74. Solution: E
First note \( R = \frac{10}{T} \). Then
\[
F_R(r) = P[R \leq r] = P \left[ \frac{10}{T} \leq r \right] = P \left[ T \geq \frac{10}{r} \right] = 1 - F_T \left( \frac{10}{r} \right) .
\]
Differentiating with respect to \( r \)
\[
f_R(r) = F'_R(r) = \frac{d}{dr} \left( 1 - F_T \left( \frac{10}{r} \right) \right) = - \frac{d}{dt} F_T(t) \left( \frac{10}{r^2} \right) .
\]
Since \( T \) is uniformly distributed on \([8, 12]\),
\[
\frac{d}{dt} F_T(t) = f_T(t) = \frac{1}{4} .
\]
Therefore
\[
f_R(r) = - \frac{1}{4} \left( \frac{10}{r^2} \right) = \frac{5}{2r^2} .
\]

75. Solution: A
Let \( X \) and \( Y \) be the monthly profits of Company I and Company II, respectively. We are given that the pdf of \( X \) is \( f \). Let us also take \( g \) to be the pdf of \( Y \) and take \( F \) and \( G \) to be the distribution functions corresponding to \( f \) and \( g \). Then \( G(y) = P[Y \leq y] = P[2X \leq y] = P[X \leq y/2] = F(y/2) \) and \( g(y) = G'(y) = \frac{d}{dy} F(y/2) = \frac{1}{2} F'(y/2) = \frac{1}{2} f(y/2) .\)

76. Solution: A
First, observe that the distribution function of \( X \) is given by
\[
F(x) = \int_0^x \frac{3}{t^2} \, dt = - \frac{1}{t} \bigg|_0^x = 1 - \frac{1}{x^3} , \quad x > 1
\]
Next, let \( X_1, X_2, \) and \( X_3 \) denote the three claims made that have this distribution. Then if \( Y \) denotes the largest of these three claims, it follows that the distribution function of \( Y \) is given by
\[
G(y) = P[Y \leq y] = P[X_1 \leq y] P[X_2 \leq y] P[X_3 \leq y]
= \left( 1 - \frac{1}{y^3} \right)^3 , \quad y > 1
\]
while the density function of \( Y \) is given by
\[
g(y) = G'(y) = 3 \left( 1 - \frac{1}{y^3} \right)^2 \left( 3 y^{-4} \right) = \left( \frac{9}{y^4} \right) \left( 1 - \frac{1}{y^3} \right)^2 , \quad y > 1
\]
Therefore,