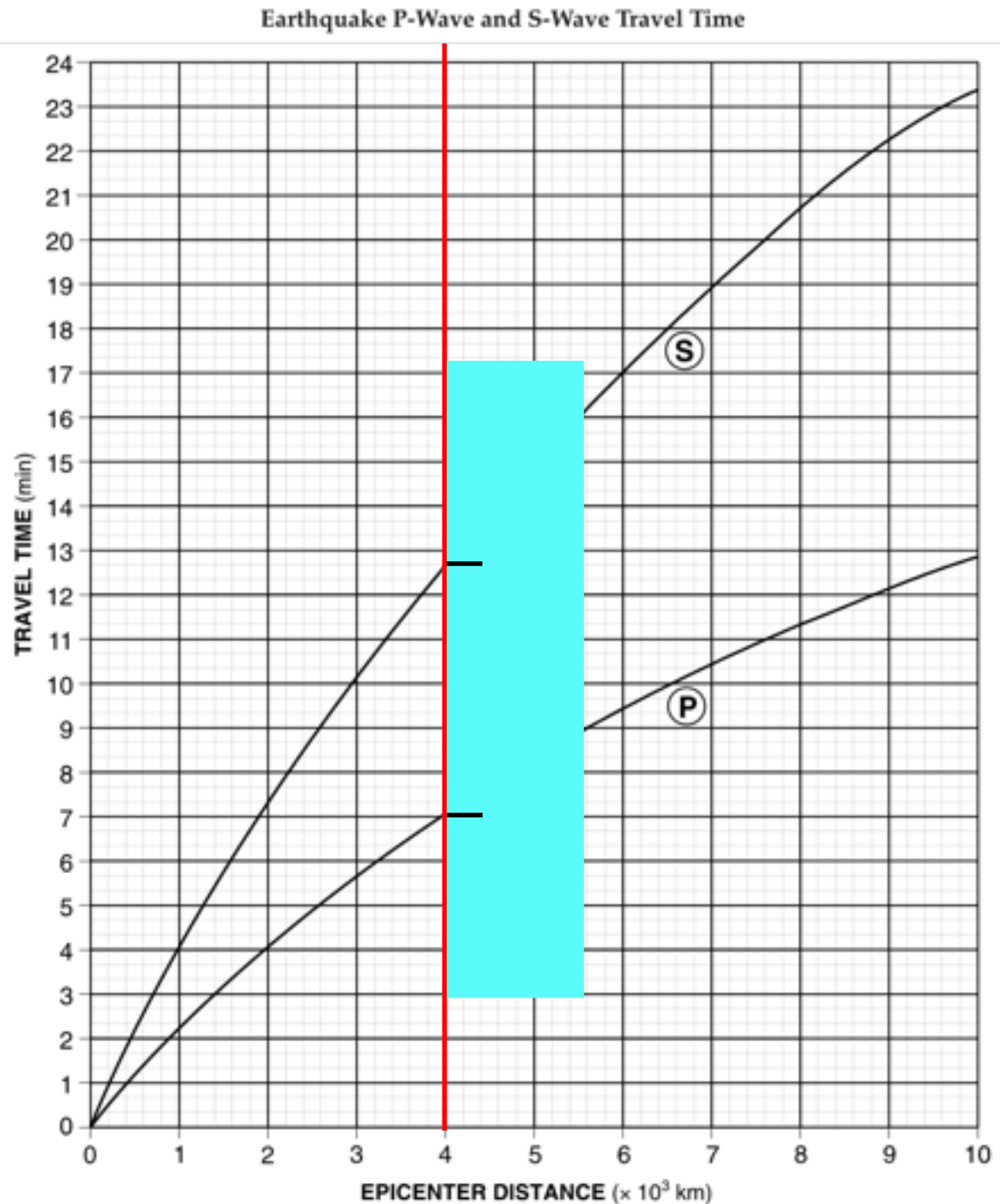
Answer: 06:14:40



6) If you are asked to determine the arrival time of the S-wave and given a clock time for the arrival of the P-wave:

- Find difference in arrival time between P-wave and S-wave at the given epicenter distance.
- Add the difference in arrival time to the clock time of the P-wave.

