56. Solution: C
Let \( Y \) represent the payment made to the policyholder for a loss subject to a deductible \( D \).
That is \( Y = \begin{cases} 
0 & \text{for } 0 \leq X \leq D \\
X - D & \text{for } D < X \leq 1
\end{cases} \)

Then since \( E[X] = 500 \), we want to choose \( D \) so that
\[
\frac{1}{5000} \int_0^{1000} (x - D) \, dx = \frac{1}{5000} \int_0^{1000} \frac{(x - D)^2}{2} \, dx = \frac{(1000 - D)^2}{2000}
\]
\[(1000 - D)^2 = 2000/4 \cdot 500 = 500^2\]
\[1000 - D = \pm 500\]
\[D = 500 \text{ (or } D = 1500 \text{ which is extraneous)}.\]

57. Solution: B

We are given that \( M_x(t) = \frac{1}{(1-2500r)^{4t}} \) for the claim size \( X \) in a certain class of accidents.

First, compute
\[
M_x'(t) = \frac{-4(-2500)}{(1-2500r)^{4t}} = \frac{10,000}{(1-2500r)^{4t}}
\]
\[
M_x''(t) = \frac{(10,000)(-5)(-2500)}{(1-2500r)^{6t}} = \frac{125,000,000}{(1-2500r)^{6t}}
\]

Then
\[
E[X] = M_x'(0) = 10,000
\]
\[
E[X^2] = M_x''(0) = 125,000,000
\]
\[
\text{Var}[X] = E[X^2] - \{E[X]\}^2 = 125,000,000 - (10,000)^2 = 25,000,000
\]
\[
\sqrt{\text{Var}[X]} = 5,000.
\]

58. Solution: E
Let \( X_J, X_K, \) and \( X_L \) represent annual losses for cities \( J, K, \) and \( L \), respectively. Then
\( X = X_J + X_K + X_L \) and due to independence

\[
M(t) = E\left[e^{\mu t}\right] = E\left[e^{\lambda x_J + \lambda x_K + \lambda x_L + \mu t}\right] = E\left[e^{\lambda x_J + \mu t}\right]E\left[e^{\lambda x_K + \mu t}\right]E\left[e^{\lambda x_L + \mu t}\right]
\]
\[
= M_x(t)M_K(t)M_L(t) = (1 - 2t)^{-3} (1 - 2t)^{-2.5} (1 - 2t)^{-4.5} = (1 - 2t)^{-10}
\]

Therefore,
\[
M'(t) = 20(1 - 2t)^{-11}
\]
\[
M''(t) = 440(1 - 2t)^{-12}
\]
\[
M'''(t) = 10,560(1 - 2t)^{-13}
\]
\[
E[X^3] = M'''(0) = 10,560
\]