

## Chapter 8

$$8.1a. P(X > 45) \approx \frac{(60-45) \times 2}{50 \times 15} + \frac{(75-60) \times 2}{50 \times 15} = .0800$$

$$b. P(10 < X < 40) \approx \frac{(15-10) \times 16}{50 \times 15} + \frac{(30-15) \times 8}{50 \times 15} + \frac{(40-30) \times 8}{50 \times 15} = .4800$$

$$c. P(X < 25) \approx \frac{(-15-[-30]) \times 6}{50 \times 15} + \frac{(0-[-15]) \times 10}{50 \times 15} + \frac{(15-0) \times 17}{50 \times 15} + \frac{(25-15) \times 7}{50 \times 15} = .7533$$

$$d. P(35 < X < 65) \approx \frac{(45-35) \times 6}{50 \times 15} + \frac{(60-45) \times 2}{50 \times 15} + \frac{(65-60) \times 2}{50 \times 15} = .1333$$

$$8.2a. P(X > 45) \approx \frac{(60-45) \times 3}{50 \times 15} + \frac{(75-60) \times 3}{50 \times 15} = .1200$$

$$b. P(10 < X < 40) \approx \frac{(15-10) \times 17}{50 \times 15} + \frac{(30-15) \times 7}{50 \times 15} + \frac{(40-30) \times 6}{50 \times 15} = .3333$$

$$c. P(X < 25) \approx \frac{(-30-[-45]) \times 5}{50 \times 15} + \frac{(-15-[-30]) \times 5}{50 \times 15} + \frac{(0-[-15]) \times 2}{50 \times 15} + \frac{(15-0) \times 16}{50 \times 15} + \frac{(25-15) \times 8}{50 \times 15} = .6667$$

$$d. P(35 < X < 65) \approx \frac{(45-35) \times 8}{50 \times 15} + \frac{(60-45) \times 3}{50 \times 15} + \frac{(65-60) \times 3}{50 \times 15} = .1867$$

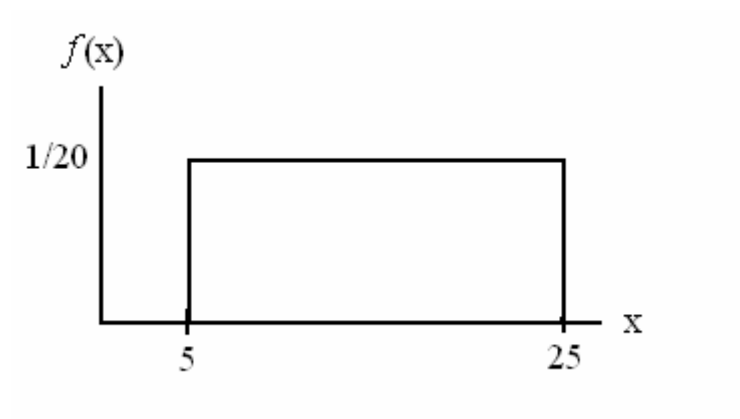
$$8.3a. P(55 < X < 80) \approx \frac{(60-55) \times 16}{60 \times 10} + \frac{(70-60) \times 5}{60 \times 10} + \frac{(80-70) \times 24}{60 \times 10} = .6167$$

$$b. P(X > 65) \approx \frac{(70-65) \times 5}{60 \times 10} + \frac{(80-70) \times 24}{60 \times 10} + \frac{(90-80) \times 7}{60 \times 10} + \frac{(100-90) \times 1}{60 \times 10} = .5750$$

$$c. P(X < 85) \approx \frac{(50-40) \times 7}{60 \times 10} + \frac{(60-50) \times 16}{60 \times 10} + \frac{(70-60) \times 5}{60 \times 10} + \frac{(80-70) \times 24}{60 \times 10} + \frac{(85-80) \times 7}{60 \times 10} = .9250$$

$$d. P(75 < X < 85) \approx \frac{(80-75) \times 24}{60 \times 10} + \frac{(85-80) \times 7}{60 \times 10} = .2583$$

8.4 a.

