A&T-3.9 Y and X denote the water level and increase in water level at B, respectively. \( \{Y : \text{Overflow at B}\} = \{X + Y > 40\} \)
(a) \( \text{Area} = 1 = a = 2/25 \)
(b) \( P(O) = 0.7P(X > 15) + 0.3P(X > 5) = 0.227 \)
(c) \( p = 0.7P(X < 15)/(1 - P(O)) = 0.845 \)

A&T-3.19 \( X : N(30, \sigma) \) and \( P(X < 40) = 0.9 \)
(a) \( P(X < 40) = 0.9 \Rightarrow \sigma = 7.78 \) and thus \( P(X < 50) = 0.994915 \)
(b) \( P(X < 0) = \phi(-3.86) = 0.00006 \)
(c) \( X : L - N(\lambda = 30, \zeta = 7.78) \Rightarrow \ln X : N(\mu = 3.37, \sigma = 0.255) \)
\( P(X < 50) = P(\ln X < 50) = \phi(2.13) = 0.983414 \)

A&T-3.20 Let T be the time btw breakdowns and \( T : L - N(6,1.5) \) thus \( \ln T : N(1.76, 0.25) \)
(a) \( T_M = \text{time until maintenance. } P(T \geq T_M) = 0.9 \Rightarrow T_M = 4.22 \)
(b) \( P(T > T_M + 1 | T > T_M) = P(T > T_M + 1) / P(T > T_M) = 0.74 \)

A&T-3.22 \( H : L - N(30,0.2(30)) \Rightarrow \ln H : N(3.38,0.198) \)
(a) \( P(H > 39) = 0.078 \)
(b) \( P(H < 44 | H > 39) = P(39 < H < 44) / P(H > 39) = 0.72 \)

A&T-3.46 Let X be # of hurricanes : Poisson(\( \lambda = .8 \)) and let \( W : L - N(100,20) \Rightarrow \ln H : N(4.59,0.198) \) be wind speed.
(a) \( P(X \geq 1) = 1 - e^{-2X} = 0.798 \)
(b) \( P(W > 130) = 1 - \phi(140.0) = 0.919243 = 0.081 = 1 - p \)
(c) \( P(\text{no damage}) = P(X = 0) + P(X = 1)p + P(X = 2)p^2 = 0.72 \)

A&T-3.50 Given consumption \( C : N(500,150) \) and supply S with \( P(S = 600) = 0.7 \) and \( P(S = 750) = 0.3 \)
(a) \( P(\text{shortage}) = 0.7P(C > 600) + 0.3P(C > 750) = 0.19 = p \)
(b) \( P(\text{shortage in a week}) = 1 - p^0q^7 = 0.77 \)
(c) \( \text{How often \( \frac{1}{p} \) day} \Rightarrow \frac{1}{1/5} \Rightarrow \text{\( \lambda \approx 5 \)} \)
\( \Rightarrow P(\text{shortage in a week}) = 1 - e^{-7/5} = 0.75 \)
(d) \( P(C > S) = 0.01 \Rightarrow \phi(S - 500/150) = 0.99 \Rightarrow S \approx 850 \)

A&T-3.53 \( E[X] = 1/c = 2 \Rightarrow c = 0.5 \)
(a) \( P(X > 6) = \int_6^\infty e^{-cx}dx = e^{-6c} = p \)
(b) \( \text{Return Period} \frac{1}{p} = 20 \text{ days} \)

A&T-3.56 Let T be time until breakdown : Exp. with \( E[T] = 24 \)
(a) \( P(T < 5) = 1 - \exp(-5/24) = p \)
(b) \( P(T > 10 | T > 5) = P(T > 5) = 1 - p \)
(c) \( P(\text{at most one}) = p^0q^5 + 3pq \approx 0.993 \)
(d) \( P(\text{repair}) = 1 - p^0q^5 = .1 \Rightarrow q = \exp(-T/24) = .979 \Rightarrow T = 0.5 \)

