# AI5002 - Assignment 1

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Download code and LaTeX from below hyperlinks
1. Codes/RayleighDist_CDF_PDf_Plot.py
2. LaTeX

***Problem* 6.1.4**

Find an expression for $F_A(x)$ using the definition. Plot this expression and compare with the result of problem 6.1.3

***Solution***

Given,

$$A = \sqrt{V} \tag{0.0.1}$$

$$F_A(x) = P\ (\ A\ \leq\ x) \tag{0.0.2}$$

$$F_A(x) = P\ (\ \sqrt{V}\ \leq\ x) \tag{0.0.3}$$

$$F_A(x) = P\ (\ V\ \leq\ x^2) \tag{0.0.4}$$

$$F_A(x) = F_V(x^2) \tag{0.0.5}$$

From (6.1.2.1) we get

$$\mathrm{F}_V(x)\ =\ \begin{cases} 1\ -\ e^{-\alpha x} & ;\ x \geq 0 \end{cases}$$

Now for $\mathrm{x}^2$, *we substitute* $x^2$ *in place of* $x$

$$F_V(x^2) = \begin{cases} 1\ -\ e^{-\alpha x^2} & ;\ x^2 \geq 0 \end{cases} \tag{0.0.6}$$

$$\textit{Putting } \alpha\ =\ \frac{1}{2\sigma^2}\ =\ \frac{1}{2}\quad [\because\ \sigma^2 \textit{ is given as } 1]$$

We get,

$$F_V(x^2)\ =\ 1\ -\ e^{\frac{-x^2}{2}}\quad ;\ x^2\ \geq\ 0 \tag{0.0.7}$$

Thus the CDF is derived as

$$F_A(x) = F_V(x^2)\ =\ 1\ -\ e^{\frac{-x^2}{2}}\quad ;\ x^2\ \geq\ 0$$

***Problem* 6.1.5**

Find an expression for $p_A(x)$ using the definition.

***Solution***

The PDf can be derived by differentiating the CDF expression from the previous problem 6.1.4

$$f_A(x) = f_V(x^2) \tag{0.0.8}$$

$$f_V(x^2) = \frac{d}{dx}(F_V(x^2)) \tag{0.0.9}$$

$$f_V(x^2) = \frac{d}{dx}(1 - e^{\frac{-x^2}{2}}) \tag{0.0.10}$$

$$f_V(x^2) = e^{\frac{-x^2}{2}}.x \tag{0.0.11}$$

$$p_A(x) = f_A(x) = e^{\frac{-x^2}{2}}.x$$