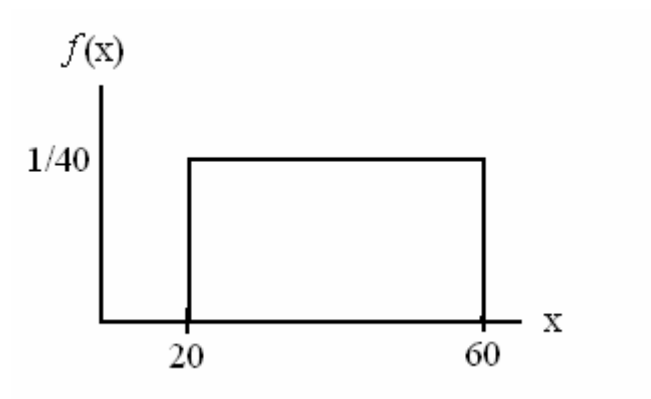


b.  $P(X > 25) = 0$

c.  $P(10 < X < 15) = (15 - 10) \frac{1}{20} = .25$

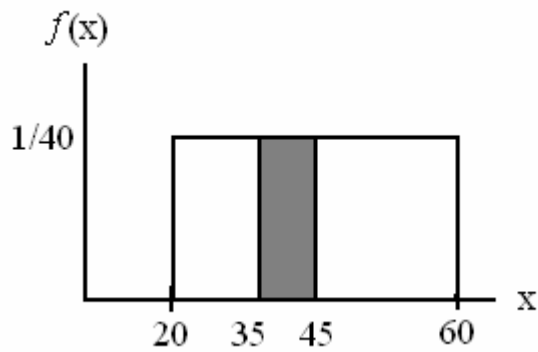
d.  $P(5.0 < X < 5.1) = (5.1 - 5) \frac{1}{20} = .005$

8.5a.  $f(x) = \frac{1}{(60 - 20)} = \frac{1}{40} \quad 20 < x < 60$



b.  $P(35 < X < 45) = (45 - 35) \frac{1}{40} = .25$

c.



$$8.6 \ f(x) = \frac{1}{(60 - 30)} = \frac{1}{30} \quad 30 < x < 60$$

$$a. \ P(X > 55) = (60 - 55) \frac{1}{30} = .1667$$

$$b. \ P(30 < X < 40) = (40 - 30) \frac{1}{30} = .3333$$

$$c. \ P(X = 37.23) = 0$$

$$8.7 \ \frac{1}{4} \times (60 - 30) = 7.5; \text{ The first quartile} = 30 + 7.5 = 37.5 \text{ minutes}$$

$$8.8 \ .10 \times (60 - 30) = 3; \text{ The top decile} = 60 - 3 = 57 \text{ minutes}$$

$$8.9 \ f(x) = \frac{1}{(175 - 110)} = \frac{1}{65} \quad 110 < x < 175$$

$$a. \ P(X > 150) = (175 - 150) \frac{1}{65} = .3846$$

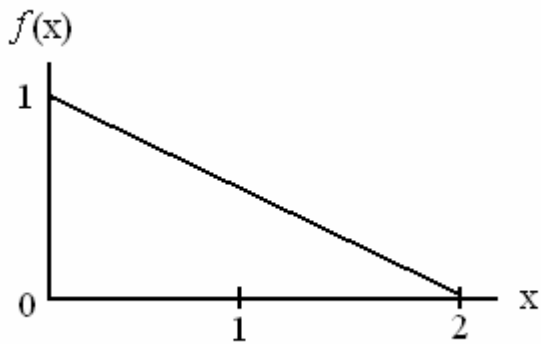
$$b. \ P(120 < X < 160) = (160 - 120) \frac{1}{65} = .6154$$

$$8.10 \ .20(175 - 110) = 13. \text{ Bottom 20\% lie below } (110 + 13) = 123$$

*For Exercises 8.11 to 8.14 we calculate probabilities by determining the area in a triangle. That is,*

$$\text{Area in a triangle} = (.5)(\text{height})(\text{base})$$

8.11a.



