Another example: Let’s consider again the continuous random variable \( X \) that has density \( f_X(x) = (1/4)x^3 \) for \( 0 < x < 2 \), and \( f_X(x) = 0 \) otherwise. Find \( E(1/X) \). We recall, 
\[
E(g(X)) = \int_{-\infty}^{\infty} g(x)f_X(x) \, dx
\]
In this case, the density is only nonzero for \( 0 < x < 2 \). Also \( g(X) = 1/X \). So we have
\[
E(1/X) = \int_{0}^{2} (1/x)(1/4)x^3 \, dx = 1/4 \int_{0}^{2} x^2 \, dx = (1/4)x^3/3 \bigg|_{x=0}^{x=2} = 2/3.
\]
Here’s another example. Suppose we want to compute \( E(1/X^2) \). We compute:
\[
E(1/X^2) = \int_{0}^{2} (1/x^2)(1/4)x^3 \, dx = 1/4 \int_{0}^{2} x \, dx = (1/4)x^2/2 \bigg|_{x=0}^{x=2} = 1/2.
\]
One thing to really emphasize here is that
\[
E(1/X) \neq 1/E(X).
\]
That’s a very common mistake. In this case, \( E(1/X) = 2/3 \). We also saw earlier that \( E(X) = 8/5 \), so \( 1/E(X) = 5/8 \neq E(1/X) \).

Similarly, we have \( E(1/X^2) = 1/2 \). On the other hand, \( E(X^2) = 8/3 \), so \( 1/E(X^2) = 3/8 \neq E(1/X^2) \).

Those are really common errors, and please try to avoid such things. This is kind of like the fact that expected value of \( X^2 \) is not necessarily equal to the square of the expected value of \( X \), i.e., \( E(X^2) \) is not necessarily equal to \( (E(X))^2 \).