

Exercise 309

The 1906 earthquake in San Francisco had a magnitude of 8.3 on the Richter scale. At the same time, in Japan, an earthquake with magnitude 4.9 caused only minor damage. Approximately how much more energy was released by the San Francisco earthquake than by the Japanese earthquake? See the definition of Richter Scale in [link] in this section.

Solution

The definition of the Richter Scale is given in Example 1.39.

$$R_1 - R_2 = \log_{10} \left(\frac{A_1}{A_2} \right)$$

Let earthquake 1 be the one in San Francisco and let earthquake 2 be the one in Japan so that the difference $R_1 - R_2$ is positive.

$$8.3 - 4.9 = \log_{10} \left(\frac{A_1}{A_2} \right)$$

$$3.4 = \log_{10} \left(\frac{A_1}{A_2} \right)$$

The base is 10, the exponent is 3.4, and the result is A_1/A_2 .

$$10^{3.4} = \frac{A_1}{A_2}$$

Solve for A_1 .

$$A_1 = 10^{3.4}A_2 \approx 2512A_2$$

Therefore, the San Francisco earthquake had 2512 times more energy than the one in Japan.