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FEEDBACK
Geometric distributions are also memoryless.

## 1

0 points possible (ungraded)
The y-intercept of the pdf of an exponentially distribution with $\lambda = 2$ is

- $0$
- $0.5$
- $1$
- $2$ ✔

**Answer**
Correct: Video: Exponential Distribution

**Explanation**
The y-intercept of a pdf is $f_X(0)$. For an exponential distribution that has pdf $f_X(x) = 2e^{-2x}$, the y-intercept is $f_X(0) = 2$.

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Answers are displayed within the problem

## 2

2.0/2.0 points (graded)
Assume the lifetimes of some kind of batteries follow exponential distribution with mean 1 year.

- What is the probability that one such batteries can be used for more than 1.5 years?

0.22313 ✔ **Answer:** 0.22313

$0.22313$

**Explanation**
Let $X \sim \text{Exponential}(\lambda)$ denote the age of the battery. Since $1 = E(X) = 1/\lambda$ we have $\lambda = 1$. Further, for an exponential distribution, the CDF is given by $F_X(x) = P(X \leq x) = 1 - e^{-\lambda \cdot x}$, $x \geq 0$Thus $P(X > 1.5) = 1 - P(X \leq 1.5) = 1 - F_X(1.5) = e^{-1.5} = 0.22313$

- What is the probability that one such batteries can be used for more than 1.5 years **in total** if it has already been used for 0.5 year?

0.367879 ✔ **Answer:** 0.367879

$0.367879$

**Explanation**

By the memoryless property of expoential distribution, $P(X > 1.5 | X > 0.5) = P(X > 1)$ Following the same steps as the previous part above, $P(X > 1) = e^{-1} = 0.367879$

Submit You have used 1 of 4 attempts

Answers are displayed within the problem

## 3

3.0/3.0 points (graded)

Let $X, Y$ be two independent exponential random variables with means $1$ and $3$, respectively. Find $P(X > Y)$.

0.25 ✔ **Answer:** 0.25

$0.25$

**Explanation**

From the description we have $f_X(x) = e^{-t}$, $f_Y(y) = \frac{1}{3}e^{-\frac{y}{3}}$.

Hence $P(Y < y) = F_Y(y) = \int_{-\infty}^{y} f_Y(y')\,dy' = \int_0^y \frac{1}{3}e^{-\frac{y'}{3}}\,dy' = 1 - e^{\frac{y}{3}}$

$P(X > Y) = \int_0^\infty f_X(t)\,P(Y < t)\,dt = \int_0^\infty e^{-t}\left(1 - e^{-t/3}\right)dt = \int_0^\infty e^{-t} - e^{-4t/3}dt = 1/4$

Submit You have used 3 of 4 attempts

Answers are displayed within the problem

## 4

0 points possible (ungraded)

In order to attend an important $8$ A.M. lecture, you arrive at the shuttle stop at a time distributed uniformly between $7:20$ A.M. and $7:30$ A.M. The time between consecutive shuttle arrivals is known to be exponentially distributed with mean $15$ minutes. If the journey takes $30$ minutes, what is the probability that you arrive late to the lecture?

45 ✖ **Answer:** 0.730

$45$

**Explanation**

Let $Y$ be the time in minutes between $7:20$ A.M. and $7:30$ A.M. that you arrive at the shuttle stop. Let $Z$ be the time you have to wait until the next shuttle arrives. Then $Y \sim \text{Unif}(0, 10)$ and by the memoryless property of the exponential, $Z \sim \text{Exp}(1/15)$. Note also that in this case $Y$ is independent of $Z$.
Now you arrive late to class iff $Y + Z > 10$. Therefore the required probability is
$P(Y + Z > 10) = \int_0^{10} f_Y(t)\, P(Z > 10 - t)\, dt = \int_0^{10} 1/10 \cdot e^{-(10-t)/15} dt = 3/2 \cdot (1 - e^{-2/3}) = 0.730$
.

Submit You have used 4 of 4 attempts

Answers are displayed within the problem

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