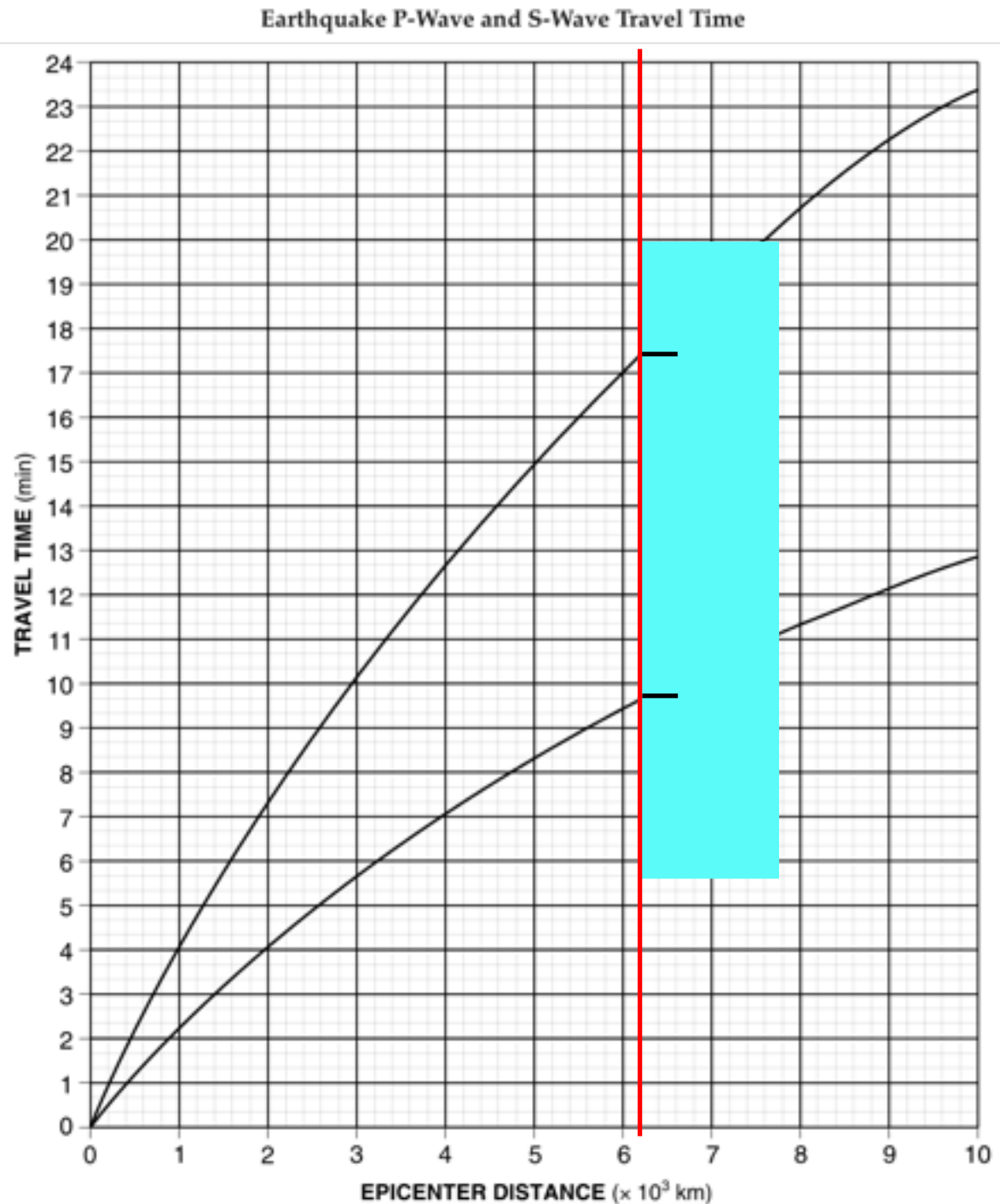
Question 7: A P-wave arrived at a seismic station 4,000 km away at 01:25:00. What time did the first S-wave arrive at this station?



7) If you are asked to determine the arrival time of the P-wave and given a clock time for the arrival of the S-wave:

- Find difference in arrival time between P-wave and S-wave at the given epicenter distance,
- Subtract the difference in arrival time from the clock time of the S-wave.

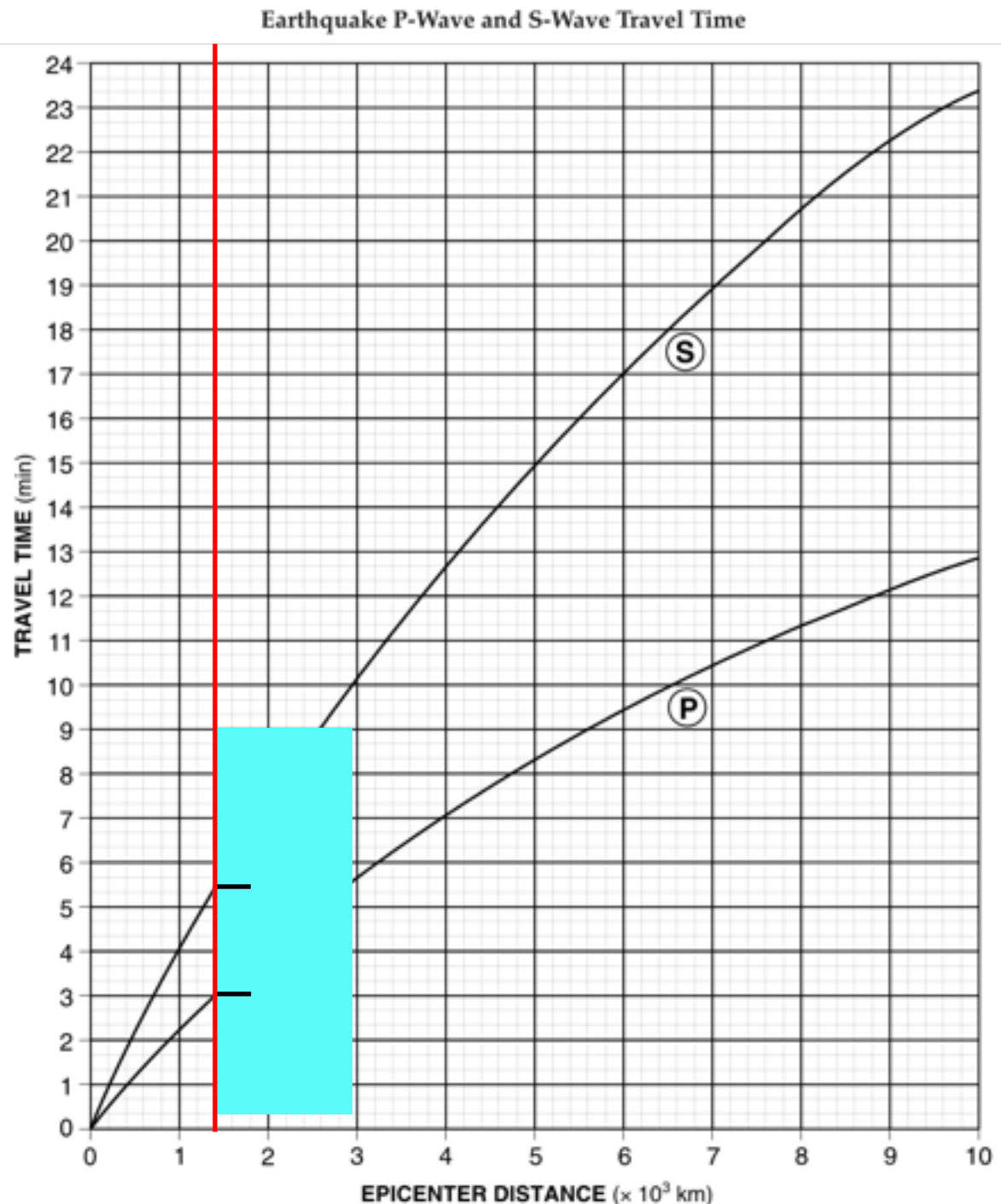
Question 8: An S-wave arrived at a seismic station 6,200 km away at 04:48:00. What time did the first P-wave arrive at this station?



