8. (18 points) The Richter magnitude, R, of an earthquake of intensity I is given by

$$R = \log\left(\frac{I}{I_0}\right),$$

where I_0 is the intensity of a certain "standard" earthquake.

a. The 2008 Chino Hills earthquake had a Richter magnitude of 5.4. What was its intensity (in terms of I_0)?

$5.4 = \log\left(\frac{I}{I_0}\right)$

$\log(5.4) \log\left(\frac{5.4}{I_0}\right)$

The intensity equals $\log\left(\frac{5.4}{I_0}\right)$

-5

b. What is the Richter magnitude of an earthquake whose intensity is 2 million times the intensity of the standard earthquake?

$R = \log\left(\frac{2 \times 10^6 I_0}{I_0}\right)$

Plug in calc

$= \log(2 \times 10^6)$

The magnitude is $= 2000000\, I$

-5

c. The 1999 California Hector Mine earthquake was initially reported to have a magnitude of 7.0. The *Los Angeles Times* reported that this was "three times more powerful" than the 1994 Northridge quake, which had a magnitude of 6.7. Was the newspaper correct?

To find out, $I_0 = \frac{7.0}{6.7} = 1.044$

-4

You can solve for both intensities

$6.7 = \log\left(\frac{I}{I_0}\right)$

$10^{6.7} = \frac{I}{I_0}$

$I = 10^{6.7}$ $\frac{I}{I_0} = 5$

$7 = \log\left(\frac{I}{I_0}\right)$

-14 $I - 10^7 I_0 = 1000000$

In the newspaper was not correct.

$R = \log\left(\frac{I}{I_0}\right)$

$R = \log\left(\frac{3I}{I_0}\right)$

$= \log 3 + \log\left(\frac{I}{I_0}\right)$

$= 0.477 + 6.7$