1. **Problem**

   A population is known to have a standard deviation $\sigma = 250$. What is the sample size n needed to build a 80% confidence interval with a margin of error $ME = 20$?

   Solution

   Let's remember the formulas for confidence intervals (with known σ):

$$SE = \frac{\sigma}{\sqrt{n}}$$

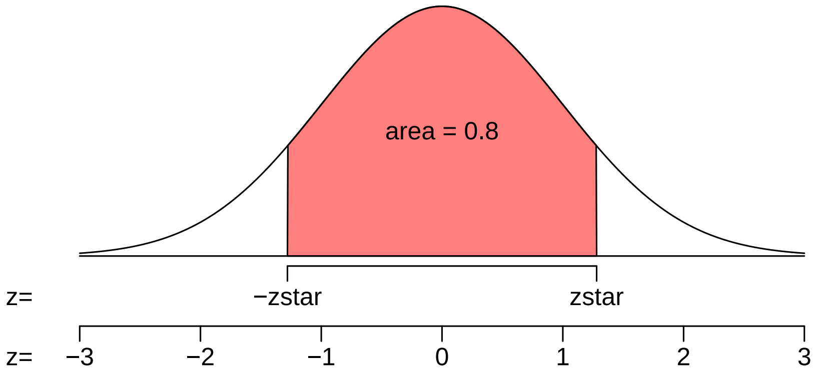
$$CL = P(|Z| < z^{\star})$$

$$ME = z^{\star} SE$$

$$CI = \bar{x} \pm ME$$

From the confidence level $CL = 0.8$, we determine $z^{\star}$.

$$P(|Z| < z^{\star}) = 0.8$$



You can use a z table or the last row of the t-table (where $df = \infty$).

$$z^{\star} = 1.28$$

We know that $ME = z^{\star} SE$, so

$$SE = \frac{ME}{z^{\star}} = \frac{20}{1.28} = 15.6$$

We know that $SE = \frac{\sigma}{\sqrt{n}}$. Let's solve for n.

$$SE = \frac{\sigma}{\sqrt{n}}$$

Multiply both sides by $\sqrt{n}$.

$$SE\sqrt{n} = \sigma$$

Divide both sides by SE.

$$\sqrt{n} = \frac{\sigma}{SE}$$

Square both sides. (Raise both sides to the power of 2.)

$$n = \left(\frac{\sigma}{SE}\right)^2$$

$$n = \left(\frac{250}{15.625}\right)^2 = 256$$

We round n up.

$$n = 256$$