Assume you survey 1000 voters randomly and 440 voted for Prop 39. Construct a 99% confidence interval for the population proportion.

1) $\hat{p} = \frac{x}{n} = \frac{440}{1000} = .440$, $\hat{q} = 1 - \hat{p} = .560$, $n = 1000$, conf = .99.
440 ≥ 10 successes & 1000 − 440 = 560 ≥ 10 failures. ✓

2) $\alpha = 1 - \text{conf.} = 1 - .99 = .01$

3) Table A1

	.07	.08
2.5	.9949	.9951

$1 - \alpha/2 = .995$

* Conf = .99 → $z_{\alpha/2} = 2.576$

4) $E = z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}}$

$= 2.576\sqrt{\frac{.440 \cdot .560}{1000}}$

$= .040$

5) $\hat{p} - E < p < \hat{p} + E$

$.440 - .040 < p < .440 + .040$

$.400 < p < .480$

$40.0\% < p < 48.0\%$

We are 99% confident that the proportion of all voters who voted for prop 39 is between 40.0% & 48.0%

Algebra → Solve the E formula for n.

$E = z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}}$

square

$E^2 = z_{\alpha/2}^2 \frac{\hat{p}\hat{q}}{n}$

divide by E^2 multiply by n

$n = \frac{z_{\alpha/2}^2 \hat{p}\hat{q}}{E^2}$

Sample Size: If we want to pick a margin of error, E, we must sample at least

$n = \frac{z_{\alpha/2}^2 \hat{p}\hat{q}}{E^2}$

Preliminary data are required for $\hat{p}$ & $\hat{q}$ values.