7) If you are asked to determine the arrival time of the P-wave and given a clock time for the arrival of the S-wave:

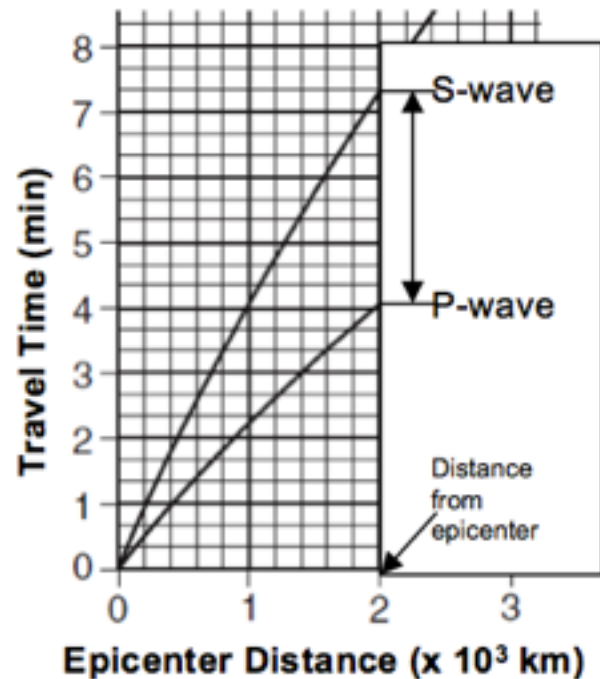
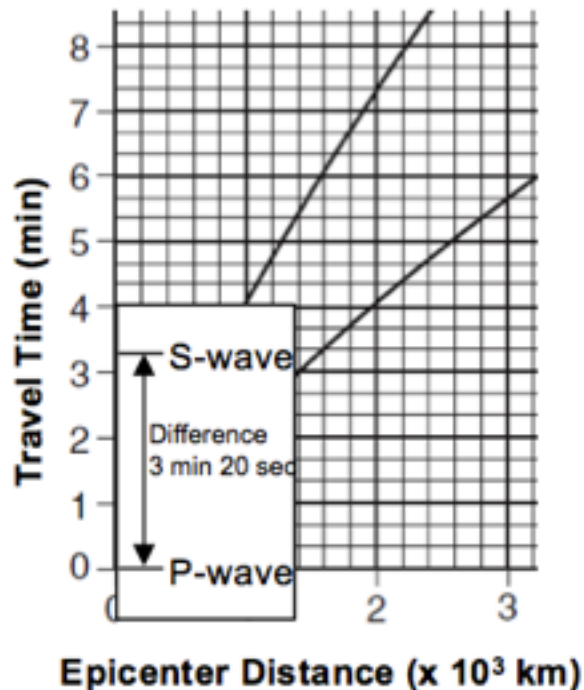
- Find difference in arrival time between P-wave and S-wave at the given epicenter distance,
- Subtract the difference in arrival time from the clock time of the S-wave.

Question 9: An S-wave arrived at a seismic station 1,400 km away at 09:20:40. What time did the first P-wave arrive at this station?



8) If you are asked to determine the **epicenter distance using the difference in arrival time** of P-wave and S-wave:

- Find the difference in clock time between the P-wave and S-wave by subtracting the given times.
- Use the Y-axis (time travel) and use a piece of scrap paper to mark the time difference.
- Place the marked scrap paper between the P-wave and S-wave line on the graph. Slide the scrap paper along the graph to find the location that the interval is touching both P-wave and S-wave line.
- Determine the epicenter distance of this location using the X-axis.



