5.30 Averages of several measurements are less variable than individual measurements. Suppose Antonio measures the mass of some whiskey in order to determine its alcohol content. The true mass of the whiskey sample is 4600 milligrams and Antonio’s measurements are normally distributed with mean 4600 milligrams and standard deviation 10 milligrams. In this case, the mean of the three measurements he makes also has a normal distribution.

(a) Sketch on the same graph the two normal curves, for individual measurements and for the means of 3 measurements.

(b) What is the probability that Antonio misses the true mass by more than 10 milligrams in either direction if he makes only 1 measurement?

(c) What is the probability that Antonio misses the true mass by more than 10 milligrams if he instead takes the mean of 3 measurements?
Answer to 5.30

(a) (Sketch the graphs.)
(b) .683
(c) .248
5.36 The distribution of grades in Statistics 101 at NCSU in the Fall 2003 semester course was:

<table>
<thead>
<tr>
<th>Grade</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability</td>
<td>.21</td>
<td>.43</td>
<td>.30</td>
<td>.05</td>
<td>.01</td>
</tr>
</tbody>
</table>

(a) Using the common scale from 0 to 4 for grades, take $X$ to be the grade of a randomly chosen Statistics 101 student. Find the rv mean and rv standard deviation of $X$.

(b) Statistics 101 is a large course. We can take the grades of a simple random sample of 50 students to be independent of each other. If $\bar{x}$ is the sample mean of these 50 grades, what are the mean and standard deviation of $\bar{x}$?

(c) What is the probability $P(X \geq 3)$ that a randomly chosen Statistics 101 student gets a B or better? What is the approximate probability $P(\bar{x} \geq 3)$ that the mean grade of 50 randomly chosen Statistics 101 students is a B or better?
Answer to 5.36

(a) $\mu_X = 2.78$, $\sigma_X = .867$

(b) $\mu_{\bar{x}} = 2.78$, $\sigma_{\bar{x}} = .1226$

(c) .64, .0364