

7, Functions, equations and inequalities (2 points)

Earthquake Magnitude. The magnitude R , measured on the Richter scale, of an earthquake of intensity I is defined as

$$R = \log \frac{I}{I_0},$$

Where I_0 is a minimum intensity used for comparison. We can think of I_0 as a threshold intensity that is the weakest earthquake that can be recorded on a seismograph. If one earthquake is 10 times as intense as another, its magnitude on the Richter scale is 1 greater than that of the other. If one earthquake is 100 times as intense as another, its magnitude on the Richter scale is 2 higher, and so on. Thus an earthquake whose magnitude is 7 on the Richter scale is 10 times as intense as an earthquake whose magnitude is 6. Earthquake intensities can be interpreted as multiples of the minimum intensity I_0 .

The earthquake in Ahmadabad, India, on January 26, 2001, had an intensity of $10^{7.9} \times I_0$. What was its magnitude on the Richter scale?

8, Elementary financial mathematics (2 points)

Saving for College. Following the birth of twins, the grandparents deposit \$16,000 in a college trust fund that earns 4.2% interest, compounded quarterly.

- Find a function for the amount in the account after t years.
- Find the amount of money in the account at $t = 0, 6, 12,$ and 18 yr.

9, Functions, equations and inequalities (2 points)

Area of the Peace Monument. Through the Mentoring in the City Program sponsored by Marian College, in Indianapolis, Indiana, children have turned a vacant downtown lot into a monument for peace.* This community project brought together neighbourhood volunteers, businesses, and government in hopes of showing children how to develop positive, nonviolent ways of dealing with conflict. A landscape architect† used the children's drawings and ideas to design a triangular shaped peace garden. Two sides of the property, formed by Indiana Avenue and Senate Avenue, measure 182 ft and 230 ft, respectively, and together form a 44.7° angle. The third side of the garden, formed by an apartment building, measures 163 ft. What is the area of this property?

10, Combinatory (2 points)

- How many 5-letter code symbols can be formed with the letters A, B, C, and D if we allow a letter to occur more than once?
- How many distinguishable code symbols can be formed from the letters of the word BUSINESS? BIOLOGY? MATHEMATICS?
- A professor is going to grade her 24 students on a curve. She will give 3 A's, 5 B's, 9 C's, 4 D's, and 3 F's. In how many ways can she do this?
- Phone Numbers.* How many 7-digit phone numbers can be formed with the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9, assuming that the first number cannot be 0 or 1? Accordingly, how many telephone numbers can there be within a given area code, before the area needs to be split with a new area code?