Epicenter Distance Using Difference in Arrival Times

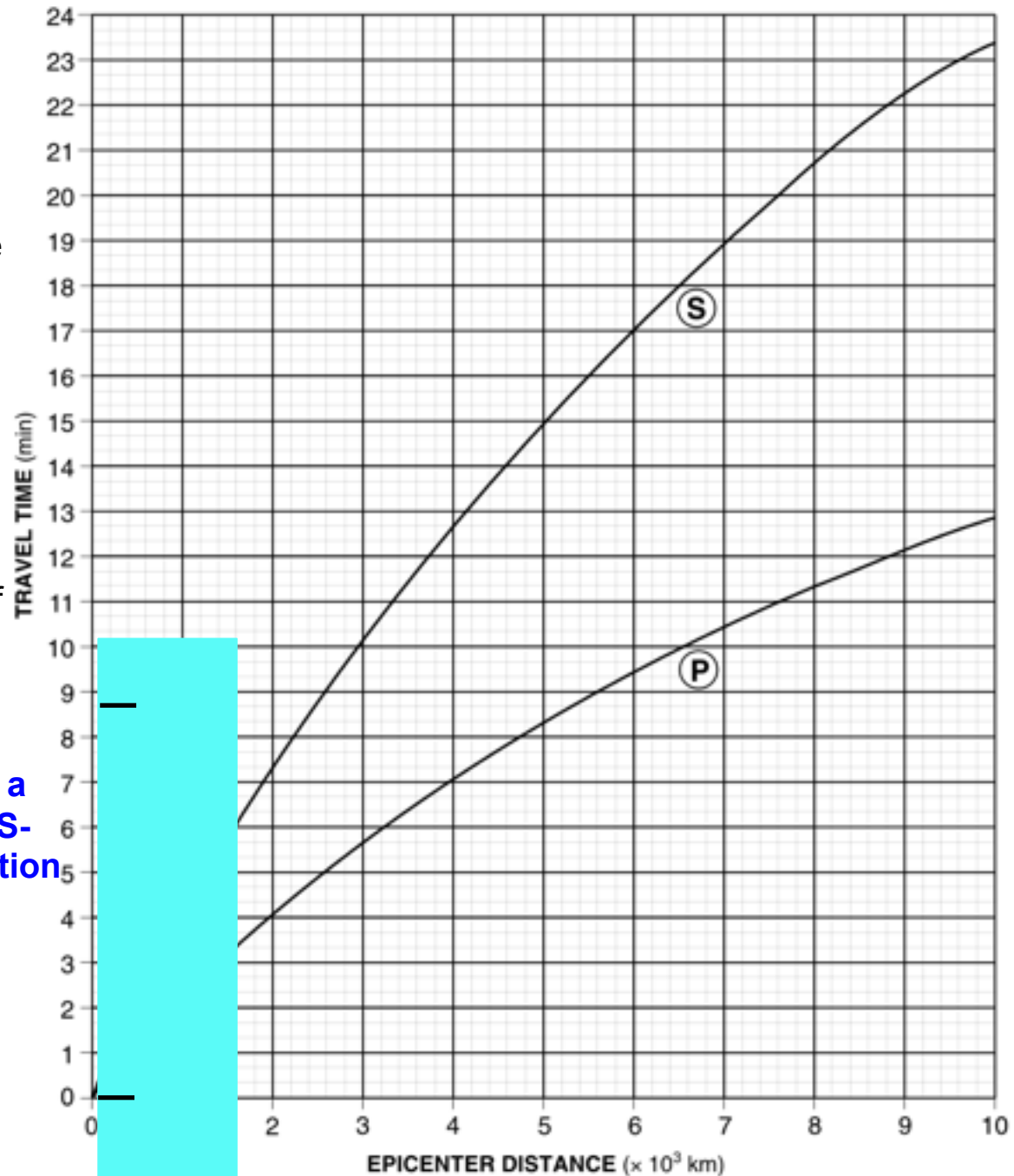
Earthquake P-Wave and S-Wave Travel Time

8) If you are asked to determine the **epicenter distance using the difference in arrival time** of P-wave and S-wave:

- Find the difference in clock time between the P-wave and S-wave by subtracting the given times.
- Use the Y-axis (time travel) and use a piece of scrap paper to mark the time difference.
- Place the marked scrap paper between the P-wave and S-wave line on the graph. Slide the scrap paper along the graph to find the location that the interval is touching both P-wave and S-wave line.
- Determine the epicenter distance of this location using the X-axis.

Example: The first P-wave arrived at a seismic station at 10:00:00. The first S-wave arrived at the same seismic station at 10:08:40. How far is this seismic station from the epicenter?

