1. It is known that 3% of the circuit boards from a production line are defective. If a random sample of 120 circuit boards is taken from this production line, use the Poisson approximation to estimate the probability that the sample contains:
   a) Exactly 2 defective boards.
   b) At least 2 defective boards.

2. Let $X$ be a Poisson random variable with parameter $\lambda$
   a) Which $n = n(\lambda) \geq 0$ is the most likely value of $X$, i.e. maximizes $P(X = n)$?
   b) Suppose the experiment described by $X$ has returned the value $n \geq 0$. Which parameter $\lambda = \lambda(n)$ maximizes $P(X = n)$?

3. Exercise 3.7.

4. a) Define the function
   \[ f(x) = \begin{cases} 
   3x - b & x \in [0, 1] \\
   0 & \text{otherwise}
   \end{cases} \]
   Show that there is no value of $b$ for which this is the p.d.f. of some r.v. $X$.
   b) Let
   \[ f(x) = \begin{cases} 
   \sin x & x \in [0, b] \\
   0 & \text{otherwise}
   \end{cases} \]
   Show that there is exactly one value of $b$ for which this could be the p.d.f. of some r.v. $X$.

5. Answer questions (a) - (f) of Exercise 3.31 for the function
   \[ f(x) = \begin{cases} 
   cx^{-3} & x \geq 1 \\
   0 & \text{otherwise}
   \end{cases} \]

6. Suppose that a r.v. $X$ has cumulative distribution function
   \[ F(x) = \begin{cases} 
   \frac{\pi}{2} \arctan x & x > 0 \\
   0 & x \leq 0
   \end{cases} \]
   Compute $E\left(\frac{1}{\sqrt{1+X^2}}\right)$.

7. Exercise 3.20