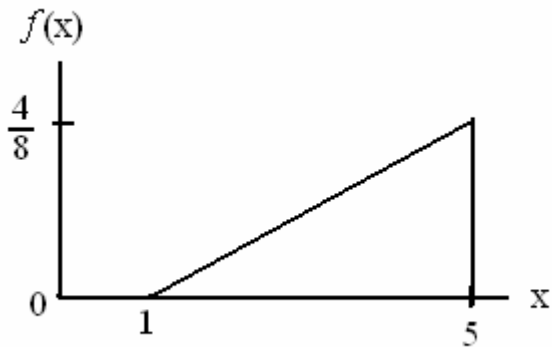
b.  $P(0 < X < 2) = (.5)(2-0)(1) = 1.0$

c.  $P(X > 1) = (.5)(2-1)(.5) = .25$

d.  $P(X < .5) = 1 - P(X > .5) = 1 - (.5)(.75)(2-.5) = 1 - .5625 = .4375$

e.  $P(X = 1.5) = 0$

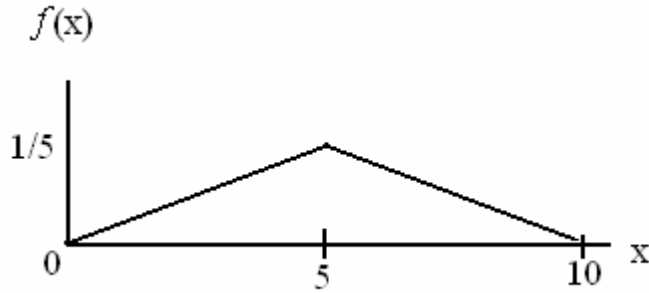
8.12 a



b.  $P(2 < X < 4) = P(X < 4) - P(X < 2) = (.5)(\frac{3}{8})(4-1) - (.5)(\frac{1}{8})(2-1) = .5625 - .0625 = .5$

c.  $P(X < 3) = (.5)(\frac{2}{8})(3-1) = .25$

8.13a.



$$b. P(1 < X < 3) = P(X < 3) - P(X < 1) = \frac{1}{2} \times \frac{3}{25} \times (3 - 0) - \frac{1}{2} \times \frac{1}{25} \times (1 - 0) = .18 - .02 = .16$$

$$c. P(4 < X < 8) = P(4 < X < 5) + P(5 < X < 8)$$

$$P(4 < X < 5) = P(X < 5) - P(X < 4) = \frac{1}{2} \times \frac{5}{25} \times (5 - 0) - \frac{1}{2} \times \frac{4}{25} \times (4 - 0) = .5 - .32 = .18$$

$$P(5 < X < 8) = P(X > 5) - P(X > 8) = \frac{1}{2} \times \frac{5}{25} \times (10 - 5) - \frac{1}{2} \times \frac{2}{25} \times (10 - 8) = .5 - .08 = .42$$

$$P(4 < X < 8) = .18 + .42 = .60$$

$$d. P(X < 7) = 1 - P(X > 7)$$

$$P(X > 7) = \frac{1}{2} \times \frac{3}{25} \times (10 - 7) = .18$$

$$P(X < 7) = 1 - .18 = .82$$

$$e. P(X > 3) = 1 - P(X < 3)$$

$$P(X < 3) = \frac{1}{2} \times \frac{3}{25} \times (3 - 0) = .18$$

$$P(X > 3) = 1 - .18 = .82$$

$$8.14 a. f(x) = .10 - .005x \quad 0 \leq x \leq 20$$

$$b. P(X > 10) = (.5)(.05)(20 - 10) = .25$$

$$c. P(6 < X < 12) = P(X > 6) - P(X > 12) = (.5)(.07)(20 - 6) - (.5)(.04)(20 - 12) = .49 - .16 = .33$$

$$8.15 P(Z < 1.50) = .9332$$

$$8.16 P(Z < 1.51) = .9345$$

$$8.17 P(Z < 1.55) = .9394$$

$$8.18 P(Z < -1.59) = .0559$$

$$8.19 P(Z < -1.60) = .0548$$

$$8.20 P(Z < -2.30) = .0107$$

$$8.21 P(-1.40 < Z < 0.60) = P(Z < 0.60) - P(Z < -1.40) = .7257 - .0808 = .6449$$

$$8.22 P(Z > -1.44) = 1 - P(Z < -1.44) = 1 - .0749 = .9251$$

$$8.23 P(Z < 2.03) = .9788$$

$$8.24 P(Z > 1.67) = 1 - P(Z < 1.67) = 1 - .9525 = .0475$$

$$8.25 P(Z < 2.84) = .9977$$

$$8.26 P(1.14 < Z < 2.43) = P(Z < 2.43) - P(Z < 1.14) = .9925 - .8729 = .1196$$

$$8.27 P(-0.91 < Z < -0.33) = P(Z < -.33) - P(Z < -.91) = .3707 - .1814 = .1893$$

$$8.28 P(Z > 3.09) = .5 - P(0 < Z < 3.09) = .5 - .4990 = .0010$$

$$8.29 P(Z > 0) = 1 - P(Z < 0) = 1 - .5 = .5$$

$$8.30 P(Z > 4.0) = 0$$

$$8.31 P(Z < z_{.02}) = 1 - .02 = .9800; z_{.02} = 2.05$$

$$8.32 P(Z < z_{.045}) = 1 - .045 = .9550; z_{.045} = 1.70$$

$$8.33 P(Z < z_{.20}) = 1 - .20 = .8000; z_{.20} = .84$$

$$8.34 P(X > 145) = P\left(\frac{X - \mu}{\sigma} > \frac{145 - 100}{20}\right) = P(Z > 2.25) = 1 - P(Z < 2.25) = 1 - .9878 = .0122$$