$$\begin{array}{r}
 10:08:40 \\
 - 10:00:00 \\
 \hline
 00:08:40
 \end{array}$$

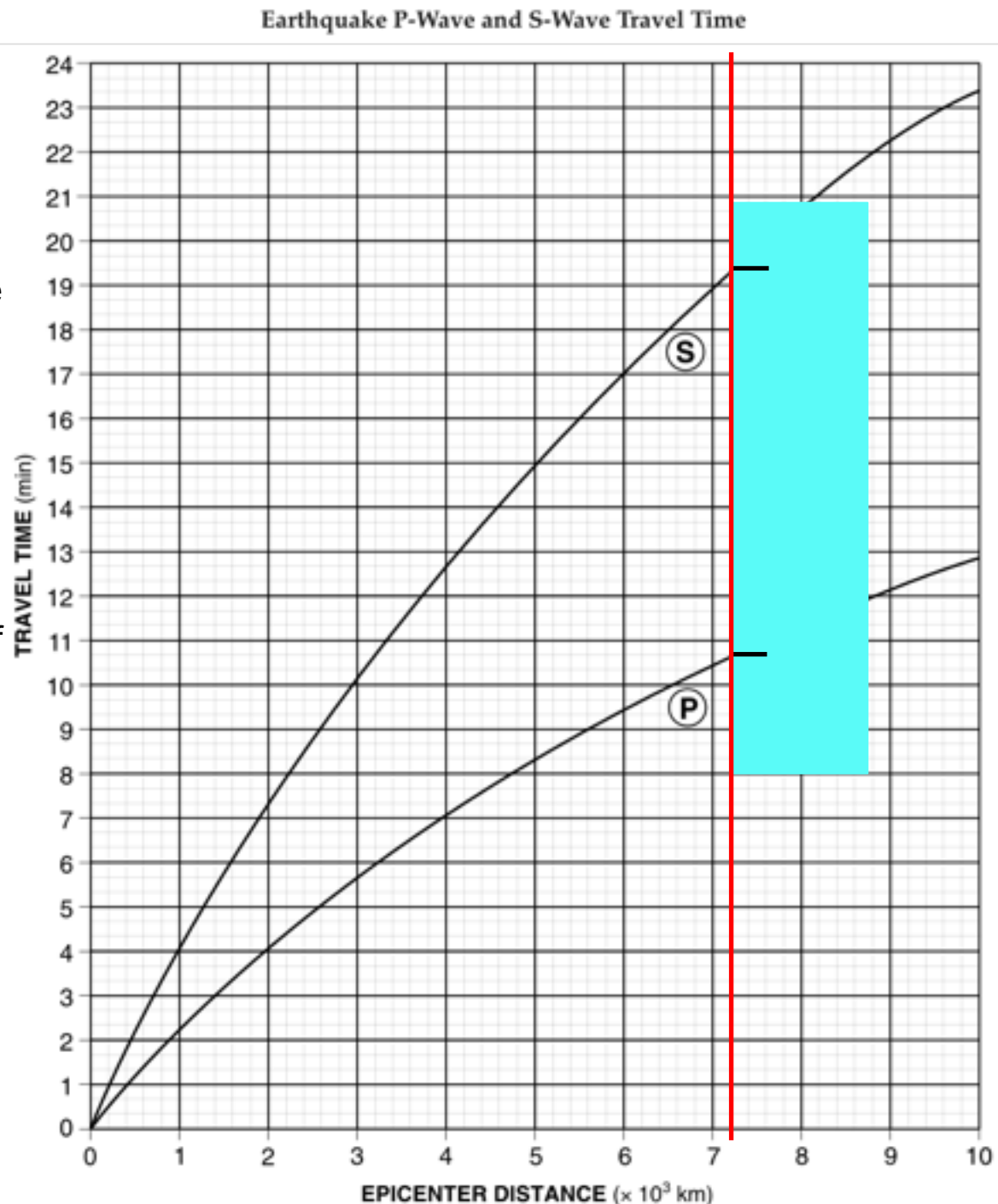


8) If you are asked to determine the **epicenter distance using the difference in arrival time** of P-wave and S-wave:

- Find the difference in clock time between the P-wave and S-wave by subtracting the given times.
- Use the Y-axis (time travel) and use a piece of scrap paper to mark the time difference.
- Place the marked scrap paper between the P-wave and S-wave line on the graph. Slide the scrap paper along the graph to find the location that the interval is touching both P-wave and S-wave line.
- Determine the epicenter distance of this location using the X-axis.

Example: The first P-wave arrived at a seismic station at 10:00:00. The first S-wave arrived at the same seismic station at 10:08:40. How far is this seismic station from the epicenter?

