

40 Seconds that Shook L.A.

At 4:31 Monday morning an earthquake registering 6.6 on the Richter scale jolted residents of Los Angeles from their sleep. It was not The Big One, but it left at least 55 people dead, brought down major freeways and destroyed or damaged thousands of homes. Source: Chicago Tribune Newspaper 1994

Richter Value	Description
1	cannot be felt except by instruments
2	cannot be felt except by instruments
3	cannot be felt except by instruments
4	like vibrations from a passing train
5	strong enough to wake sleepers
6	very strong; walls crack, people injured
7	ruinous; ground cracks, houses collapse
8	very disastrous; few buildings survive, landslides

The Richter Scale is a measurement that can be used to compare earthquake magnitudes based on the formula:

$$R = \log\left(\frac{x}{0.001}\right) \quad \text{where} \quad R = \text{the Richter scale value}$$

$x = \text{the intensity (strength) of an earthquake as registered on a seismograph}$

Note that the Richter value, R, is a logarithm which means that it is an exponent (where the base is 10).

Objective: Given two Richter values you will be able to find how much greater in intensity one earthquake is as compared to the other.

ex.1) If earthquake 1 has a value of $R = 5$ and earthquake two has a value $R = 8$, how much greater in intensity was the second earthquake compared to the first earthquake?

Method 1 (long way of doing it): $R = \log\left(\frac{x}{0.001}\right)$ gives $x = 100$ and $R = \log\left(\frac{x}{0.001}\right)$ gives $m = 100,000$
dividing 100,000 by 100 gives an answer of 1000

Method 2 (faster, shortcut way): subtract $8 - 5$ (the exponents) and raise 10 to that answer, i.e. $10^{(8 - 5)} = 1000$

I. Answer the following:

- 1) The 1994 L.A. earthquake had a Richter value of 6.6. One day later L.A. had after shocks with an $R = 4.6$. How much greater in intensity was the original earthquake compared to the after shock? 1) 100
- 2) The 1964 Alaskan earthquake was calculated to be 8.3 on the Richter scale. How much greater in intensity was the Alaskan earthquake than the 1994 L.A. earthquake? 2) 50.1
- 3) The highest Richter value ever calculated was 8.9 in 1905 off Columbia, South America and also in 1933 in Japan. How much greater in intensity were these earthquakes as compared to the 1994 L.A. earthquake? 3) 199.5

II. Answer the following:

- 1) A psychic predicted that "The Big One" (earthquake) would hit L.A. in the 21st century in the same year as the Richter value of the earthquake. The psychic gave a clue as to when this earthquake would occur by stating that the earthquake would be 2511.89 stronger than the L.A. after shocks. Recall that the L.A. after shock had a Richter value of 4.6.
 - a) In what year did the psychic think the earthquake would occur? 1a) 2008
(Solve algebraically showing all work.)
 $\log 2511.89 = 3.4 \quad 3.4 + 4.6 = 8$
 - b) What is the difference in Richter values between the L.A. after shock and "The Big One" as predicted by the psychic? 1b) 25.1