$$8.35 P(Z < z_{.15}) = 1 - .15 = .8500; z_{.15} = 1.04; z_{.15} = \frac{x - \mu}{\sigma}; 1.04 = \frac{x - 250}{40}; x = 291.6$$

$$8.36 P(800 < X < 1100) = P\left(\frac{800-1,000}{250} < \frac{X-\mu}{\sigma} < \frac{1,100-1,000}{250}\right) = P(-.8 < Z < .4) \\ = P(Z < .4) - P(Z < -.8) = .6554 - .2119 = .4435$$

$$8.37 P(Z < -z_{.08}) = .0800; -z_{.08} = -1.41; -z_{.08} = \frac{x-\mu}{\sigma}; -1.41 = \frac{x-50}{8}; x = 38.72$$

$$8.38 \text{ a } P(5 < X < 10) = P\left(\frac{5-6.3}{2.2} < \frac{X-\mu}{\sigma} < \frac{10-6.3}{2.2}\right) = P(-.59 < Z < 1.68) \\ = P(Z < 1.68) - P(Z < -.59) = .9535 - .2776 = .6759$$

$$\text{b } P(X > 7) = P\left(\frac{X-\mu}{\sigma} > \frac{7-6.3}{2.2}\right) = P(Z > .32) = 1 - P(Z < .32) = 1 - .6255 = .3745$$

$$\text{c } P(X < 4) = P\left(\frac{X-\mu}{\sigma} < \frac{4-6.3}{2.2}\right) = P(Z < -1.05) = .1469$$

$$8.39 P(Z < z_{.10}) = 1 - .10 = .9000; z_{.10} = 1.28; z_{.10} = \frac{x-\mu}{\sigma}; 1.28 = \frac{x-6.3}{2.2}; x = 9.116$$

Calls last at least 9.116 minutes.

$$8.40 P(X > 5,000) = P\left(\frac{X-\mu}{\sigma} > \frac{5,000-5,100}{200}\right) = P(Z > -.5) = 1 - P(Z < -.5) = 1 - .3085 = .6915$$

$$8.41 P(Z < -z_{.02}) = .02; -z_{.02} = -2.05; -z_{.02} = \frac{x-\mu}{\sigma}; -2.05 = \frac{x-5100}{200}; x = 4690;$$

$$8.42 \text{ a } P(X > 12,000) = P\left(\frac{X-\mu}{\sigma} > \frac{12,000-10,000}{2,400}\right) = P(Z > .83) = 1 - P(Z < .83) = 1 - .7967 = .2033$$

$$\text{b } P(X < 9,000) = P\left(\frac{X-\mu}{\sigma} < \frac{9,000-10,000}{2,400}\right) = P(Z < -.42) = .3372$$

$$8.43 P(Z < z_{.001}) = .9990; z_{.001} = 3.08; z_{.001} = \frac{x-\mu}{\sigma}; 3.08 = \frac{x-10,000}{2,400}; x = 17,392$$

$$8.44 \text{ a } P(X > 70) = P\left(\frac{X-\mu}{\sigma} > \frac{70-65}{4}\right) = P(Z > 1.25) = 1 - P(Z < 1.25) = 1 - .8944 = .1056$$

$$b \ P(X < 60) = P\left(\frac{X - \mu}{\sigma} < \frac{60 - 65}{4}\right) = P(Z < -1.25) = .1056$$

$$c \ P(55 < X < 70) = P\left(\frac{55 - 65}{4} < \frac{X - \mu}{\sigma} < \frac{70 - 65}{4}\right) = P(-2.50 < Z < 1.25) \\ = P(Z < 1.25) - P(Z < -2.50) = .8944 - .0062 = .8882$$

$$8.45 \ a \ P(X < 70,000) = P\left(\frac{X - \mu}{\sigma} < \frac{70,000 - 82,000}{6,400}\right) = P(Z < -1.88) = .0301$$

$$b \ P(X > 100,000) = P\left(\frac{X - \mu}{\sigma} > \frac{100,000 - 82,000}{6,400}\right) = P(Z > 2.81) = 1 - P(Z < 2.81) = 1 - .9975 = .0025$$

$$8.46 \ \text{Top 5\%: } P(Z < z_{.05}) = 1 - .05 = .9500; \ z_{.05} = 1.645; \ z_{.05} = \frac{x - \mu}{\sigma}; \ 1.645 = \frac{x - 32}{1.5}; \ x = 34.4675$$

