

3.6 – Margin of Error (MOE)

– margin of (sampling) error (MOE) → represents a limit on the difference between how a sample responds and how the total population would respond

Margin of Error (MOE) “Formula” → If the percent of people in a sampling respond in a certain way is p and the size of the sample n , then 95% of the time, the percent of the population responding in that same way will be between $p - \text{MOE}$ and $p + \text{MOE}$, where $\text{MOE} = 2 \cdot \sqrt{\frac{p(1-p)}{n}}$

Example 1: Find the margin of error (MOE) where round it to the nearest percent. $\text{MOE} = ?$

<p>a.) $p = 72\%$ and $n = 100$ $\text{MOE} = ?$</p> $\text{MOE} = 2 \sqrt{\frac{.72(1-.72)}{100}}$ $\text{MOE} = .09 \rightarrow \boxed{\text{MOE} = 9\%}$	<p>b.) $p = 31\%$ and $n = 500$ $\text{MOE} = ?$</p> $\text{MOE} = 2 \sqrt{\frac{.31(1-.31)}{500}}$ $\text{MOE} = .04 \rightarrow \boxed{\text{MOE} = 4\%}$
<p>c.) In a survey of 1000 randomly selected adults, 37% answered “yes” to a particular question.</p> $p = .37$ $\text{MOE} = ?$ $\text{MOE} = 2 \sqrt{\frac{.37(1-.37)}{1000}}$ $\text{MOE} = .03 \rightarrow \boxed{\text{MOE} = 3\%}$	<p>d.) In a survey of 520 randomly-selected high school students, 68% of those surveyed stated that they were involved in extracurricular activities. $\text{MOE} = ?$</p> $\text{MOE} = 2 \sqrt{\frac{.68(1-.68)}{520}}$ $\text{MOE} = .04 \rightarrow \boxed{\text{MOE} = 4\%}$

Example 2: Find the number of people surveyed in each situation. $n = ?$

<p>a.) $p = 67\%$ and $\text{MOE} = 2\%$ $n = ?$</p> $\frac{.02}{2} = \sqrt{\frac{.67(1-.67)}{n}}$ $(.01)^2 = \left(\sqrt{\frac{.2211}{n}} \right)^2$ $\frac{1 \times 10^{-4}}{1} = \frac{.2211}{n}$ $\frac{1 \times 10^{-4} n}{(1 \times 10^{-4})} = \frac{.2211}{(1 \times 10^{-4})} \rightarrow \boxed{n = 2211 \text{ people surveyed}}$ <p><i>coincidence that same #</i></p>	<p>b.) In a recent Gallup Poll, 25% of the people surveyed said they had smoked cigarettes in the past week. The margin of error was 3%.</p> $\frac{.03}{2} = \sqrt{\frac{.25(1-.25)}{n}}$ $(.015)^2 = \left(\sqrt{\frac{.1875}{n}} \right)^2$ $\frac{2.25 \times 10^{-4}}{1} = \frac{.1875}{n}$ $\frac{2.25 \times 10^{-4} n}{(2.25 \times 10^{-4})} = \frac{.1875}{(2.25 \times 10^{-4})} \rightarrow \boxed{n = 833 \text{ people surveyed}}$
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Example 3: Find the percent of people surveyed who said “yes” in each situation. $p = ?$

<p>a.) $n = 1000$ and $\text{MOE} = 3\%$ $p = ?$</p> $\frac{.03}{2} = \sqrt{\frac{p(1-p)}{1000}}$ $(.015)^2 = \left(\sqrt{\frac{p-p^2}{1000}} \right)^2$ $\frac{2.25 \times 10^{-4}}{1} = \frac{p-p^2}{1000}$ $p-p^2 = .225$ $p-p^2-.225=0$ $y_2=0$ <p>Find intersection</p> <p>left side = .34 = 34%</p> <p>right side = .66 = 66%</p> <p>$\boxed{34\% \text{ or } 66\% \text{ of people surveyed said yes}}$</p>	<p>b.) According to a survey in American Demographics, 283 Americans age 12 or older said they listen to the radio every day. The survey had a margin of error of 5%.</p> $\frac{.05}{2} = \sqrt{\frac{p(1-p)}{283}}$ $(.025)^2 = \left(\sqrt{\frac{p-p^2}{283}} \right)^2$ $\frac{6.25 \times 10^{-4}}{1} = \frac{p-p^2}{283}$ $p-p^2 = .176875$ $p-p^2-.176875=0$ $y_2=0$ <p>Find intersection</p> <p>left side = .23 = 23%</p> <p>right side = .77 = 77%</p> <p>$\boxed{23\% \text{ or } 77\% \text{ of people surveyed said yes}}$</p>
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