Answer: 7,200 km

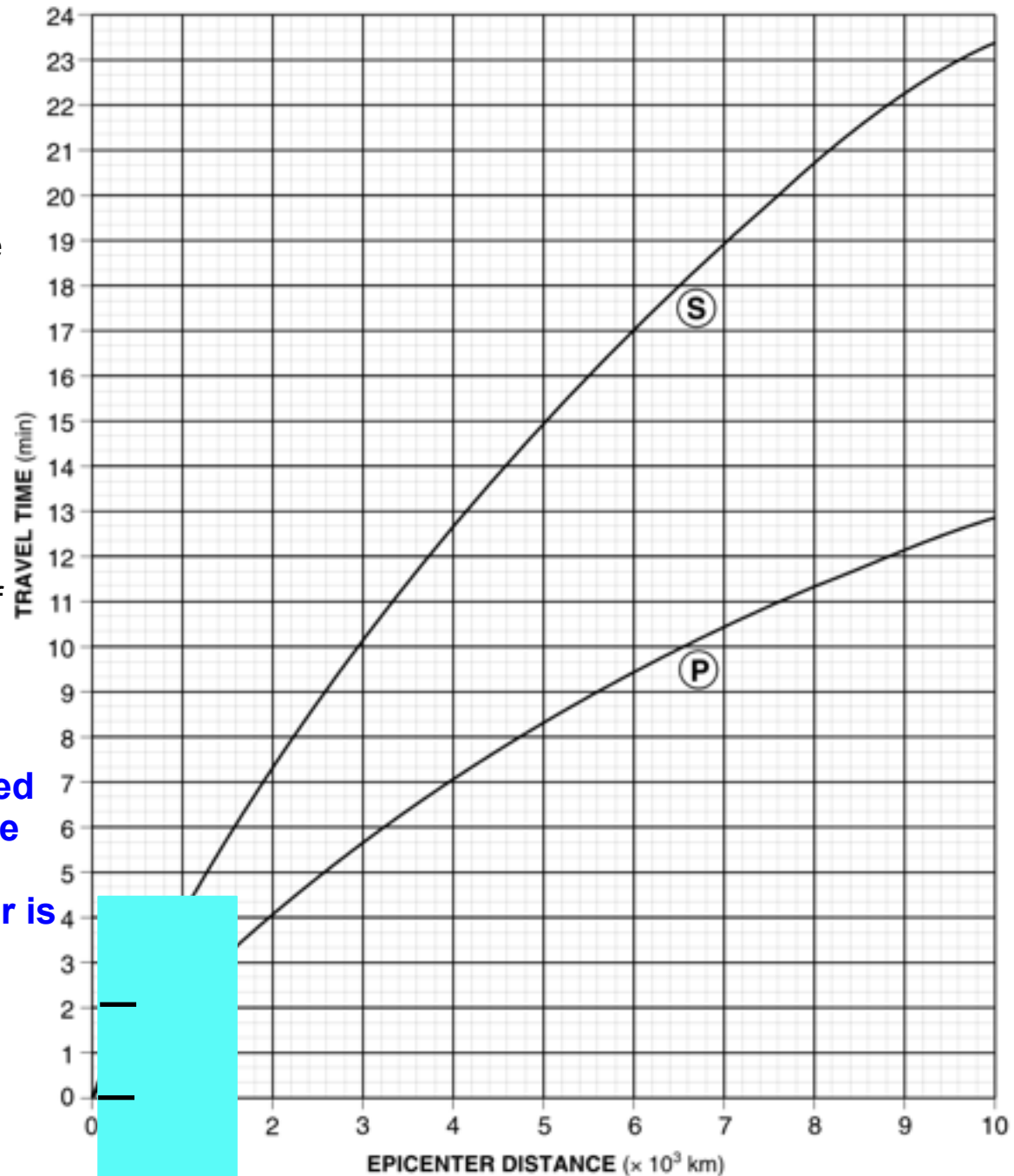


Earthquake P-Wave and S-Wave Travel Time

8) If you are asked to determine the **epicenter distance using the difference in arrival time** of P-wave and S-wave:

- Find the difference in clock time between the P-wave and S-wave by subtracting the given times.
- Use the Y-axis (time travel) and use a piece of scrap paper to mark the time difference.
- Place the marked scrap paper between the P-wave and S-wave line on the graph. Slide the scrap paper along the graph to find the location that the interval is touching both P-wave and S-wave line.
- Determine the epicenter distance of this location using the X-axis.

Question 10: The first P-wave arrived at a seismic station at 06:32:20. The first S-wave arrived at the same seismic station at 06:34:20. How far is this seismic station from the epicenter?



Arrival Time

3) If you are asked for the **arrival time** of an earthquake wave and given an epicenter distance and origin time:

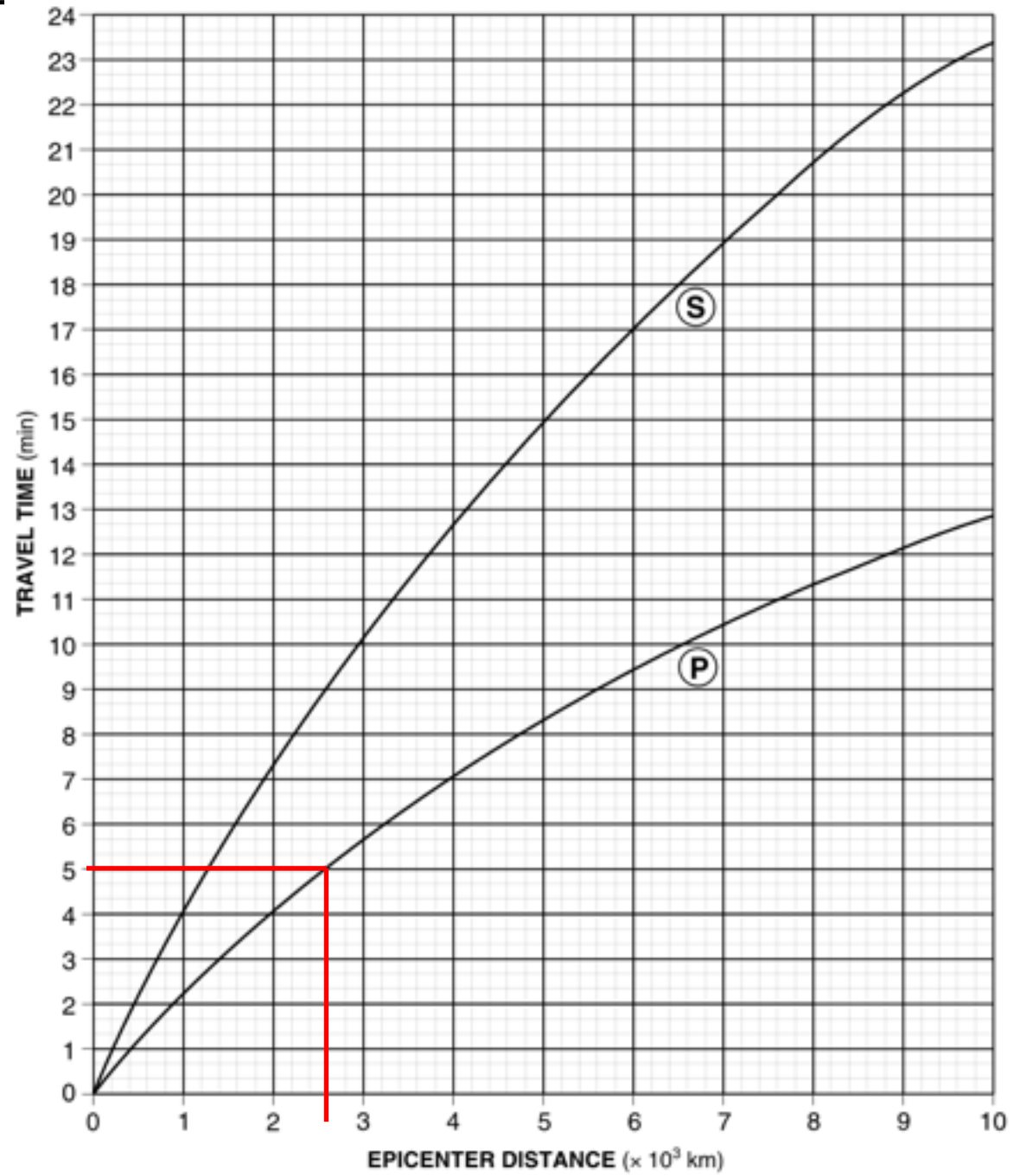
- a) Determine travel time of the wave (see #1)
- b) Add travel time to the origin time given.

