7.2 The dotted line is the t-distribution with 1 degree of freedom, the dashed line is the t-distribution with 5 degrees of freedom, and the solid line is the standard normal distribution. As the degrees of freedom increases the t-distribution approaches the normal distribution. Another valid justification is that lower the degrees of freedom, thicker the tails.

7.4

(a)	$n = 26$	$T = 2.485$	$df = 26 - 1 = 25$	$p - value = 0.020$	Do not reject H_0
(a)	$n = 18$	$T = 0.5$	$df = 18 - 1 = 17$	$p - value = 0.623$	Do not reject H_0

7.6 The sample mean is the mid-point of the confidence interval, i.e. the average of the upper and lower bounds:

$$\bar{x} = \frac{65 + 77}{2} = 71$$

The margin of error is $77 - 71 = 6$. Since $n = 25$, $df = 24$, and the critical t-score is $t^{\star}_{35} = 1.71$. Then,

$$6 = 1.71 \frac{s}{\sqrt{25}} \quad \to s \approx 17.54$$

7.10 With a larger critical value, the confidence interval ends up being wider. This makes intuitive sense as when we have a small sample size and the population standard deviation is unknown, we should have a wider interval than if we knew the population standard deviation, or if we had a large enough sample size.

7.12

(a) $H_0 : \mu = 35$, $H_A : mu \neq 35$.

(b) 1. Independence: if we can assume that these 52 officers represent a random sample (big assumption), then independence would be satisfied, but we cannot check this.

2. Normality: We don't have a plot of the distribution that we can use to check this condition. We at least have more than 30 observations, so the distribution would have to be extremely skewed to be an issue. We again cannot check this, but this seems like a less concerning issue than the independence consideration.

(c) The test statistic and the p-value can be calculated as follows:

$$T = \frac{124.32 - 35}{\frac{37.74}{\sqrt{52}}} \approx 17.07$$

$$df = 52 - 1 = 51$$

$$p - value = 2 \times P(T_{51} > 17.07) < 0.001$$

The hypothesis test yields a very small p-value, so we reject H_0. Given the direction of the data, there is very convincing evidence that the police officers have been exposed to a higher concentration of lead than individuals living in a suburban area.

7.16

(a) True.

(b) True.

(c) True.

(d) False. We find the difference of each pair of observations, and then we do inference on these differences.

7.18

(a) Paired, on the same day the stock prices may be dependent on external factors that affect the price of both stocks.

(b) Paired, the prices are for the same items.

(c) Not paired, these are two independent random samples, individual students are not matched.

7.22

(a) A 95% confidence interval can be calculated as follows:

$$\begin{aligned}\bar{x}_{diff} \pm t^{\star}_{df}\frac{s_{diff}}{\sqrt{n}} &= -0.545 \pm 1.98 \times \frac{8.887}{\sqrt{200}} \\ &= -0.545 \pm 1.98 \times 0.6284 \\ &= -0.545 \pm 1.244 \\ &= (-1.79, 0.70)\end{aligned}$$

(b) We are 95% confident that on the reading test students score, on average, 1.79 points lower to 0.70 points higher than they do on the writing test.

(c) No, since 0 is included in the interval.