1. Ten students got the following scores on an exam:

$$77, \ 77, \ 77, \ 82, \ 82, \ 82, \ 82, \ 89, \ 89, \ 94.$$

   (a) Find the mean of these scores.

   (b) What is the standard deviation of these scores?

   (c) How many scores fall within one standard deviation of the mean?

2. The following graph corresponds to the probability density function (pdf) for a random variable X. The regions separated by dashed lines have areas as shown. Here, k is a constant that is less than 1.
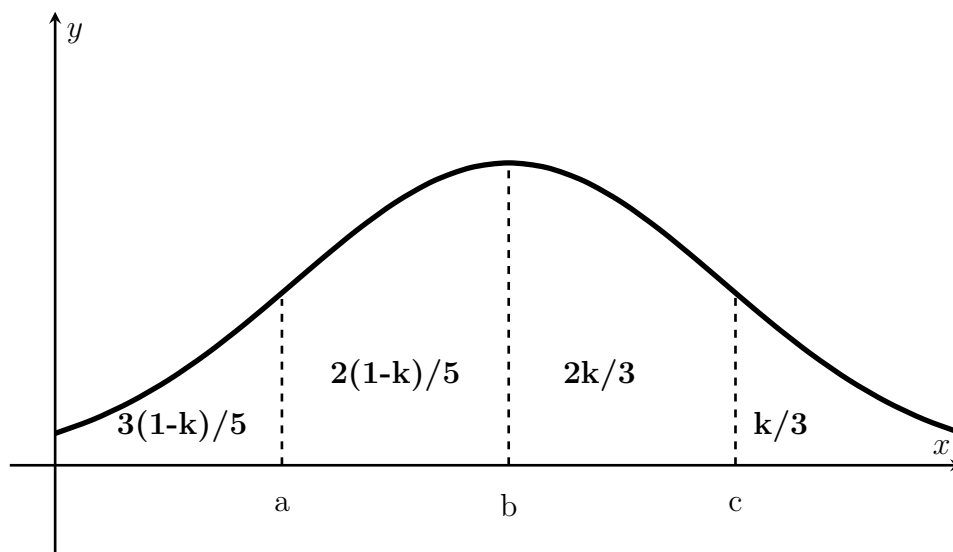
   (a) Find $P(x < b)$ (answer in terms of k).

   (b) Find $P(x > a)$ (answer in terms of k).

   (c) Find r such that $P(x > r) = k$ (answer in terms of a, b, c).

   (d) Looking at the above graph, about what do you think k is equal to? (Your answer should be an explicit real number.) Please explain.

3. The mean of a set of 30 exam scores is computed and found to equal 82. (Not all scores are the same.) Later, a 31st exam is found. (It's a long story. It turns out the dog *hadn't* eaten that exam.) The exam is graded, and the score comes out also to be 82.

   (a) Is the *mean* of the new set of 31 scores less than, equal to, or greater than the mean of the original set of 30 scores? Please explain.

   (b) Is the *standard deviation* of the new set of 31 scores less than, equal to, or greater than the standard deviation of the original original set of 30 scores? Please explain.

4. Given below are four intervals of real numbers.

$$(3.878, 3.922), \quad (3.874, 3.926), \quad (3.876, 3.920), \quad (3.871, 3.929)$$

   Three of them are confidence intervals for a population mean computed from the same sample, from some population X. One of these three is a 95% confidence interval, one a 98% confidence interval, and one a 99% confidence interval. The fourth interval is *not* a confidence interval computed from this sample. Which of the intervals is which? Please explain.

5. Colorado has 53 "fourteeners," or mountains over 14,000 feet elevation (with at least 300 feet of prominence). Below is a frequency table for the elevations of these 53 mountains.

Elevation range (ft)	Frequency	Relative Frequency Density (RFD)
$[14000, 14100)$	23	
$[14100, 14200)$	9	
$[14200, 14300)$	14	
$[14300, 14400)$	4	
$[14400, 14500)$	3	

   (a) Fill in the table above with RFD values. Include four decimal places.

