**Continuous Random Variables**

For the limits  and  with, there are four different interval cases.

 : Open interval defined as all numbers between  and 



: Interval defined as all numbers between  and  including  and 



 : Interval defined as all numbers between  and  including  and not including 



 : Interval defined as all numbers between  and  not including  and including 



**The Cumulative Distribution Function (CDF)**

The cumulative distribution function of random variable *X* is



Properties of CDF



* ***X* is a continuous random variable if the CDF**  **is a continuous function.**

Quiz 3.1) The cumulative distribution function of the random variable *Y* is



Sketch the CDF of *Y* and calculate the following probabilities.

1. 

=0

2. 



3. 



4. 



**The Probability Density Function**

The **probability density function (PDF) of a continuous random variable *X*** is



*For comparison purpose, the discrete random variable* ***PMF in ch2*** *is defined as*

**

For a continuous random variable *X* with PDF,



Given the properties of PDF, we can prove the next property.



Proof:



***x1***

***x2***

****

****

***x***

Ex)







Find PDF (probability density function) of *Y* and the probability that *Y* is between ¼ and ¾





Probability of observing *Y* between ¼ and ¾



or



Quiz 3.2) Random variable  has probability density function



Sketch the PDF and find the following

1. the constant 
2. the CDF 
3. 



1. the constant 

Note:









1. the CDF 





3. 



Expected values

*Recall that in* ***discrete random variable X****, the expected value is*

**

The expected value of continuous random variable *X* is



The expected value of a function of random variable *X* is



The properties of any random variable *X*,







Quiz 3.3) The probability density function, pdf, of the random variable *Y* is



Sketch the PDF and find the following:

* 1. the expected value 
  2. the second moment 
  3. the variance 
  4. the standard deviation 



1. the expected value 



1. the second moment 



1. the variance 



1. the standard deviation 



**Uniform Random Variable**









**Exponential Random Variable**

*X* is an exponential () random variable if the PDF of *X* is





If *X* is an exponential () random variable,





