1. Let the continuous random variable \( X \) have probability density function (pdf) given by:
\[
f(x) = \begin{cases} 
0.04x & 0 < x < 5 \\
0.4 - 0.04x & 5 \leq x < 10 \\
0 & \text{otherwise}
\end{cases}
\]
as shown in the following graph:

a) Determine \( \Pr(X = 5) \).
b) Determine \( \Pr(X \leq 3) \).
c) Determine \( \Pr(X > 8) \).
d) Determine the cumulative distribution function (cdf) of \( X \).

2. Suppose that the distance (in hundreds of miles) driven by a trucker in one day is a continuous random variable \( Y \) whose cumulative distribution function (cdf) is given by:
\[
G(y) = \begin{cases} 
0 & y \leq 0 \\
\frac{y^2}{36} & 0 < y < 6 \\
1 & y \geq 6
\end{cases}
\]
a) Determine the probability that the trucker travels more than 500 miles in a day.
b) Determine the probability that the trucker travels exactly 200 miles in a day.
c) Let the random variable \( T \) represent the time (in number of days) required for the trucker to make a 3000-mile cross-country trip, so \( T = 30/Y \). Determine the expected value of \( T \).

3. Let the random variable \( T \) represent the time (in minutes on the game clock) until the first score in a (randomly selected) professional football game. Suppose that \( T \) follows an exponential distribution with mean 6.4 minutes, independently from game to game.

a) Determine the probability that the first score in a (randomly selected) professional football game occurs within the first 7.5 minutes.
b) Suppose that no score has occurred in the first 15 minutes of a (randomly selected) professional football game. Determine the conditional probability that no score occurs in the next 15 minutes. (In other words, determine the probability that the game will be scoreless at halftime, given that it is scoreless after one quarter.) Justify your answer.

c) Suppose that 16 professional football games take place at the same time, and let the random variable U represent the time (in minutes) until the first score in any of these games. Determine the expected value of U. Justify your answer.

4. Suppose that my morning commute time to school on a randomly selected day has follows a normal distribution with mean 29 minutes and standard deviation 2 minutes.

a) Consider the probability that my commute takes more than 30 minutes. Express this probability in terms of \( \Phi(z) \), the cdf of a standard normal distribution, and then use the standard normal probability table to determine this probability.

b) If I am willing to be late for my first appointment of the day 4% of the time, how many minutes before my first appointment should I leave home? Show the calculations to justify your answer.

5. Consider two discrete random variables X and Y with joint pmf given in the following table:

<table>
<thead>
<tr>
<th></th>
<th>y = -1</th>
<th>y = 0</th>
<th>y = 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>x = -1</td>
<td>0</td>
<td>.25</td>
<td>0</td>
</tr>
<tr>
<td>x = 0</td>
<td>.25</td>
<td>0</td>
<td>.25</td>
</tr>
<tr>
<td>x = 1</td>
<td>0</td>
<td>.25</td>
<td>0</td>
</tr>
</tbody>
</table>

a) Determine the covariance between X and Y. Show how you calculate this value.

b) Are X and Y independent random variables? Explain.