Section 6-2

21. $P(z > 0.82) = 1 - 0.7939 = 0.2061$

31. $P(-2.11 < z < 4.00) = P(z < 4.00) - P(z < -2.11) = 0.9999 - 0.0174 = 0.9825$ (Tech: 0.9827)

34. $P(z > -3.80) = 0.9999$ 0.9999

Section 6-3

15. $z_{x=90} = \frac{90-100}{15} = -0.67$ which has an area of 0.2514 to the left of it. $z_{x=110} = \frac{110-100}{15} = 0.67$ which has an area of 0.7486 to the left of it. The area between the two scores is $0.7486 - 0.2514 = 0.4972$. (Tech: 0.4950)

18. $z = -0.67$ which means the score is $x = -0.67 \cdot 15 + 100 = 90$

19. $z = 0.67$ which means the score is $x = 0.67 \cdot 15 + 100 = 110$

22. a. $z_{x=64} = \frac{64-63.8}{2.6} = 0.08$ and $z_{x=77} = \frac{77-63.8}{2.6} = 5.08$. The area between the two z scores is $0.9999 - 0.5319 = 0.4680$ or 46.80%. (Tech: 46.93%.)

    b. $z_{x=64} = \frac{64-69.5}{2.4} = -2.29$ and $z_{x=77} = \frac{77-69.5}{2.4} = 3.13$. The area between the two z scores is $0.9991 - 0.0110 = 0.9881$ or 98.81%.

    c. The z score with 3% to the left of it for women is –1.88 which corresponds to a height of $-1.88 \cdot 2.6 + 63.8 = 58.9$ in. The z score with 3% to the right of it for men is 1.875 or 1.88 which corresponds to a height of $1.88 \cdot 2.4 + 69.5 = 74$ in

Section 6-4

1. a. The sample mean will tend to center about the population parameter of 5.67 g.
   b. The sample mean will tend to have a distribution that is approximately normal.
   c. The sample proportions will tend to have a distribution that is approximately normal.

2. a. Without replacement
   b. (1) When selecting a relatively small sample from a large population, it makes no significant difference whether we sample with replacement or without replacement. (2) Sampling with replacement results in independent events that are unaffected by previous outcomes, and independent events are easier to analyze and they result in simpler calculations and formulas.

4. No. The data set is only one sample, but the sampling distribution of the mean is the distribution of the means from all samples, not the one sample mean obtained from this single sample.

7. a. The mean of the population is $\mu = \frac{4+5+9}{3} = 6$, and the variance is

$$\sigma^2 = \frac{(4-6)^2 + (5-6)^2 + (9-6)^2}{3} = 4.7$$

b. The possible sample of size 2 are {(4, 4), (4, 5), (4, 9), (5, 4), (5, 5), (5, 9), (9, 4), (9, 5), (9, 9)} which have the following variances {0, 0.5, 12.5, 0.5, 0, 8, 12.5, 8, 0} respectively.

Sample Variance	Probability
0	3/9
0.5	2/9
8	2/9
12.5	2/9

c. The sample variances' mean is $\frac{3{\cdot}0 + 2{\cdot}0.5 + 2{\cdot}8 + 2{\cdot}12.5}{9} = 4.7$

d. Yes. The mean of the sampling distribution of the sample variances (4.7) is equal to the value of the population variance (4.7) so the sample variances target the value of the population variance.

9. a. The population median is 5
   b. The possible sample of size 2 are {(4, 4), (4, 5), (4, 9), (5, 4), (5, 5), (5, 9), (9, 4), (9, 5), (9, 9)} which have the following medians {4, 4.5, 6.5, 4.5, 5, 7, 6.5, 7, 9}

Sample Median	Probability
4	1/9
4.5	2/9
5	1/9
6.5	2/9
7	2/9
9	1/9

   c. The mean of the sampling distribution of the sampling median is

$$\frac{4+4.5+4.5+5+6.5+6.5+7+7+9}{9} = 6$$

   d. No. The mean of the sampling distribution of the sample medians is 6, and it is not equal to the value of the population median of 5, so the sample medians do not target the value of the population median.

Section 6-5

1. Because the sample size is greater than 30, the sampling distribution of the mean ages can be approximated by a normal distribution with mean μ and standard deviation $\frac{\sigma}{\sqrt{40}}$.

2. No. Because the original population is normally distributed, the sample means will be normally distributed for any sample size, not just those greater than 30.

5. a. $z_{x=222.7} = \frac{222.7-205.5}{8.6} = 2$, which has a probability of 0.9772.

   b. $z_{x=207} = \frac{207-205.5}{\frac{8.6}{\sqrt{49}}} = 1.22$, which has a probability of 0.8888. (Tech: 0.8889.)

7. a. $z_{x=218.4} = \frac{218.4-205.5}{8.6} = 1.5$, which has a probability of $1-0.9332 = 0.0668$ to the right of it

   b. $z_{x=204} = \frac{204-205.5}{\frac{8.6}{\sqrt{9}}} = -0.52$ which has a probability of $1-0.3015 = 0.6985$ to the right of it. (Tech: 0.6996.)

   c. Because the original population has a normal distribution, the distribution of sample means is normal for any sample size.

8. a. $z_{x=195} = \frac{195-205.5}{8.6} = -1.22$ which has an area of $1-0.1112 = 0.8888$ to the right of it. (Tech: 0.8889.)

   b. $z = \frac{203-205.5}{\frac{8.6}{\sqrt{25}}} = -1.45$ which has an area of $1-0.0735 = 0.9265$ to the right of it. (Tech: 0.9270.)

   c. Because the original population has a normal distribution, the distribution of sample means is normal for any sample size

Section 6-7

9. $\mu = 100 \cdot 0.22 = 22,\ \sigma = \sqrt{100 \cdot 0.22 \cdot 0.78} = 4.1425$

$z_{x=19.5} = \dfrac{19.5 - 22}{\sqrt{100 \cdot 0.22 \cdot 0.78}} = -0.60$ which has a probability of 0.2743. (Tech: 0.2731.)

10. $z_{x=24.5} = \dfrac{24.5 - 22}{\sqrt{100 \cdot 0.22 \cdot 0.78}} = 0.60$ which has a probability of $1 - 0.7257 = 0.2743$ to the right of it. (Tech: 0.2731.)

13. $\mu = 611 \cdot 0.3 = 183.3,\ \sigma = \sqrt{611 \cdot 0.3 \cdot 0.7} = 11.3274$

a. $z_{x=172.5} = \dfrac{172.5 - 183.3}{\sqrt{611 \cdot 0.3 \cdot 0.7}} = -0.95$ and $z_{x=171.5} = \dfrac{171.5 - 183.3}{\sqrt{611 \cdot 0.3 \cdot 0.7}} = -1.04$ which have a probability of $0.1711 - 0.1492 = 0.0219$ between them. (Tech using normal approximation: 0.0214; Tech using binomial: 0.0217)

b. $z_{x=172.5} = \dfrac{172.5 - 183.3}{11.3274} = -0.95$ which has a probability of 0.1711. The result of 172 overturned calls is not unusually low. (Tech using normal approximation: 0.1702; Tech using binomial: 0.1703.)

c. The result from part (b) is useful. We want the probability of getting a result that is at least as extreme as the one obtained.

d. If the 30% rate is correct, there is a good chance (17.11%) of getting 172 or fewer calls overturned, so there is not strong evidence against the 30% rate.