(1 pt. + 1 pt. Bonus) 1. If X is a uniform distribution defined over the interval (a,b) verify that

$(1\,pt.)\ a)\ E(X) = \frac{a+b}{2}$.

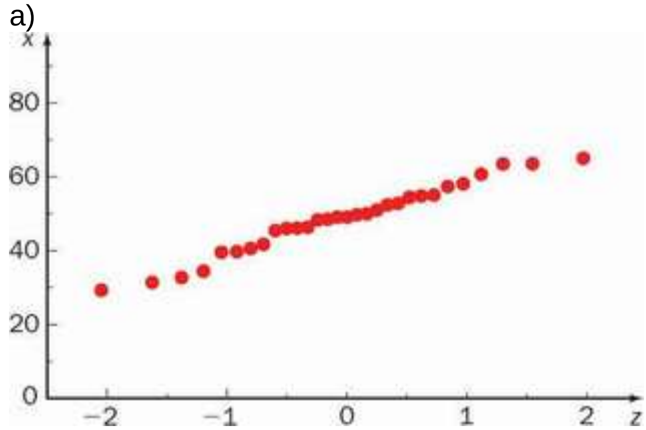
$(1\,pt. BONUS)\ b)\ Var(X) = \frac{(b-a)^2}{12}$

(5 pts.) 2. A Gold Canyon candle is designed to last nine hours. However, depending on the wind, air bubbles in the wax, the quality of the wax, and the number of times the candle is re-lit, the actual burning time (in hours) is a uniform random variable with *a* = 6.5 and *b* = 10.5. Suppose one of these candles is randomly selected.

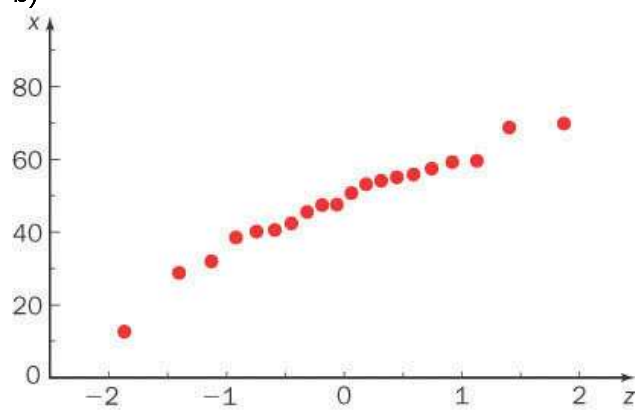
a) Find the probability that the candle burns at least seven hours.
b) Find the probability that the candle burns at most eight hours.
c) Find the probability that the candle burns between seven and 10 hours.
d) Find the mean burning time of the candles.
e) Find the standard deviation of the burning time of the candles.

(4 pts.) 3. Examine each normal probability plots below. Is there any evidence to suggest the data are from a non-normal population? Justify your answer.

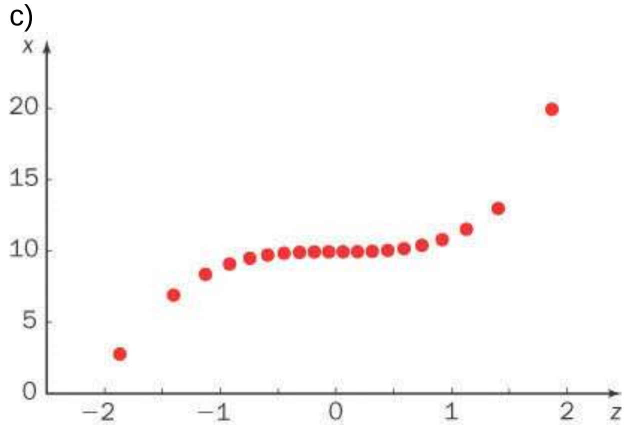
a)



