

## Math 189 – Section 6.1: Continuous Probability Distributions

1. Suppose that some phenomenon has the following probability distribution.

$$f(x) = \begin{cases} kx^2 & \text{for } 6 \leq x \leq 12 \\ 0 & \text{otherwise} \end{cases}$$

- Calculate  $k$  so that  $f(x)$  is indeed a probability distribution function.
  - Calculate the probability of  $x$  being between 6 and 9.
  - Calculate the mean value of  $x$  (also called the expectation value of  $x$ ).
2. Suppose you have a continuous variable with the probability distribution below.

$$f(x) = \begin{cases} \frac{k}{x} & \text{for } 1 \leq x \leq 2 \\ 0 & \text{otherwise} \end{cases}$$

- Calculate  $k$  so that  $f(x)$  is indeed a probability distribution function.
  - Calculate  $\mu$ , the mean value of  $x$ .
  - Calculate the standard deviation  $\sigma$  of  $x$ .
3. Suppose that some variable has the following probability distribution

$$f(x) = \begin{cases} 5e^{-5x} & \text{for } x \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

- Calculate the probability that  $x$  will be between 1 and 3.
  - Calculate the probability that  $x$  will be less than 0.5.
  - From your answer to (b), calculate the probability that  $x$  will be greater than 0.5.
4. Suppose that some random variable has the probability distribution given by

$$f(x) = \begin{cases} x & \text{for } 0 \leq x \leq 1 \\ 2-x & \text{for } 1 \leq x \leq 2 \\ 0 & \text{otherwise} \end{cases}$$

Show that this truly represents a probability distribution function by verifying that the area under the curve is exactly 1.

## Answers

1. a)  $k = \frac{1}{504}$       b) 34%      c) 9.6

2. a)  $k = \frac{1}{\ln 2} \approx 1.4$       b)  $\mu = k = \frac{1}{\ln 2} \approx 1.4$       c)  $\sigma \approx 0.29$

3. a) 0.67%      b) 92%      c) 8.2%

4. see solution on web