Example: If an earthquake occurs at 08:50:40, what time did the P-wave arrive at a seismic station 2,600 km away?

08:50:40
+00:05:00

Answer: 08:55:40

Earthquake P-Wave and S-Wave Travel Time

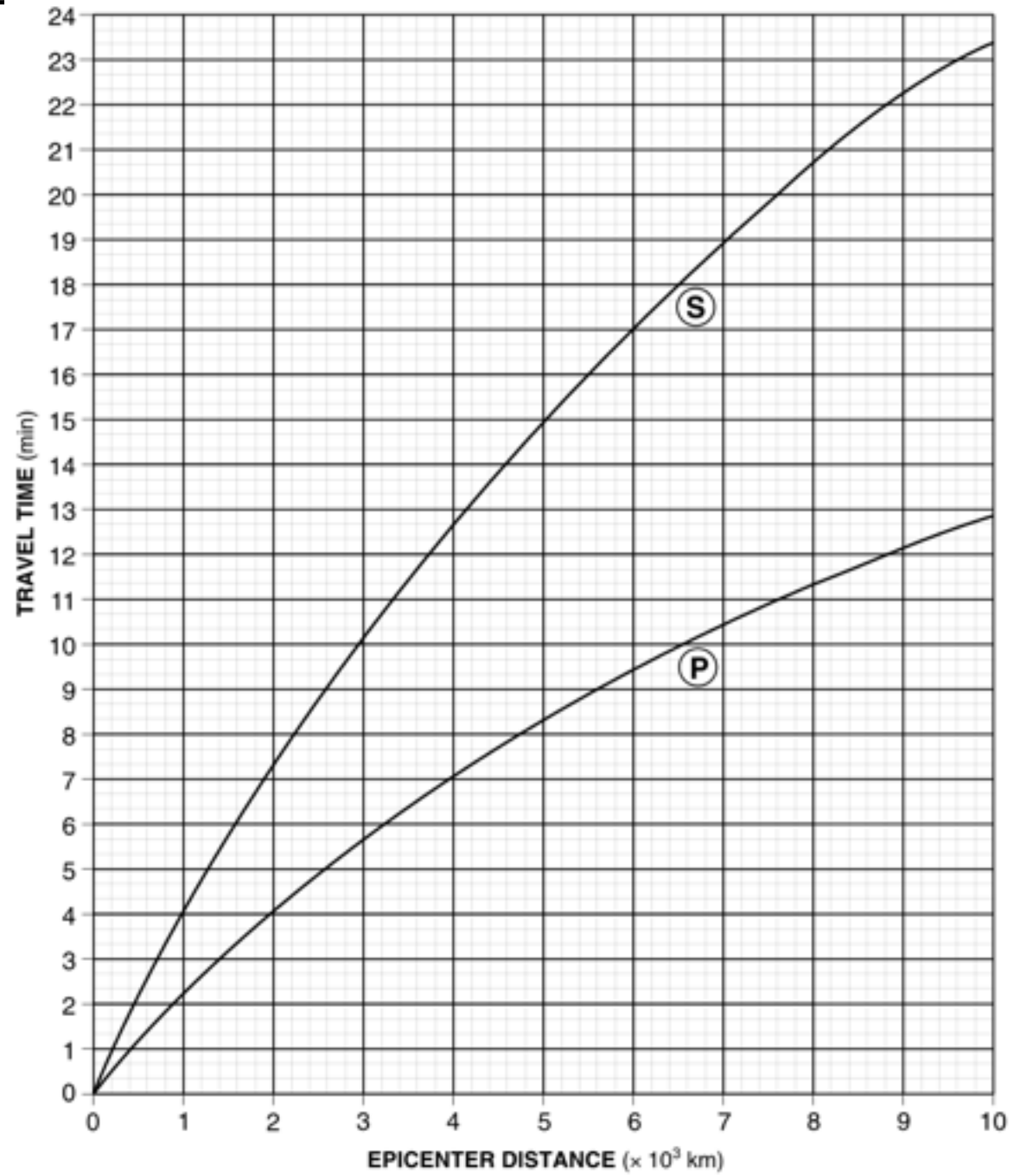


3) If you are asked for the **arrival time** of an earthquake wave and given an epicenter distance and origin time:

- a) Determine travel time of the wave (see #1)
- b) Add travel time to the origin time given.