$$\text{Bottom 5\%: } P(Z < -z_{.05}) = .0500; \ -z_{.05} = -1.645; \ -z_{.05} = \frac{x - \mu}{\sigma}; \ -1.645 = \frac{x - 32}{1.5}; \\ x = 29.5325$$

$$8.47 \ a \ P(X > 36) = P\left(\frac{X - \mu}{\sigma} > \frac{36 - 32}{1.5}\right) = P(Z > 2.67) = 1 - P(Z < 2.67) = 1 - .9962 = .0038$$

$$b \ P(X < 34) = P\left(\frac{X - \mu}{\sigma} < \frac{34 - 32}{1.5}\right) = P(Z < 1.33) = .9082$$

$$c \ P(30 < X < 33) = P\left(\frac{30 - 32}{1.5} < \frac{X - \mu}{\sigma} < \frac{33 - 32}{1.5}\right) = P(-1.33 < Z < .67) \\ = P(Z < .67) - P(Z < -1.33) = .7486 - .0918 = .6568$$

$$8.48 \ P(X > 8) = P\left(\frac{X - \mu}{\sigma} > \frac{8 - 7.2}{.667}\right) = P(Z > 1.20) = 1 - P(Z < 1.20) = 1 - .8849 = .1151$$

$$8.49 \ P(Z < z_{.25}) = .7500; \ z_{.25} = .67; \ z_{.25} = \frac{x - \mu}{\sigma}; \ .67 = \frac{x - 7.2}{.667}; \ x = 7.65 \text{ hours}$$

$$8.50 \ a \ P(X > 10) = P\left(\frac{X - \mu}{\sigma} > \frac{10 - 7.5}{2.1}\right) = P(Z > 1.19) = 1 - P(Z < 1.19) = 1 - .8830 = .1170$$

$$b \ P(7 < X < 9) = P\left(\frac{7 - 7.5}{2.1} < \frac{X - \mu}{\sigma} < \frac{9 - 7.5}{2.1}\right) = P(-.24 < Z < .71) \\ = P(Z < .71) - P(Z < -.24) = .7611 - .4052 = .3559$$



$$c \ P(X < 3) = P\left(\frac{X - \mu}{\sigma} < \frac{3 - 7.5}{2.1}\right) = P(Z < -2.14) = .0162$$

$$d \ P(Z < -z_{.05}) = .0500; \ -z_{.05} = -1.645; \ -z_{.05} = \frac{x - \mu}{\sigma}; \ -1.645 = \frac{x - 7.5}{2.1}; \ x = 4.05 \text{ hours}$$

$$8.51 \ a \ P(X > 12,000) = P\left(\frac{X - \mu}{\sigma} > \frac{12,000 - 11,500}{800}\right) = P(Z > .63) = 1 - P(Z < .63) = 1 - .7357 = .2643$$

$$b \ P(X < 10,000) = P\left(\frac{X - \mu}{\sigma} < \frac{10,000 - 11,500}{800}\right) = P(Z < -1.88) = .0301$$

$$8.52 \ P(Z < -z_{.01}) = .0100; \ -z_{.01} = -2.33; \ -z_{.01} = \frac{x - \mu}{\sigma}; \ -2.33 = \frac{x - 11,500}{800}; \ x = 9,636$$

$$8.53 \ a \ P(24 < X < 28) = P\left(\frac{24 - 26}{2.5} < \frac{X - \mu}{\sigma} < \frac{28 - 26}{2.5}\right) = P(-.80 < Z < .80) = P(Z < .80) - P(Z < -.80) \\ = .7881 - .2119 = .5762$$

$$b \ P(X > 28) = P\left(\frac{X - \mu}{\sigma} > \frac{28 - 26}{2.5}\right) = P(Z > .80) = 1 - P(Z < .80) = 1 - .7881 = .2119$$

$$c \ P(X < 24) = P\left(\frac{X - \mu}{\sigma} < \frac{24 - 26}{2.5}\right) = P(Z < -.80) = .2119$$

$$8.54 \ a \ P(X > 30) = P\left(\frac{X - \mu}{\sigma} > \frac{30 - 27}{7}\right) = P(Z > .43) = 1 - P(Z < .43) = 1 - .6664 = .3336$$

$$b \ P(X > 40) = P\left(\frac{X - \mu}{\sigma} > \frac{40 - 27}{7}\right) = P(Z > 1.86) = 1 - P(Z < 1.86) = 1 - .9686 = .0314$$

