Lesson 10.2.1

10-22. a. Answers will vary significantly based on the class, object used, and many other factors.

b. Answers will vary.

10-23. a. The mean should be approximately normal.

b. See completed table below. Some of the values below are debatable, but the “yes” values should hopefully match pretty well.

Mean distribution is normal?
For each cell, write “yes” if it is normal, “no” if not, “maybe” if unclear

	$n = 4$	$n = 15$	$n = 30$	$n = 99$
Uniform	Maybe	Yes	Yes	Yes
Normal	Yes	Yes	Yes	Yes
Right-skewed (Peak/Balance = 0.3)	No	Maybe	Yes	Yes
VERY left-skewed (Peak/Balance = 0.9)	No	No	No	Almost
Bimodal symmetric (Peak/Balance = 0.5)	No	Yes	Yes	Yes
Bimodal skewed (Peak/Balance = 0.3)	No	Maybe	Yes	Yes
Alice word counts	No	Maybe	Yes	Yes

c. The distribution is approximately normal when the original data is normal OR when the sample size is large. How large the sample needs to be to achieve normality depends on how different the original data is from normal.

10-24. a. Answers vary.

b. Tony is incorrect—the standard deviation of the mean is not the same thing as the standard deviation of the original sample—students do not know how wide the sampling distribution is in this case!

10-25. a. $2X$ represents taking *a* data value and doubling it. $X + X$ represents adding two independent data values together.

b. Mean of $X + X = 2\mu$. SD of $X + X = \sigma\sqrt{2}$.

c. For $\frac{X+X}{2}$, mean: μ. SD: $\frac{\sigma}{\sqrt{2}}$.

d. Mean: μ. SD: $\frac{\sigma}{\sqrt{3}}$.

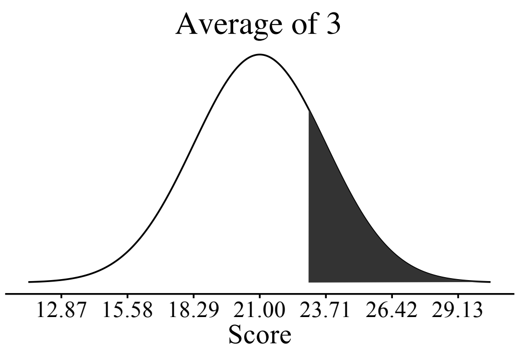
e. Mean: μ. SD: $\frac{\sigma}{\sqrt{n}}$.

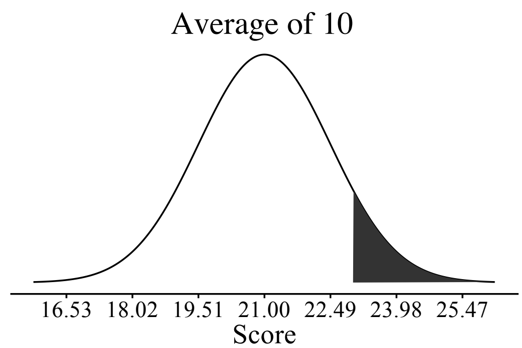
10-26. The formula requires σ, the standard deviation of the original population. Tony does not have that value; he only has s, the sample standard deviation of his sample.

10-27. To find the confidence interval for the mean, use 1.22 as the center, 1.96 as the critical value and $\frac{0.05}{\sqrt{100}} = 0.005$. The confidence interval is about 1.21 to 1.23, so 1.25 is well outside the interval and the company should absolutely be concerned about miscalibration.

10-28. a. Since the original population is approximately normal, the sampling distribution of the means is normal even with a tiny sample size.

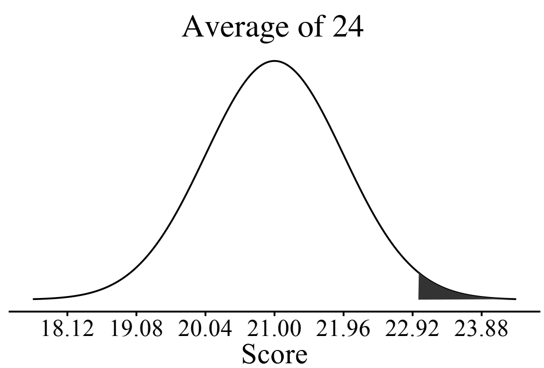
b. The standard deviation of the means is $\frac{4.7}{\sqrt{3}} = 2.71$. $P(\text{mean} > 23) = 0.23$ or 23%. See diagram below left.





c. standard deviation = 1.49, probability = 0.0898 ≈ 9%. See diagram above right.

d. The 98th percentile of the standard normal curve is about 2.05. Therefore, you need 23 to be at least 2.05 standard deviations above the mean, which means you need the standard deviation to be smaller than $\frac{2}{2.05} = 0.976$. Set $0.976 > \frac{4.71}{\sqrt{n}}$ and get $n > 23.3$. Thus you would need to sample at least 24 students to get the probability down to 2%. A check with $n = 24$ shows $P(\text{avg} > 23) = 0.0186$. See diagram at right.



10-29. His percentage of 68% is a census so there is no need to test it. It is preferred in this course to write the null hypothesis with an equals sign, though this is a convention that varies. These shots are not a random sample of anything. Both the null and alternative hypothesis contain 0.75.

10-30. Home smoke detectors sound in events (A) or (D) from the diagram. That would be a probability of 0.00198 + 0.00998 = 0.01196. Of the probability of a smoke alarm sounding, event (D) is a false alarm. So if a residential smoke alarm sounds in Madelinton it has a $\frac{0.00998}{0.01196} = 0.834$ chance of being a false alarm. If the fire is real, the probability of substantial damage, injury or even death far outweighs the inconvenience of responding to false alarms. See possible table below.

	0.002 have a fire	0.998 do *not* have a fire
Alarm is correct 0.99	(A) 0.00198	(B) 0.98802
Alarm is *not* correct 0.01	(C) 0.00002	(D) 0.00998 *false alarms*