The length of human pregnancies from conception to birth varies according to a distribution that is approximately normal with mean 266 days and standard deviation 14 days. Suppose that a random sample of 49 pregnant women were obtained and the average length of pregnancy was recorded as 265 days.

1. **Clearly, with detail, and using appropriate labeling notation**, sketch the distribution of the length of human pregnancies by hand.

   \[ \mu = 266 \]
   \[ \sigma = 14 \]

   ![Distribution of length of human pregnancies](image)

   Length of pregnancy in days

   224 238 252 266 280 294 308

2. **Clearly, with detail, and using appropriate labeling notation**, sketch by hand the distribution of the mean lengths of human pregnancies obtained from random samples of 49 pregnant women.

   \[ \mu(\bar{x}) = \mu = 266 \]
   \[ SD(\bar{x}) = \sigma \div \sqrt{n} = \frac{14}{\sqrt{49}} = 2 \]

   ![Distribution of mean lengths of human pregnancies](image)

   Average pregnancy length of 49 women

   260 262 264 266 268 270 272
3. Use your calculator to answer the following questions. Round your answers to four decimal places. Don’t put down just answers, i.e., *show all work!*

a) What is the probability that a random pregnancy lasts between 200 and 300 days?

   **ANSWER:** X distribution
   
   \[
   \text{normalcdf}(200, 300, 266, 14) = 0.9924 \text{ or } 99.24\%
   \]

b) What percent of mean pregnancy lengths from samples last more than 270 days?

   **ANSWER:** \( \bar{X} \) distribution
   
   The “mean pregnancy lengths from samples” is referring to the sample means or \( \bar{X} \) numbers.
   
   \[
   \text{normalcdf}(270, 1\times10^9, 266, 2) = 0.02275 \text{ or } 2.275\%
   \]

c) How long do the shortest 10% of pregnancies last? Remember to use units of measure in your answer.

   **ANSWER:** X distribution
   
   \[
   \text{Invnorm}(0.10, 266, 14) = 248.058
   \]
   
   The shortest 10% of pregnancies last 248 days or less.

d) What is the z-score for the mean pregnancy length derived from the sample at the beginning of this quiz (in the paragraph before question 1)?

   **ANSWER:** \( \bar{X} \) distribution
   
   The mean pregnancy length at the beginning is “265 days” which refers to the “sample of 49 pregnant women.” Therefore 265 is the value of just one \( \bar{X} \) number. Its z-score is
   
   \[
   z = \frac{(\bar{X} - \mu)}{\left(\frac{\sigma}{\sqrt{n}}\right)} = \frac{(265 - 266)}{\left(\frac{14}{\sqrt{49}}\right)} = \frac{-1}{2} = -0.5
   \]

e) What proportion of samples have an average pregnancy length lasting less than 250 days?

   **ANSWER:** \( \bar{X} \) distribution
   
   “samples have an average pregnancy length” refers to the sample means or \( \bar{X} \) numbers.

   The word “proportion” in the question is misleading. Replace it with “percent” and rereading it makes more sense.

   \[
   \text{normalcdf}(-1\times10^9, 250, 266, 2) = 0
   \]
   
   This answer makes sense if you look at the \( \bar{X} \) distribution. There we see that 250 is 8 standard deviations below the mean!