$$c \ P(X < 15) = P\left(\frac{X - \mu}{\sigma} < \frac{15 - 27}{7}\right) = P(Z < -1.71) = .0436$$

$$d \ P(Z < z_{.20}) = 1 - .20 = .8000; \ z_{.20} = .84; \ z_{.20} = \frac{x - \mu}{\sigma}; \ .84 = \frac{x - 27}{7}; \ x = 32.88$$

$$8.55 \ a \ P(X < 4) = P\left(\frac{X - \mu}{\sigma} < \frac{4 - 7.5}{1.2}\right) = P(Z < -2.92) = .0018$$

$$b \ P(7 < X < 10) = P\left(\frac{7 - 7.5}{1.2} < \frac{X - \mu}{\sigma} < \frac{10 - 7.5}{1.2}\right) = P(-.42 < Z < 2.08) = P(Z < 2.08) - P(Z < -.42) \\ = .9812 - .3372 = .6440$$

$$8.56 \text{ a } P(X < 10) = P\left(\frac{X - \mu}{\sigma} < \frac{10 - 16.40}{2.75}\right) = P(Z < -2.33) = .0099$$

$$\text{b } P(Z < -z_{.10}) = .1000; -z_{.10} = -1.28; -z_{.10} = \frac{x - \mu}{\sigma}; -1.28 = \frac{x - 16.40}{2.75}; x = 12.88$$

$$8.57 \text{ A: } P(Z < z_{.10}) = 1 - .10 = .9000; z_{.10} = 1.28; z_{.10} = \frac{x - \mu}{\sigma}; 1.28 = \frac{x - 70}{10}; x = 82.8$$

$$\text{B: } P(Z < z_{.40}) = 1 - .40 = .6000; z_{.40} = .25; z_{.40} = \frac{x - \mu}{\sigma}; .25 = \frac{x - 70}{10}; x = 72.5$$

$$\text{C: } P(Z < -z_{.20}) = .2000; -z_{.20} = -.84; -z_{.20} = \frac{x - \mu}{\sigma}; -.84 = \frac{x - 70}{10}; x = 61.6;$$

$$\text{D: } P(Z < -z_{.05}) = .0500; -z_{.05} = -1.645; -z_{.05} = \frac{x - \mu}{\sigma}; -1.645 = \frac{x - 70}{10}; x = 53.55$$

$$8.58 \text{ } P(Z < z_{.02}) = 1 - .02 = .9800; z_{.02} = 2.05; z_{.02} = \frac{x - \mu}{\sigma}; 2.05 = \frac{x - 100}{16}; x = 132.80$$

(rounded to 133)

$$8.59 \text{ } P(X > 70,000) = P\left(\frac{X - \mu}{\sigma} > \frac{70,000 - 61,823}{17,301}\right) = P(Z > .47) = 1 - P(Z < .47) = 1 - .6808 = .3192$$

$$8.60 \text{ } P(X < 45,000) = P\left(\frac{X - \mu}{\sigma} < \frac{45,000 - 41,825}{13,444}\right) = P(Z < .24) = .5948$$

$$8.61 \text{ } P(Z < -z_{.01}) = .0100; -z_{.01} = -2.33; -z_{.01} = \frac{x - \mu}{\sigma}; -2.33 = \frac{x - 75}{8}; x = 56.36$$

$$8.62 \text{ } P(x > 150,000) = P\left(\frac{X - \mu}{\sigma} < \frac{150,000 - 99,700}{30,000}\right) = P(Z > 1.68) = 1 - P(Z < 1.68) = 1 - .9535 = .0465$$

$$8.63 \text{ } P(Z < z_{.06}) = 1 - .06 = .9400; z_{.06} = 1.55; z_{.06} = \frac{ROP - \mu}{\sigma}; 1.55 = \frac{ROP - 200}{30}; ROP = 246.5$$

(rounded to 247)

$$8.64 \text{ } P(Z < z_{.20}) = 1 - .20 = .8000; z_{.20} = .84; z_{.20} = \frac{x - \mu}{\sigma}; .84 = \frac{x - 150}{25}; x = 171$$

$$8.65 \quad P(Z < z_{.30}) = 1 - .30 = .7000; \quad z_{.30} = .52; \quad z_{.30} = \frac{x - \mu}{\sigma}; \quad .52 = \frac{x - 850}{90}; \quad x = 896.8$$

