

Exponential Distribution

*Exponential distribution $X \sim \text{Exp}(\theta)$ then its pdf is given by

$$f(x) = f(x; \theta) = \begin{cases} \theta e^{-\theta x} & ; x \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

Parameter of the Distribution: $\theta > 0$

Mean and Variance

If X is a continuous random variable has Exponential distribution with parameter θ then,

$$E(X) = \frac{1}{\theta} \quad \text{and} \quad V(x) = \frac{1}{\theta^2}$$

#NOTE

Cumulative Distribution Function

$$F(x) = P(X \leq x) = \int_0^x \theta e^{-\theta x} dx = -e^{-\theta x} \Big|_0^x = 1 - e^{-\theta x}$$

Direct way to find probabilities

- I. $P(X \leq a) = F(a) = 1 - e^{-\theta a}$
- II. $P(a \leq X \leq b) = F(b) - F(a) = e^{-\theta a} - e^{-\theta b}$
- III. $P(X \geq b) = e^{-\theta b}$

Example 4.3"from slides"

The time between arrivals of cars at Al's full-service gas pump follows an exponential distribution with a mean time between arrivals of 3 minutes. Al would like to know the probability that the time between two successive arrivals will be 2 minutes or less. Then find the variance.

Solution

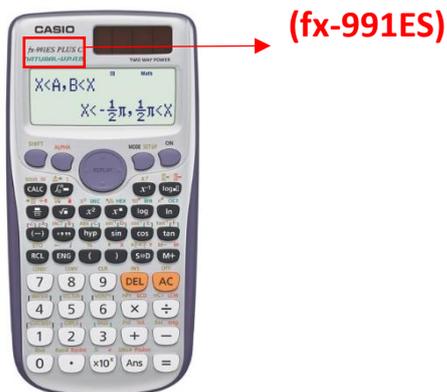
Let X represents the time between two successive arrivals.

$$\theta = \frac{1}{3} \Rightarrow X \sim \text{Exp}\left(\frac{1}{3}\right).$$

$$P(X \leq 2) = 0.4866.$$

$$V(X) = 9.$$

#Now a way to solve the Exponential distribution question with the calculator type(fx-991ES)



#steps:

- Solve $P(X \leq 2) = 0.4866$

First click (1-) "Subtract " , then  ,  ,  , then but negative sign

 Then click  and write (2) then move down by one click  and write (3) finally click "=" to have a solve 0.4866 .

- Solve $V(X) = 9$

First click  and write (1) then then move down by one click

 and click again  and write (1) then then move down by

one click  and write (3) then final step move to right by one

click to right  then click  and finally press "=" to have the solve 9 .

- Extra part "find the main"=3.

First click  and write (1) then then move down by one click

 and click again  and write (1) then then move down by

one click  and write (3) then finally press "=" to have the solve 3 .

***So complete in this way with any question just change θ value**