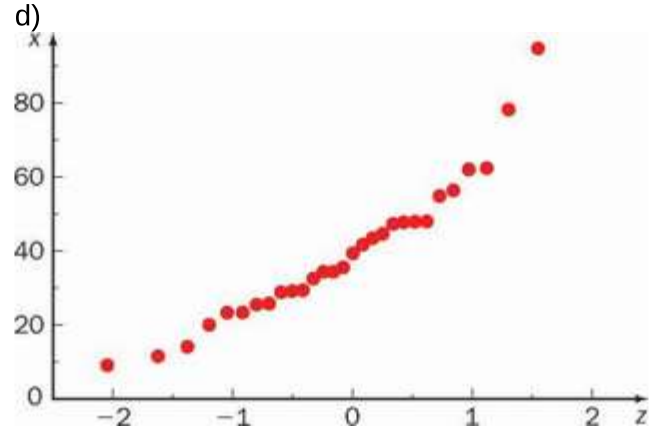
b)



c)



d)



(5 pts.) 4. The purpose of an automobile's timing belt is to provide a connection between the camshaft and the crankshaft. This allows the valves to open and close in sync with the pistons. Suppose the duration of a timing belt (in miles) can be modeled by an exponential random variable with mean 100,000 miles.

(1 pt.) a) Find the value of λ.
(1 pt.) b) What is the standard deviation of the duration of the timing belts?
(1 pt.) c) Find the probability that a randomly selected timing belt lasts for more than 120,000 miles.
(1 pt.) d) Find the probability that a randomly selected timing belt lasts for between 75,000 and 125,000 miles.
(1 pt.) e) If the timing belt on a new car breaks within 70,000 miles, the dealer will install a new belt free of charge. What is the probability the dealer will be forced to install a new timing belt free of charge on a randomly selected car?

(5 pts.) 5. This is similar to Example 7.6 (Section 7.2). Also look at Example 7.3 (Section 7.1). or planning purposes, U.S. Bancorp has determined the probability distribution for the retirement age, *X*, of employees in the mortgage work group. The probability distribution for *X* is given in the table below.

x	64	65	66
p(x)	0.1	0.7	0.2

(1 pt.) a. Find the mean of *X*.
(2 pts.) b. Suppose two employees from this work group are selected at random. Find the exact probability distribution for the sample mean, $\bar{X}$.
(1 pt.) c. Find the mean of $\bar{X}$. How does this compare with your answer in part (a)?
(1 pt.) d) Does this confirm or deny the Properties of the Sample Mean on p. 306 (Section 7.2) in the textbook. Please explain your answer.

(3 pts.) 6. In certain hurricane-prone areas of the United States, concrete columns used in construction must meet specific building codes. The minimum diameter for a cylindrical column is 8 inches. Suppose the diameter of the columns is normally distributed with a mean diameter for all columns of 7.75 inches and a standard deviation of 0.1 inch.

(1 pt.) a) What is the probability that the sample diameter for one column will be greater than 8 inches?
(1 pt.) b) What is the probability that the sample mean diameter for a random sample of 35 columns will be greater than 8 inches?
(1 pt.) c) Why are the answers to parts a) and b) different?

(3 pts.) 7. Carbon dioxide (CO_2) is one of the primary gases contributing to the greenhouse effect and global warming. The mean amount of CO_2 in the atmosphere for March 2013 was 397.34 parts per million (ppm). Suppose 40 atmospheric samples are selected at random in May 2013 and the standard deviation for CO_2 in the atmosphere is $\sigma = 20$ ppm.

(1 pt.) a) Find the probability that the sample mean CO_2 level is less than 393 ppm.
(1 pt.) b) Find the probability that the sample mean CO_2 level is between 395 and 403 ppm.
(1 pt.) c) Suppose the sample mean CO_2 level is 400. Is there any evidence to suggest that the population mean CO_2 level has increased? Justify your answer. Hint: What is the probability that the time is more than the new sample given that the distribution does not change?