

Many homeowners buy detectors to check for the invisible gas radon in their homes. We want to determine the accuracy of these detectors. To answer this question, university researchers placed 12 radon detectors in a chamber that exposed them to 105 picocuries per liter of radon. The detector readings were as follows:

91.9	97.8	111.4	122.3	105.4	95.0
103.8	99.6	96.6	119.3	104.8	101.7

Assume that $\sigma = 9$ picocuries per liter of radon for the population of all radon detectors.

We want to determine if there is convincing evidence at the 10% significance level that the mean reading of all detectors of this type differs from the true value 105, so our hypotheses are $H_0: \mu = 105$ and $H_a: \mu \neq 105$. A significance test was completed to answer this question. The test statistic is $z = -0.3336$ and the P -value is 0.74.

3. Describe what a Type I error would be in this situation.
4. Calculate the probability of a Type I error for this problem.
5. Describe what a Type II error would be in this situation.
6. The researchers who carried out the study suspect that the large P -value is due to low power. First determine the probability of a Type II error when in fact $\mu = 100$. Then compute the power of the test against the alternative.
7. If the sample size is increased to $n = 30$, what will be the power against the alternative, $\mu = 100$?