

Normal Random Variables

5.3 Finding Percentiles of the Normal Curve (Using the Table in Reverse)

1. In 2010, the Bureau of Labor Statistics in the United States completed a time-use survey. The survey revealed that the average American watches 2.7 hours of TV per day. The standard deviation is 1.3 hours per day. Assume the amount of TV watched per day is normally distributed, and find the number of hours of TV watched per day by Americans in the 10th percentile (i.e.-the ten percent of the population with the lowest amount of time spent in front of the TV).
2. A total of 1,348 undergraduate students (429 men, 919 women) at a large, public Southwestern university participated in a study for course credit in an introductory psychology course. The sample was composed of 67% Euro-American, 17% Hispanic, and 16% Asian participants. Participants ranged from 18 to 42 years old with a mean age of 19.03 for men (range, 18–32) and 18.79 for women (range, 18–42). The study was designed to determine the effects of ethnicity, gender, and culture on sexual behavior. Among several other questions, students were asked to give the age at which they first engaged in intercourse. For Hispanic women, the average age 16.52 years old with a standard deviation of 2.25 years. The data appears to be normally distributed. Find the age of first intercourse that separates the earliest 15% from the rest of the population of Hispanic women.
3. A recent study compared the effectiveness of four different weight loss strategies. The most effective method of weight loss for women was combining a low carb diet with weight training (resistance exercise). The average female participant had a weight change of -20.24 pounds (that is a loss of 20.24 pounds) with a standard deviation of 5.5 pounds. Assuming the weight change was normally distributed, what is the weight change achieved by the top 25% of dieters (note: this is the value that separates the top 25% from the remaining 75% below)?

Answers:

1. About one hour per day: $X = -1.28(1.3) + 2.7 = 1.036$ hrs/day
2. About 14 years old: $X = -1.04(2.25) + 16.52 = 14.18$ yrs
3. About -24 pounds: $X = -0.67(5.5) + -20.24 = -23.925$ pounds

Note: this one is a little tricky because the top 25% of weight loss is actually on the left side of the curve since those people lost the most weight (their weight change was more negative or greater than the people to the right of that location). This makes the z-score negative. You could have also done the problem using weight loss instead of weight change, but then the mean is 20.24 not -20.24. That would allow you to place the top 25% on the right side of the curve because the right side is where the top weight loss totals reside, and the calculation becomes:

$X = 0.67(5.5) + 20.24 = -23.925$ pounds. The difference between the two approaches is simply a matter of looking at the problem from a point of view of weight loss vs. weight change.