1. The current in a certain circuit as measured by an ammeter is a continuous random variable X with the following density function:

$$f(x) = \begin{cases} .075x + .2 & 3 \le x \le 5 \\ 0 & \text{otherwise} \end{cases}$$

   a. Graph the pdf and verify that the total area under the density curve is indeed 1.
   b. Calculate $P(X \le 4)$. How does this probability compare to $P(X < 4)$?
   c. Calculate $P(3.5 \le X \le 4.5)$ and also $P(4.5 < X)$.

2. Suppose the reaction temperature X (in °C) in a certain chemical process has a uniform distribution with $A = -5$ and $B = 5$.
   a. Compute $P(X < 0)$.
   b. Compute $P(-2.5 < X < 2.5)$.
   c. Compute $P(-2 \le X \le 3)$.
   d. For k satisfying $-5 < k < k + 4 < 5$, compute $P(k < X < k + 4)$.

3. The error involved in making a certain measurement is a continuous rv X with pdf

$$f(x) = \begin{cases} .09375(4 - x^2) & -2 \le x \le 2 \\ 0 & \text{otherwise} \end{cases}$$

   a. Sketch the graph of $f(x)$.
   b. Compute $P(X > 0)$.
   c. Compute $P(-1 < X < 1)$.
   d. Compute $P(X < -.5 \text{ or } X > .5)$.

4. Let X denote the vibratory stress (psi) on a wind turbine blade at a particular wind speed in a wind tunnel. The article "Blade Fatigue Life Assessment with Application to VAWTS" (*J. of Solar Energy Engr.*, 1982: 107–111) proposes the Rayleigh distribution, with pdf

$$f(x; \theta) = \begin{cases} \dfrac{x}{\theta^2} \cdot e^{-x^2/(2\theta^2)} & x > 0 \\ 0 & \text{otherwise} \end{cases}$$

   as a model for the X distribution.
   a. Verify that $f(x; \theta)$ is a legitimate pdf.
   b. Suppose $\theta = 100$ (a value suggested by a graph in the article). What is the probability that X is at most 200? Less than 200? At least 200?
   c. What is the probability that X is between 100 and 200 (again assuming $\theta = 100$)?
   d. Give an expression for $P(X \le x)$.

5. A college professor never finishes his lecture before the end of the hour and always finishes his lectures within 2 min after the hour. Let X = the time that elapses between the end of the hour and the end of the lecture and suppose the pdf of X is

$$f(x) = \begin{cases} kx^2 & 0 \le x \le 2 \\ 0 & \text{otherwise} \end{cases}$$

   a. Find the value of k and draw the corresponding density curve. [*Hint*: Total area under the graph of $f(x)$ is 1.]
   b. What is the probability that the lecture ends within 1 min of the end of the hour?