1. Exercise 9.14 in the text. Find the confidence interval, not the "prediction interval" - this is something else we have not covered yet.

   Solution:

   The sample mean is $\bar{X}_n = 3.7867$ and the sample standard deviation is 0.971. Since we estimated the standard deviation and we assumed the data was normally distributed, we use the t distribution with $15-1 = 14$ degrees of freedom for the interval since

$$\frac{\bar{X}_n - \mu}{s/\sqrt{n}} \sim t_{n-1}$$

   is the appropriate pivot. The 97.5% percentile of the t distribution with 14 df is 2.145 so that the interval is

$$(\bar{X}_n - t_{14,.975}s/\sqrt{15}, \bar{X}_n + t_{14,.975}s/\sqrt{15})$$

$$= (3.25, 4.32).$$

2. Exercise 9.22 in the text. Use the information provided to find a 99% confidence interval for the population mean. Do not do any of this "prediction" or "tolerance" stuff. We may get to that later.

   Solution:

   This is pretty much the same as problem 1 above. We assume the data is normal and estimate σ by s, so we use the $t_{df=49}$ distribution. The 99.5% percentile of this t distribution is 2.68. Compare that to the normal percentile which is 2.576 and you see that our interval would be much too narrow if we used an approximate interval based on the normal distribution, that is, treating $\sigma = s$ as known. You should get

$$(76.26, 80.34).$$

3. Exercise 10.20 in the text.

   Solution:

   We perform the test using the pivot

$$\frac{\bar{X}_n - \mu}{s/\sqrt{n}} \sim t_{n-1}$$

   since σ is unknown. We reject H_0 if $\frac{\bar{X}_n - 5.5}{s/\sqrt{n}} < t_{0.05,63}$ since the alternative is one-sided and only cares about small values of μ. The test statistic value is

$$\frac{5.23 - 5.5}{0.24/\sqrt{64}} = -9$$

   which is much smaller than $t_{0.05,63} = -1.67$, so reject H_0.

4. Exercise 10.47 in the text.

   The power of the test is $1 - P($ Type II Error $)$. Explain what this "power" means.

   Solution:

   Since we assume $\sigma = 0.24$ we can use the normal percentiles instead of the t percentiles as we did in 10.20. We reject if $\frac{\bar{X}_n - 5.5}{.24/\sqrt{n}} < -1.645$. The power calculation says

$$P(\frac{\bar{X}_n - 5.2}{.24/\sqrt{n}} \leq \frac{5.5 - \frac{0.24(1.645)}{\sqrt{n}} - 5.2}{0.24/\sqrt{n}}) = 0.9$$

hence $\frac{5.5 - \frac{0.24(1.645)}{\sqrt{n}} - 5.2}{0.24/\sqrt{n}} = 1.645$ and we see that $n = 7$ (book says $n = 6$ but it's wrong).

5. Exercise 10.22 in the text. You do not need to use a "P-value".

   Solution:

   We test the hypothesis $H_0 : \mu = 8$ vs. $H_a : \mu > 8$ based on the text "does this suggest...more than 8...". Since we are given a sample of size $n = 225$, we can safely use the normal distribution and the (approximate) pivot
$$\frac{\bar{X}_n - \mu}{s/\sqrt{n}} \sim N(0, 1).$$
   Of course the exact pivot is with a t distribution but we won't be able to tell a difference with n so large. Lets use $\alpha = 0.05$. Then, the test statistic is
$$\frac{8.5 - 8}{2.25/\sqrt{225}} = 3.33$$
   which is much larger than the 95% percentile 1.645, so reject H_0.

6. Exercise 10.24 in the text. You do not need to use a "P-value".

   Solution:

Based on the wording "is there a reason to believe that there has been a **change** in..." we should test $H_0 : \mu = 162.5$ vs. $H_a : \mu \neq 162.5$. Since n is not large and we estimated σ with s, we use the t distribution. You should find that the test statistic is

$$\frac{165.2 - 162.5}{6.9/\sqrt{50}} = 2.81$$

The percentile for comparison is $t_{0.025,49} = 2.01$ for $\alpha = 0.05$ so reject H_0.