(rounded to 897)

$$8.66 \quad P(Z < z_{.40}) = 1 - .40 = .6000; \quad z_{.40} = .25; \quad z_{.40} = \frac{x - \mu}{\sigma}; \quad .25 = \frac{x - 850}{90}; \quad x = 872.5$$

(rounded to 873)

$$8.67 \quad \text{From Exercise 7.57: } \mu = 65, \sigma^2 = 21, \text{ and } \sigma = 4.58$$

$$P(X > 60) = P\left(\frac{X - \mu}{\sigma} > \frac{60 - 65}{4.58}\right) = P(Z > -1.09) = 1 - P(Z < -1.09) = 1 - .1379 = .8621$$

$$8.68 \quad P(X < 150) = P\left(\frac{X - \mu}{\sigma} < \frac{150 - 145}{5.57}\right) = P(Z < .90) = .8159$$

$$8.69 \quad \text{a. } P(X > 25) = P\left(\frac{X - \mu}{\sigma} > \frac{25 - 14}{18}\right) = P(Z > .61) = 1 - P(Z < .61) = 1 - .7291 = .2709$$

$$\text{b. } P(X < 0) = P\left(\frac{X - \mu}{\sigma} < \frac{0 - 14}{18}\right) = P(Z < -.78) = .2177$$

$$8.70 \quad \text{a. } P(X < 0) = P\left(\frac{X - \mu}{\sigma} < \frac{0 - 10.60}{14.56}\right) = P(Z < -.73) = .2327$$

$$\text{b. } P(X > 20) = P\left(\frac{X - \mu}{\sigma} > \frac{20 - 10.60}{14.56}\right) = P(Z > .65) = 1 - P(Z < .65) = 1 - .7422 = .2578$$

$$8.71 \quad \mu = 1/\lambda = 6 \text{ minutes; } \lambda = .167 \text{ customers/minute}$$

$$P(X > 10) = e^{-.167(10)} = e^{-1.67} = .1889$$

$$8.72 \quad \mu = 1/\lambda = 25 \text{ hours; } \lambda = .04 \text{ breakdowns/hour}$$

$$P(X > 50) = e^{-.04(50)} = e^{-2} = .1353$$

$$8.73 \quad \mu = 1/\lambda = 125 \text{ seconds; } \lambda = .008 \text{ transactions/second} = .48 \text{ transactions/minute}$$

$$P(X > 3) = e^{-.48(3)} = e^{-1.44} = .2369$$

8.74  $\lambda = 6$  kilograms/hour = .1 kilogram/minute

$$P(X > 15) = e^{-.1(15)} = e^{-1.5} = .2231$$

8.75  $\mu = 1/\lambda = 7.5$  minutes;  $\lambda = .133$  service/minute

$$P(X < 5) = 1 - e^{-.133(5)} = 1 - e^{-.665} = 1 - .5143 = .4857$$

8.76 a  $P(X > 2) = e^{-.3(2)} = e^{-.6} = .5488$

b  $P(X < 4) = 1 - e^{-.3(4)} = 1 - e^{-1.2} = 1 - .3012 = .6988$

c  $P(1 < X < 2) = e^{-.3(1)} - e^{-.3(2)} = e^{-.3} - e^{-.6} = .7408 - .5488 = .1920$

d  $P(X = 3) = 0$

8.77  $\mu = 1/\lambda = 2.7$  minutes;  $\lambda = .37$  service/minute

$$P(X < 3) = 1 - e^{-.37(3)} = 1 - e^{-1.11} = 1 - .3296 = .6704$$

8.78 a  $P(X > 1) = e^{-.5(1)} = e^{-.5} = .6065$

a  $P(X > .4) = e^{-.5(.4)} = e^{-.2} = .8187$

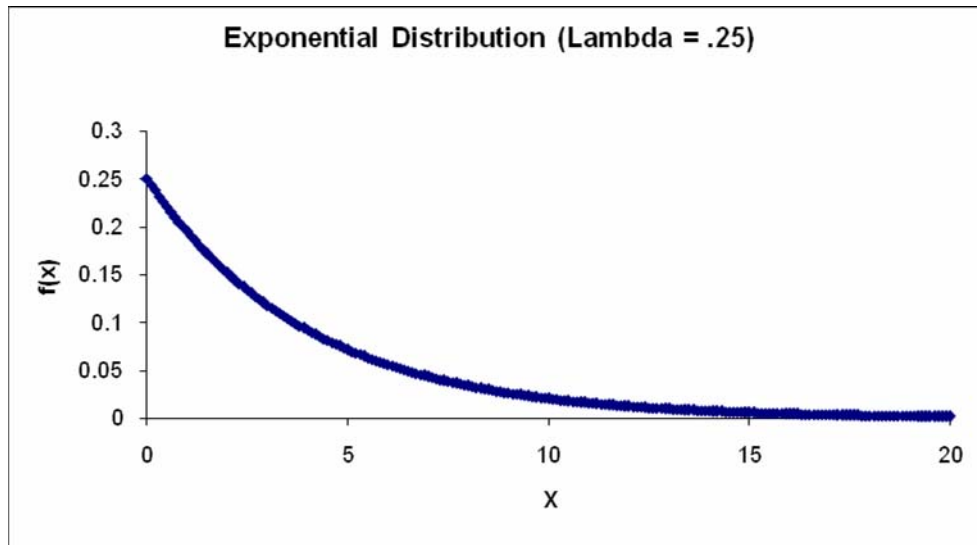
c  $P(X < .5) = 1 - e^{-.5(.5)} = 1 - e^{-.25} = 1 - .7788 = .2212$

