Problem 3

Exercise 12a, b, c on page 436.

a)

The parameter of iterest μ is the real average breaking distance at 40mph using the new design.

$$H_0: \quad \mu = 120 \text{ feet}$$

$$H_a: \quad \mu < 120 \text{ feet}$$

b)

The appropriate regection region is R_2. We want to reject the only if there is a reduction in braking distance so the regection region should be lower tailed.

c)

The signifigance level is:

$$\alpha = \Phi\left(\frac{\bar{x} - \mu}{\sigma/\sqrt{n}}\right) = \Phi\left(\frac{115.20 - 120}{10/\sqrt{36}}\right) = \mathbf{1.9884 \times 10^{-3}}$$

To acheive $\alpha = 0.001$:

$$\Phi(z) = 0.001 \implies z = -3.090$$

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} \implies \bar{x} = \frac{z\sigma}{\sqrt{n}} + \mu$$

$$\bar{x} = \frac{-3.090 \cdot 10}{\sqrt{36}} = \mathbf{114.85}$$

Calculations:

```
sigma <- 10;
n <- 36;
mu <- 120;
x <- 115.20;
z <- (115.20 - 120) / (sigma/sqrt(n))
alpha <-pnorm(z)
z2 <- qnorm(0.001)
x2 <- z2 * sigma / sqrt(n) + mu
```