A&T-3.57 Let T be interarrival time: Exp. with \( E[T] = 0.5 \)
(a) \( T_0 = \text{time of operation} \Rightarrow P(T > T_0) = .8 = e^{-2T_0} \Rightarrow T_0 = .11 \)
(b) \( P = P(T > T_0) = 0.8 \Rightarrow P(\text{none wait}) = p^4 = 0.41 \)
(c) \( n = 3 \text{ boats/24 hours} \Rightarrow P(\text{at least 1 wait}) = 1 - P(\text{none wait}) = 1 - p^3 = .488 \)

M&A- p146/37 \( T : \text{time btw quakes : Exp. with } E[T] = 12 \)
(a) \( P(T > 3) = \exp(-3/12) \)
(b) \( P(T > 7 | T > 4) = P(T > 3) = \exp(-3/12) \)

M&A- p154/86 \( T : \text{time btw calls : Exp. with } E[T] = 480/50 \)
\( P(T < 9 : 15a.m.) = 1 - \exp(-15(50/480)) = 0.79 \)
\( P(T > 3p.m.) = \exp(-360(50/480)) = 0 \)
\( P(9 : 30a.m. < T < 10a.m.) = \int_{x=930}^{10} f_T(t)dt = 0.042 \)

M&A- p155/90 \( X_B : \# \text{ of failures : Binomial(} n = 100, p = .08 \) \)
\( E[X_B] = np = 8. \text{ Since } np > 5 \)
\( P(X_B \geq 10) \approx P(X_N \geq 10) = 0.23 \)
\( P(X_B \leq 5) \approx P(X_N \leq 5) = 0.1335 \) where \( X_N : N(np, \sqrt{npq}) \)

M&R-4.44 Let \( X : N(10,2) \)
(a) \( P(X > x) = 0.5 \Rightarrow x = 10 \)
(b) \( P(X > x) = 0.95 \Rightarrow x = 6.71 \)
(c) \( P(x < X < 10) = 0.2 \Rightarrow x = 8.95 \)
(d) \( P(-x < X < 10 - x) = 0.95 \Rightarrow x = 3.92 \)
(e) \( P(-x < X < -10 - x) = 0.99 \Rightarrow x = 5.16 \)

M&R-4.66 \( X_p : \text{Poisson r.v. with } \lambda = 1000. \) Since \( \lambda > 5 \)
\( P(X_p > 10000) \approx P(X_N > 10000) = .5 \) with \( X_N : N(10\lambda, \sqrt{10 \lambda}) \)

M&R-4.83 Let \( X_E \) be distance btw cracks: Exp. with \( E[X_E] = 5 \) and \( X_p \) be the corresponding Poisson r.v.
(a) \( P(X_E > 10) = e^{-2} \) (b) \( P(X_P = 2) = 2e^{-2} \) (c) \( \sqrt{E[X_E]} = 5 \)

M&R-4.84 \( P(12 < X_E < 15) = \int_{12}^{15} f_{X_E}(x)dx = 0.041 \)
(b) \( P(\text{no cracks}) = \left[P(X_E > 5)\right]^2 = e^{-2} \)
(c) \( P(X_E > 15 | X_E > 5) = P(X_E > 10) = e^{-2} \)

M&R-4.146 Let \( X_B \) be the binomial r.v. with \( n = 200 \) and \( p = .9 \)
(a) \( P(X_B \leq 185) \approx P(X_N \leq 185) = \phi(18.1) = 0.881 \)
(b) \( P(X_B \leq 184) \approx P(X_N \leq 184) = \phi(0.94) = 0.826391 \)
(c) \( \text{Find n so that } P(X_B \leq 185) = 0.9 \) with \( p = .9 \)
\( \Rightarrow \phi(185 - np)/\sqrt{npq} = 0.95 \)
\( \Rightarrow (185 - np)/\sqrt{npq} = 1.65 \)
\( \Rightarrow n \approx 198 \)