Chebyshev’s Theorem: The proportion of any set of data lying within $K$ standard deviations of the mean is always at least $1 - \frac{1}{K^2}$, where $K > 1$.

**Expected Value (mean of a probability distribution)**

- **Key Words:** Find the Expected Value
- **Formulas:** $E(X) = \mu = \sum x \cdot P(x)$ (see table below)

<table>
<thead>
<tr>
<th>$x$</th>
<th>$P(x)$</th>
<th>$x \cdot P(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\vdots$</td>
<td>$\vdots$</td>
<td>$\vdots$</td>
</tr>
<tr>
<td>$\sum x \cdot P(x)$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For Problems Dealing With the Normal Distribution (they say normally distributed in the directions…)

**There are three cases**

1. Directions say: Find the probability of randomly selecting a …
   - Draw the bell curve, label the mean, and standard deviation
   - Put a $Z$ number line and an $X$ number line at the bottom of the curve
   - Shade the desired area that you are looking for
   - Convert your $x$ – score into a $z$-score using $Z = \frac{X - \mu}{\sigma}$
   - Look your $z$-score up on the table from the book (that is the area from your $z$-score to the mean on the curve)
   - If necessary perform the arithmetic needed to get your desired area

2. Directions say: Find the probability of randomly selecting $n$ … that have an average …
   - Draw the bell curve, label the mean, and standard deviation **do not forget that for this problem the stan. dev. becomes $\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}}$**
   - Put a $Z$ number line and an $\bar{X}$ number line at the bottom of the curve
   - Shade the desired area that you are looking for
   - Convert your $\bar{X}$ – score into a $z$-score using $Z = \frac{\bar{X} - \mu}{\sigma_{\bar{X}}}$
   - Look your $z$-score up on the table from the book (that is the area from your $z$-score to the mean on the curve)
   - If necessary perform the arithmetic needed to get your desired area

3. Directions say: Find the score (height, weight, …) that separates the bottom…
   - Draw the bell curve, label the mean, and standard deviation **Do not forget that for this problem we will be putting an area associated with a given percentile (using the normal table in reverse)**
   - Put a $Z$ number line and an $X$ number line at the bottom of the curve
   - Look up the necessary area to get your $z$ – score on the $Z$ table (watch your sign on the $z$-score)
   - Convert your $z$– score into an $X$-score using $X = Z \sigma + \mu$
Confidence Interval

Steps to Create a Confidence Interval for the mean (Large Sample)
1. List all given sample data from the problem including sample size and C-level
2. Find \( z_{a/2} \)
3. Calculate the margin of error, \( E = z_{a/2} \left( \frac{\sigma}{\sqrt{n}} \right) \)
4. Calculate \([\bar{x} - E, \bar{x} + E]\)

Steps to Create a Confidence Interval for the mean (Small Sample)
1. List all given sample data from the problem including sample size and C-level
2. Find \( t_{a/2} \)
3. Calculate the margin of error, \( E = t_{a/2} \left( \frac{s}{\sqrt{n}} \right) \)
4. Calculate \([\bar{x} - E, \bar{x} + E]\)

Steps to test a hypothesis:
1. Express the original claim symbolically
2. Identify the Null and Alternative hypothesis
3. Record the data from the problem
4. Calculate the test statistic using either \( z = \frac{\bar{x} - \mu_0}{\sigma \sqrt{n}} \) or \( t = \frac{\bar{x} - \mu_0}{s \sqrt{n}} \) or \( \rho = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0 q_0}{n}}} \)
5. Determine your rejection region (or find your p-value).
6. Find the initial conclusion
7. Word your final conclusion

Steps to creating a Confidence Interval for a population proportion:
1. Gather sample data: \( x \) (or \( \hat{p} \)), \( n \), and C-level, calculate \( \hat{p} = \frac{x}{n} \) & \( 1 - \hat{p} = \hat{q} \)
2. Find \( Z_{a/2} \)
3. Calculate the Margin of Error, \( E = Z_{a/2} \sqrt{\frac{\hat{p} \hat{q}}{n}} \)
4. Finally, form \([\hat{p} - E, \hat{p} + E]\)

Sample Size for Estimating the Mean:
\[
n = \left( \frac{z_{a/2} \sigma}{E} \right)^2
\]