Ex: from the back of BHT, uniform color. This time we will test whether wearing red changes the probability of win, either by increasing or decreasing.

Step 1: See BHT steps 1) – 4). This time we will test $H_0: \pi = 0.5$ vs. $H_a: \pi \neq 0.5$.

Step 2: Here $n = 457$ and $\pi_0 = 0.5$ so we check

$n\pi_0 = (457)(0.5) = 228.5 \geq 10$ (yes!) and

$n(1-\pi_0) = (457)(1-0.5) = 228.5 \geq 10$ (yes.)

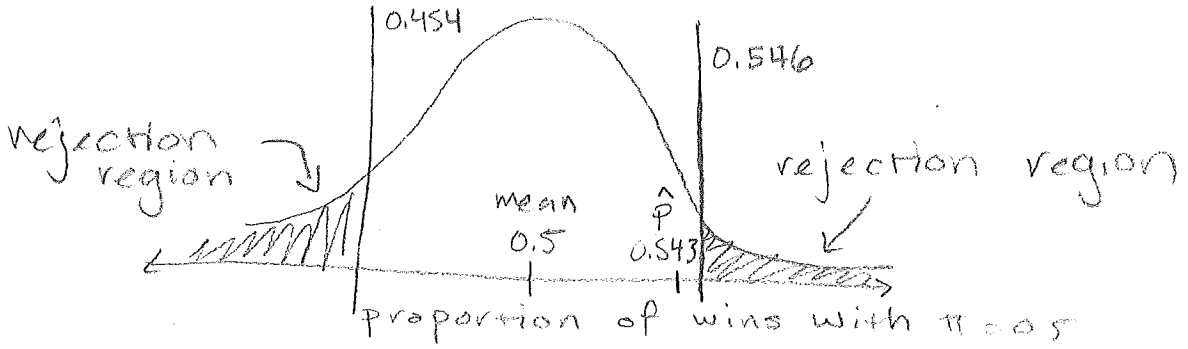
Since both inequalities are satisfied we may proceed.

Step 3: First find the mean and SD.

mean $= \pi_0 = 0.5$

$SD = \sqrt{\pi_0(1-\pi_0)/n} = \sqrt{0.5(1-0.5)/457} = 0.023$

Draw a bell-shaped graph centered at mean.



Step 4: Add lines at mean $\pm$ 2SD to the graph in 3)

mean + 2SD = $0.5 + 2(0.023) = 0.546$

mean − 2SD = $0.5 - 2(0.023) = 0.454$

Shade area beyond lines; this is the rejection region.

Step 6: The sample proportion $\hat{p} = {}^{248}/_{457} = 0.543$ is not in the rejection region so fail to reject H_0.

Handout – Performing a One proportion Z-test by hand with $\alpha = 0.05$.

Step 1: Do steps 1)–4) of the Binomial Test Handout (BTH). In step 5), choose (some number) based on your research question and write hypotheses of the form $H_0: \pi = (\text{some number})$ and $H_a: \pi \neq (\text{some number})$.

Step 2: Check the technical condition of the one sample Z-test:

> **Condition:** $n\pi_0 \geq 10$ and $n(1-\pi_0) \geq 10$
> where n = Sample size and
> π_0 is the "some number" in H_0

Step 3: Apply the CLT for sample proportions to draw the null distribution.

> **CLT:** If the sample size is large enough (step 2) then $\hat{p}$ is approximately normally distributed with mean $= \pi_0$ and standard deviation $= \sqrt{\pi_0(1-\pi_0)/n}$.

Step 4: Use the Empirical Rule to find the rejection region corresponding to $\alpha = 0.05$.

> **Empirical Rule:** 95% of the data from a normal distribution is within 2 standard deviations of the mean

Step 5: Collect data from a sample of size n and compute the sample proportion $\hat{p}$.

Step 6: If $\hat{p}$ is in the rejection region, reject H_0. otherwise fail to reject H_0.

Step 7: State your conclusion in context