I found a distribution that I was not previously familiar with, Irwin-Hall, and started plugging values of N (the number of draws) into the CDF. I came up with the formula:

$$P[N=n] = 1 - \left(\sum_{k=2}^{n-1} P[N=k] + \int_0^1 \frac{1}{(n-1)!} x^{n-1} dx\right),$$

which leads to

$$E[\text{Winnings}] = 100 + \sum_{n=3}^{\infty} 100n \left( \frac{1}{(n-1)!} - \frac{1}{n!} \right)$$
$$= 100 \left( 1 + \sum_{n=3}^{\infty} \frac{1}{(n-2)!} \right)$$
$$= 100 (1 + e - 1)$$
$$= 100e$$