Exercise 5D.1

In the general population, the gestational length of uncomplicated pregnancies varies according to a normal distribution with mean 39 weeks and (known) standard deviation 2 weeks. An investigator wishes to test whether gestational ages of African American women have a different mean length, and believes that the true mean for these women is 38.5 weeks. How large a sample would be needed to detect a difference in gestational lengths of this size with 80% power for a two-sided test with level $\alpha = 0.05$?

Exercise 5D.2

How large a sample is needed for a one-sided z-test with 90% power and $\alpha = 0.05$, if the null hypothesis assumes $\mu = 170$, we want to detect a difference of $+20$, and the standard deviation is known to be 40?

Exercise 5D.3

The Ohio Department of Education is planning a study of SAT math scores of Ohio high school seniors. They will randomly give the exam to 500 students. Assume that the population standard deviation is known to be $\sigma = 100$. The hypotheses are:

$H_0 : \mu = 450$

$H_a : \mu > 450$

Is this test sufficiently powerful to detect an increase of 12 points in the population mean SAT score? Answer this question by calculating the power of the Z-test at $\alpha = 0.01$ against the alternative $\mu = 462$.