d  $P(X < 2) = 1 - e^{-.5(2)} = 1 - e^{-1} = 1 - .3679 = .6321$

8.79  $\mu = 1/\lambda = 5$  minutes;  $\lambda = .2$  customer/minute

$$P(X < 10) = 1 - e^{-.2(10)} = 1 - e^{-2} = 1 - .1353 = .8647$$

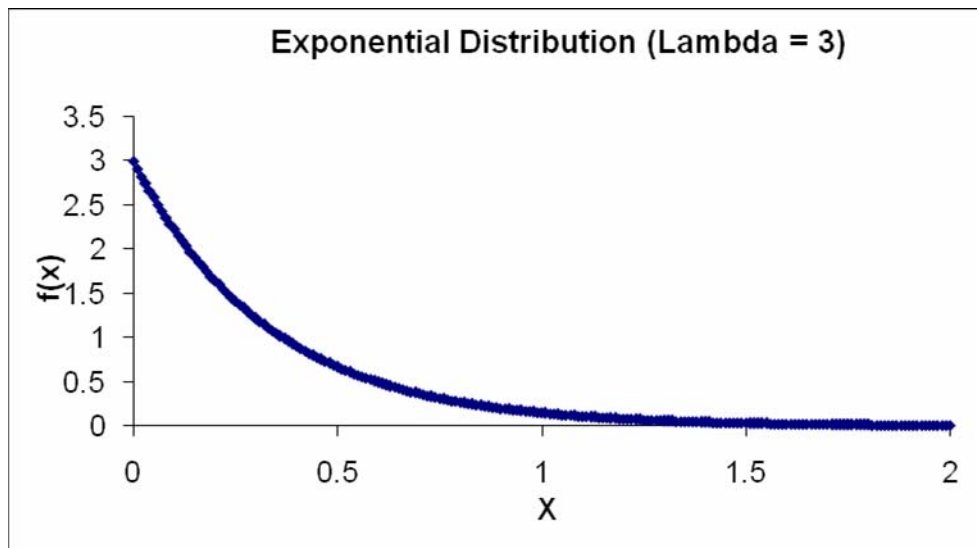
8.80



8.81  $\lambda = 10$  trucks/hour = .167 truck/minute

$$P(X > 15) = e^{-.167(15)} = e^{-2.5} = .0821$$

8.82



8.83    a 1.341                      b 1.319                      c 1.988                      d 1.653

8.84    a 2.724                      b 1.282                      c 2.132                      d 2.528

8.85    a 1.3406                      b 1.3195                      c 1.9890                      d 1.6527

8.86	a 1.6556	b 2.6810	c 1.9600	d 1.6602
8.87	a .0189	b .0341	c .0927	d .0324
8.88	a .1744	b .0231	c .0251	d .0267
8.89	a 9.24	b 136	c 9.39	d 37.5
8.90	a 17.3	b 50.9	c 2.71	d 53.5
8.91	a 73.3441	b 102.946	c 16.3382	d 24.7690
8.92	a 33.5705	b 866.911	c 24.3976	d 261.058
8.93	a .2688	b 1.0	c .9903	d 1.0
8.94	a .4881	b .9158	c .9988	d .9077
8.95	a 4.35	b 8.89	c 3.29	d 2.50
8.96	a 2.84	b 1.93	c 3.60	d 3.37
8.97	a 1.4857	b 1.7633	c 1.8200	d 1.1587
8.98	a 1.5204	b 1.5943	c 2.8397	d 1.1670
8.99	a .0510	b .1634	c .0222	d .2133
8.100	a .1050	b .1576	c .0001	d .0044