10. Exercise: Exponential PDF

Exercises due Mar 13, 2020 05:29 IST *Completed*

Exercise: Exponential PDF

2/2 points (graded)

Let X be an exponential random variable with parameter $\lambda = 2$. Find the values of the following. Use 'e' for the base of the natural logarithm (e.g., enter `e^(-3)` for e^{-3}).

a) $\mathbf{E}\left[(3X+1)^2\right] =$ 8.5 ✔ **Answer:** 8.5

b) $\mathbf{P}\left(1 \leq X \leq 2\right) =$ 0.117 ✔ **Answer:** 0.11702

Solution:

a) By expanding the quadratic, using linearity of expectations, and the facts that $\mathbf{E}\left[X\right] = 1/\lambda$ and $\mathbf{E}\left[X^2\right] = 2/\lambda^2$, we have

$$\mathbf{E}\left[(3X+1)^2\right] = 9\mathbf{E}\left[X^2\right] + 6\mathbf{E}\left[X\right] + 1 = 9 \cdot \frac{2}{2^2} + 6 \cdot \frac{1}{2} + 1 = \frac{17}{2}.$$

b) We have seen that for $a > 0$, we have $\mathbf{P}\left(X \geq a\right) = e^{-\lambda a}$, so that $\mathbf{P}\left(X \leq a\right) = 1 - e^{-\lambda a}$. Therefore,

$$\mathbf{P}\left(1 \leq X \leq 2\right) = \mathbf{P}\left(X \leq 2\right) - \mathbf{P}\left(X \leq 1\right) = \left(1 - e^{-4}\right) - \left(1 - e^{-2}\right) = e^{-2} - e^{-4}.$$

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Answers are displayed within the problem

Discussion

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Topic: Unit 5: Continuous random variables:Lec. 8: Probability density functions / 10. Exercise: Exponential PDF

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Answer(a) cannot be applied yet		1
I was overthinking the first question... hint	Hint: E[X^a+X^b+X^c] = E[X^a] + E[X^b] + E[X^c]	8
P(1≤*X*≤2) = **P**(*X*≤2)−**P**(*X*≤1)?	Can someone please explain to me why this equality is True? -- **P**(1≤*X*≤2) = **P**(*X*≤2)−**P**(*X*≤1)? Thank you	5
Link to resource on integration by parts	For part (a) I found reviewing integration by parts very useful on this link: https://www.mathsisfun.com/c...	2
I'm stumped on a) - no idea how to begin.		3
Resolving Infinities	I'm having a hard time integrating over the range 0 to infinity. Are there any resources on how to resolve...	2
different idea for solution to b)	Hi, instead of following the line of thinking given in the "show answer", I found the correct solution by int...	6
What is wrong with my solution for a)?	I have been struggling a bit with question a). Here is the approach that I used (and which failed): 1. I calc...	2 new