4.52 (a) \( F(4; 7) = .173 \)

(b) \( f(4; 7) = F(4; 7) - F(3; 7) = (.173) - (.082) = .091 \)

(c) \( \sum_{k=6}^{19} f(k; 8) = F(19; 8) - F(5; 8) = 1.0 - (.191) = .809 \)

4.55 (a) \( n = 80, p = .06, np = 4.8. \) Thus,

\[
f(4; 8.4) = F(4; 4.8) - F(3; 4.8) = (.476) - (.294) = .182
\]

(b) \( 1 - F(2; 4.8) = 1 - (.143) = .857 \)

(c)

\[
\sum_{k=3}^{6} f(k; 4.8) = F(6; 4.8) - F(2; 4.8) = (.791) - (.143) = .648
\]

4.57 \( 1 - F(12; 5.8) = 1 - .993 = .007. \)

4.59 (a) \( P(\text{at most 4 in a minute}) = F(4; 1.5) = .981. \)

(b) \( P(\text{at least 3 in 2 minutes}) = 1 - F(2; 3) = 1 - (.423) = .577. \)

(c) \( P(\text{at most 15 in 6 minutes}) = F(15; 9) = .978. \)

4.60 Expected profit = \( 600t - \sum_{x=0}^{\infty} 50x^2 f(x; .8t). \) Now,

\[
\sum_{x=0}^{\infty} x^2 f(x; .8t) = \mu'_2 = \sigma^2 + \mu^2
\]

But, \( \mu = .8t \) and \( \sigma^2 = .8t, \) so

\[
\text{Expected profit} = 600t - 50(.8t + (.8t)^2) = 560t - 32t^2.
\]

Taking the derivative, setting it equal to 0, and solving for \( t \) gives \( t = 8.75. \) Profits are maximized when \( t = 8.75 \) hours.
\[ f(x) = \begin{cases} 
2e^{-2x} & \text{for } x > 0 \\
0 & \text{elsewhere} 
\end{cases} \]

Since \(e^{-2x}\) is always positive, \(f(x)\) is always \(\geq 0\).

\[ \int_{-\infty}^{\infty} f(x) \, dx = -e^{-2x} \bigg|_{0}^{\infty} = 1 \]

Thus, \(f(x)\) is a density.

5.2 To find \(k\), we must integrate \(f(x)\) from \(x = 0\) to \(x = 1\) and set it equal to 1. Thus,

\[ \int_{0}^{1} kx^3 \, dx = 1 \quad \text{implies} \quad kx^4 \bigg|_{0}^{1} = 1 \]

which implies \(k/4 = 1\). Thus, \(k = 4\).

(a) \(P(.25 \leq X \leq .75) = \int_{.25}^{.75} 4x^3 \, dx = x^4 \bigg|_{.25}^{.75} = 80/256\)

(b) \(P(X > 2/3) = \int_{2/3}^{1} 4x^3 \, dx = x^4 \bigg|_{2/3}^{1} = 65/81\)

5.11 Integrating the density function by parts shows that the distribution function is given by

\[ F(x) = 1 - \frac{1}{3}xe^{-x/3} - e^{-x/3} \]

Thus,

\[ P(\text{power supply will be inadequate on any given day}) \]

\[ = P(\text{consumption} \geq 12 \text{ million kwh's}) \]

\[ = 1 - F(12) = 4e^{-4} + e^{-4} = 5e^{-4} = .0916 \]