4.7: $CI = 0.45 \pm (1.96)(0.012) = (0.426,\ 0.474)$
We are 95% confident the true population proportion is between 42.6% and 47.4%.

4.8: We need to determine $z^\star$ such that $P(|Z| \leq z^\star) = 0.99$. We draw a sketch of a centrally symmetric area of 0.99, leaving two tails, each with 0.005 area. We can use the z table in reverse to find $z^\star$ such that $P(Z < z^\star) = 0.995$. We determine that $z^\star = 2.58$.

$$CI = 0.52 \pm (2.58)(0.024) = (0.458,\ 0.582)$$

We are 99% confident that the true population proportion is between 0.458 and 0.582.

4.9: **(a):** False, we only have some level of confidence.

(b): True, this is was a condidence interval is.

(c): True, the entire confidence interval is below 50%.

(d): False. This is not what standard error is. Standard error is the standard deviation of a sampling distribution. The standard error comes from the random samples being different, not from the individuals.

4.10: **(a):** False. The confidence interval straddles the 50% mark.

(b): False. If the poll reached 97.6% of users, the standard error would be tiny (of course we are not sure how to deal with this situation exactly because it would mean sampling more than 10% of the population). Standard error comes from differences between random samples. It does decrease with larger sample sizes, but it is often not even a percentage...

(c): False. A higher sample size gives a smaller standard error.

(d): False. A higher confidence level has a wider confidence interval.

4.11: **(a):** We are 95% confident that the true population mean is between 1.38 and 1.92 hours.

(b): The confidence level is higher.

(c): Larger sample size leads to smaller margin of error.

4.12: **(a):** We are 95% confident that the true mean is between 3.4 and 4.24. In other words, we think if we repeated the whole survey infinite times (with new samples) and calculated new confidence intervals the same way, then 95% of the time the true mean would fall in the various confidence intervals.

(b): I think if I repeat this process, then 95% of the time the various confidence intervals will contain the true population mean.

Sometimes gambling is fun. Given no other information, my cutoff odds would be 5:95 on the true mean being in the interval.

(c): Larger

(d): Standard error of the smaller sample is larger. If we could combine all the data, then the standard error would be smaller (but we were not told the population mean stayed constant, so we can't combine the data).

4.13: **(a):** False. The sampling distribution is probably normal.

(b): False, we know the sample mean.

(c): True. This is what a confidence interval is.

(d): False. We would need to know the population mean to make a statement like this.

(e): False. A larger confidence interval needs a larger interval.

(f): True.

(g): False. We would need to quadruple the sample size.

4.14: **(a):** False. We know the sample mean exactly ($84.71).

(b): False. That skew is not harsh and our sample size is quite large. However, there is a possibility that we just don't know how much skew there truly is. Maybe some people spend a million dollars a day...

(c): False. If we assumed the population mean was truly $84.71, then this would be true, but we don't have any reason to think that.

(d): True.

(e): False. We would need a sample 9 times larger.

(f): True.

4.15: We assume the sampling distribution is approximately normal because our sample size is larger than 30 and there is no reason to think the population is extremely skewed. Notice we did not assume the population was normally distributed!
We find the standard error.

$$SE = \frac{1.97}{\sqrt{203}} = \boxed{0.138}$$

We find $z^\star$.

$$P(|Z| < z^\star) = 0.9$$

$$P(Z < z^\star) = 0.95$$

$$z^\star = \Phi^{-1}(0.95) = \boxed{1.64}$$

We find the confidence interval.

$$CI = \bar{x} \pm z^\star SE$$

$$CI = 3.2 \pm (1.64)(0.138)$$

$$CI = (2.97, 3.43)$$

We are 90% confident that the true population mean is between 2.97 and 3.43.

4.16: We assume the sampling distribution is approximately normal because our sample size is larger than 30 and there is no reason to think the population is extremely skewed. Notice we did not assume the population was normally distributed!
We find the standard error.

$$SE = \frac{4.72}{\sqrt{5534}} = 0.0634$$

We find $z^\star$.

$$P(|Z| < z^\star) = 0.95$$

$$P(Z < z^\star) = 0.975$$

$$z^\star = \Phi^{-1}(0.975) = \boxed{1.96}$$

We find the confidence interval.

$$CI = \bar{x} \pm z^\star SE$$

$$CI = 23.44 \pm (1.96)(0.0634)$$

$$CI = (23.3,\ 23.6)$$

We are 95% confident that the true population mean is between 23.3 and 23.6.