   (b) On the axes below, draw an RFD histogram for this data.
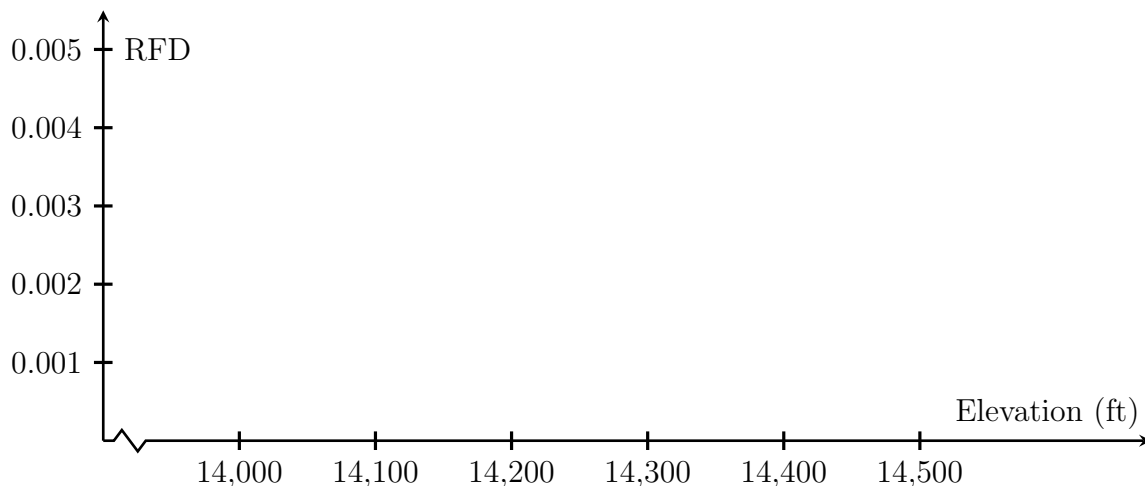
(c) Given a randomly chosen fourteener, what is the probability that its elevation is at least 14,200 but less than 14,400 feet?

(d) If one of the five elevation ranges given in the above table is selected at random, what's the probability that fewer than 10 Colorado fourteeners have elevation within that range?

6. Suppose the radii X of ball bearings produced by a certain machine are normally distributed, with mean $\mu = 10$ mm and standard deviation $\sigma = 0.1$ mm.

(a) Find the proportion of ball bearings produced by this machine that have radius between 9.8 mm and 10.2 mm.

(b) Find the proportion that have radius greater than or equal to 10.2 mm. Hint: think about the *symmetry* of the standard normal curve about the mean.

(c) Find the number L such that 95% of the bearings have radius less than L standard deviations from the mean radius.

(d) If a random sample, of size $n = 100$, of ball bearings from this machine is chosen, what is the probability that the mean radius $\bar{x}$ of this sample will be in the interval $(9.9767, 10.0233)$?

7. Suppose X is a random variable of mean $\mu = 3$ and standard deviation $\sigma = 6$. Which of the four pdfs below could possibly be a pdf for the random variable $\overline{X}$ of all sample means of X, of sample size $n = 100$? Please explain. (Describe completely how you are eliminating the incorrect choices.)
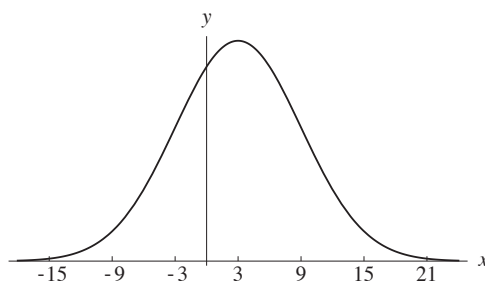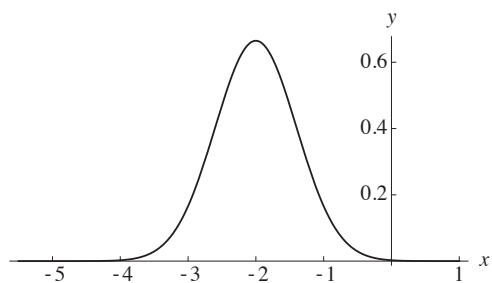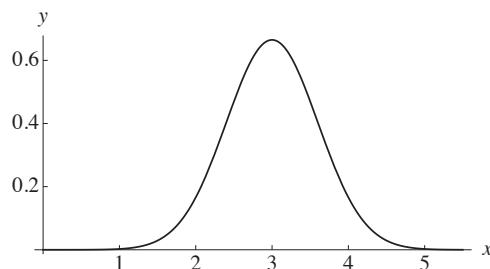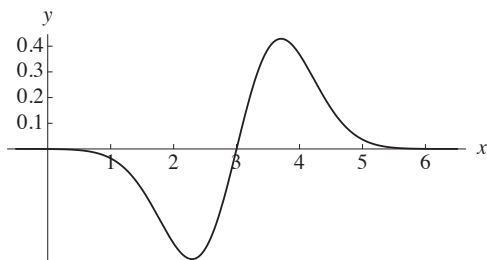
8. For healthy adults, the ideal red blood cell volume in ml per kg of body weight is 28 ml/kg. Deviation from this level indicates a serious condition. A patient has his blood tested 36 times. The mean of these tests is 32.7 ml/kg and the standard deviation is 2.18 ml/kg. Test at the 98% level the hypothesis that the patient has abnormal red blood cell volume by looking at the test statistic, z.

9. Biologists are studying Allen's hummingbird, which lives in AZ. They capture a sample of 40 hummingbirds and find a mean mass of 3.15 grams and a standard deviation of 0.33 grams. Find a 98% confidence interval for the mean mass of these hummingbirds.