Question 11: If an earthquake occurs at 02:11:20, what time did the S-wave arrive at a seismic station 9,000 km away?

Earthquake P-Wave and S-Wave Travel Time



Origin Time

4) If you are asked for the **origin time** (the time an earthquake occurred):

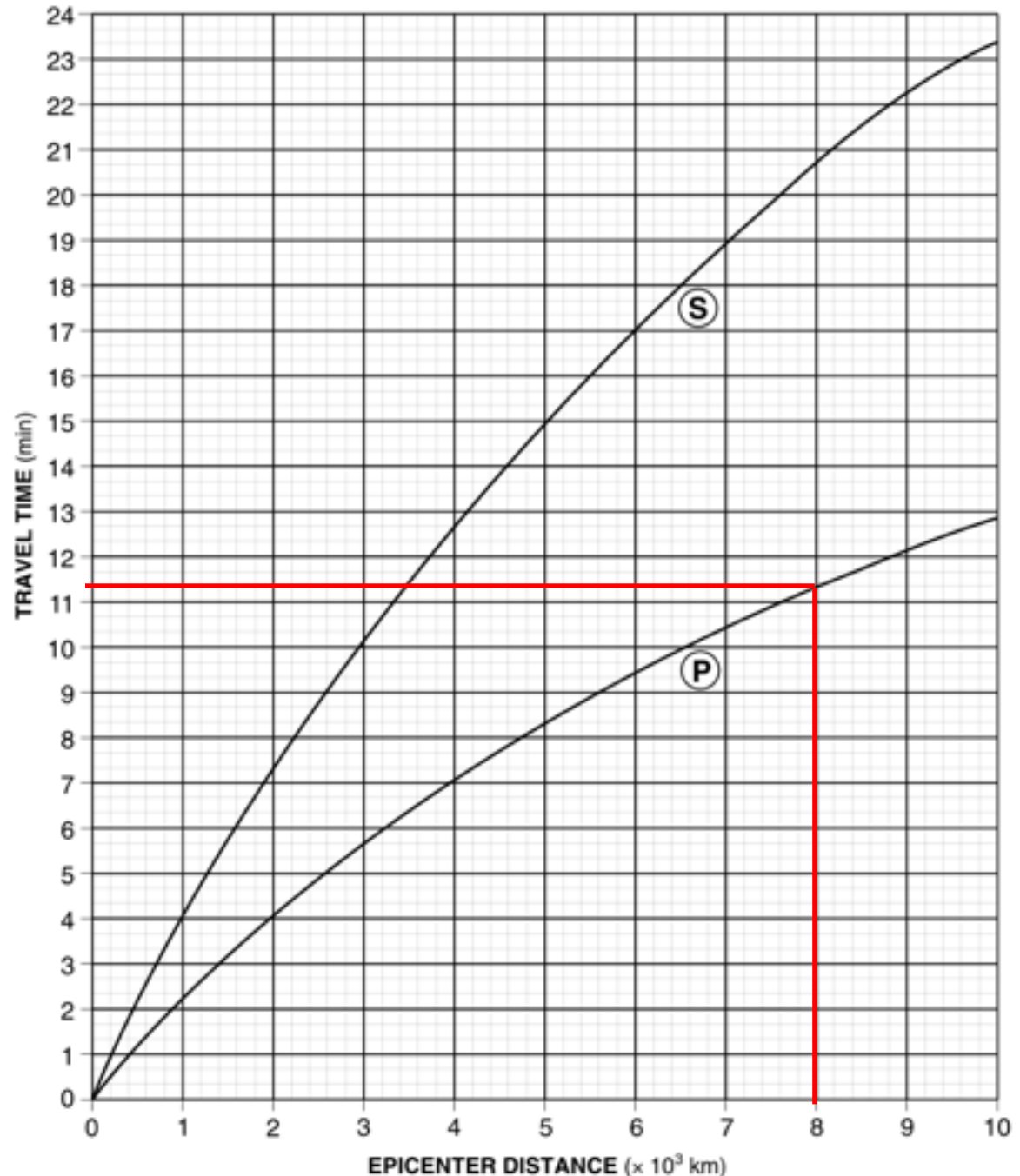
- Determine the travel time of the given wave (see #1)
- Subtract arrival time you were given minus the travel time.

Example: If a P-wave arrives at a station 8,000 km away at 12:15:00, what time did the earthquake originate?

12:15:00
- 00:11:20

Answer: 12:03:40

Earthquake P-Wave and S-Wave Travel Time



4) If you are asked for the **origin time** (the time an earthquake occurred):

- Determine the travel time of the given wave (see #1)
- Subtract arrival time you were given minus the travel time.

Question 12: If an S-wave arrives at a station 4,400 km away at 07:45:00, what time did the earthquake originate?

Earthquake P-Wave and S-Wave Travel Time

