1. Scores of the SAT Math exam follow an approximately normal distribution with mean 500 and standard deviation 100.

a. What is the probability that a given student at random will score 550 or more on said exam?

b. For a group of 20 students picked at random, what is the probability that the mean score of that group will be 550 or more?

c. Repeat (b) for a group of 100 students at random.

2. A particular course at a university is taught by many faculty members. The (individual) grades given out in the course (A = 4, B = 3, C = 2, etc...) have historically had mean 2.20 and standard deviation 1.08. One year, a new professor teaches a section of this course with 50 students. The grades in this section were as follows:

<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>Frequency</td>
<td>5</td>
<td>10</td>
<td>17</td>
<td>10</td>
<td>8</td>
</tr>
</tbody>
</table>

a. Find the mean grade in this professor's course.

b. Find the probability that a sample of 50 students at random would have a mean grade as low as the one in (a), and comment.
3. Among other things, the Central Limit Theorem makes it possible for you to purchase items like insurance. Suppose you own a $200,000 home. The insurance company believes that in any given year, there is a probability of 1/1,000 that the home will be destroyed (note the oversimplification of the problem).

From your perspective as a homeowner, your expected loss on the home in any given year would be

\[ .001 \times (\$200,000) = \$200. \]

Now, if you gave me $200 plus a modest premium of say $250 for my trouble, I as an individual certainly would not write an insurance policy on your house. However, an insurance company will, and here is the reason.

<table>
<thead>
<tr>
<th>Event</th>
<th>Insurance company payout</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nothing happens</td>
<td>$0</td>
<td>.999</td>
</tr>
<tr>
<td>House destroyed</td>
<td>$200,000</td>
<td>.001</td>
</tr>
</tbody>
</table>

On the calculator, check that this variable has mean ______________________________ and standard deviation ________________________________.

Now suppose the insurance company has underwritten 5000 insurance policies on houses just like this one. What is the probability that the average payout per policy would exceed $450 in any given year?

4. A Biologist wants to study the pH of seawater in a particular coastal area. They collect 40 samples of seawater from the area and find that the mean pH of this sample was 7.93 with a standard deviation of .23. If they were to repeat this same experiment many times (that is, collect 40 samples from this area, and look at the sample mean), find an interval where the sample mean would fall 95% of the time. Assume .23 is the "true" standard deviation, and also assume that their first estimate of 7.93 is reasonable.
2. A group of 26 students in Math 2210 are sampled and asked how they scored on the SAT math exam. Here is the data.

640 510 520 450 750 620 460 690 500 500
530 470 480 400 430 500 610 580 650 540
580 680 620 470 420 630

a. Assuming the scores follow a normal distribution, and assuming the standard deviation of our sample is an accurate estimate of the "true" standard deviation of this population, compute a 90% confidence interval for \( \mu \), the "true" mean SAT score for this group.

b. Repeat (a) for a 95% CI.