

10.3 – 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 $p - MOE$ and $p + MOE$, where $MOE = 2 \cdot \sqrt{\frac{p(1-p)}{n}}$

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

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

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

<p>a.) $p = 67\%$ and $MOE = 2\% = .02$ $= .67$ $MOE = 2 \sqrt{\frac{p(1-p)}{n}}$ $\frac{.02}{2} = \frac{2 \sqrt{\frac{.67(1-.67)}{n}}}{2}$ $(.01)^2 = \left(\sqrt{\frac{.2211}{n}} \right)^2$ $(1 \times 10^{-4}) = \frac{.2211}{n}$ <i>This is just a coincidence!</i> $n = \frac{.2211}{(1 \times 10^{-4})} = 2211$ people</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%. $p = 25\%$ $MOE = 3\%$ $= .25$ $= .03$ $\frac{.03}{2} = \frac{2 \sqrt{\frac{.25(1-.25)}{n}}}{2} = (.015) = \left(\sqrt{\frac{.1875}{n}} \right)^2$ $2.25 \times 10^{-4} = \frac{.1875}{n}$ $n = \frac{.1875}{(2.25 \times 10^{-4})}$ <u>833 people</u></p>
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Example 3: Find the percent of people surveyed who said "yes" in each situation. $p = ?$

<p>a.) $n = 1000$ and $MOE = 3\% = .03$ $p = ?$ $\frac{.03}{2} = \frac{2 \sqrt{\frac{p(1-p)}{1000}}}{2}$ $(.015)^2 = \left(\sqrt{\frac{p-p^2}{1000}} \right)^2$ $(1000) 2.25 \times 10^{-4} = \frac{p-p^2}{1000} (1000)$ $p-p^2 = .225$ $-p^2 + p - .225 = 0$ $y_1 = -p^2 + p - .225$ $y_2 = 0$ *Find intersection* $p = .34 \rightarrow 34\%$ $100 - 34 = 66\%$ <u>34% or 66% of people were surveyed</u></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>
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