UNIVERSITY OF CALIFORNIA, SAN DIEGO

Electrical & Computer Engineering Department

ECE 250 - Winter Quarter 2022

Random Processes

Aptitude Test Due Monday, January 3, 2022

Simplify the following equations as much as you can. Throughout $r \in (0, 1)$.

If the expression has a geometric or probabilistic interpretation, mention it in your solution.

1. $\sum_{n=0}^{\infty} r^n =$

2. $\sum_{n=0}^{\infty} n r^n =$

3. $\sum_{n=0}^{\infty} \frac{r^n}{n!} =$

4. $\sum_{k=0}^{n} \binom{n}{k} r^k (1-r)^{n-k} =$

5. $\sum_{k=0}^{n} k \binom{n}{k} r^k (1-r)^{n-k} =$

6. $\sum_{n=1}^{\infty} \frac{1}{n} =$

7. $\sum_{n=1}^{\infty} \frac{1}{n^2} =$

8. $\int_{-1}^{1} 1 - |x| \, dx =$

9. $\int_{0}^{\infty} e^{-x} \, dx =$

10. $\int_{0}^{\infty} xe^{-x} \, dx =$

11. $\int_{0}^{\infty} \int_{x}^{\infty} e^{-y} \, dydx =$

12. $\int_{-\infty}^{\infty} e^{-x^2} \, dx =$

13. $\int_{-\infty}^{\infty} xe^{-x^2} \, dx =$

14. $\begin{pmatrix} 1 & r \\ r & 1 \end{pmatrix}^{-1} =$

15. $\lim_{x \to 0} x \ln x =$