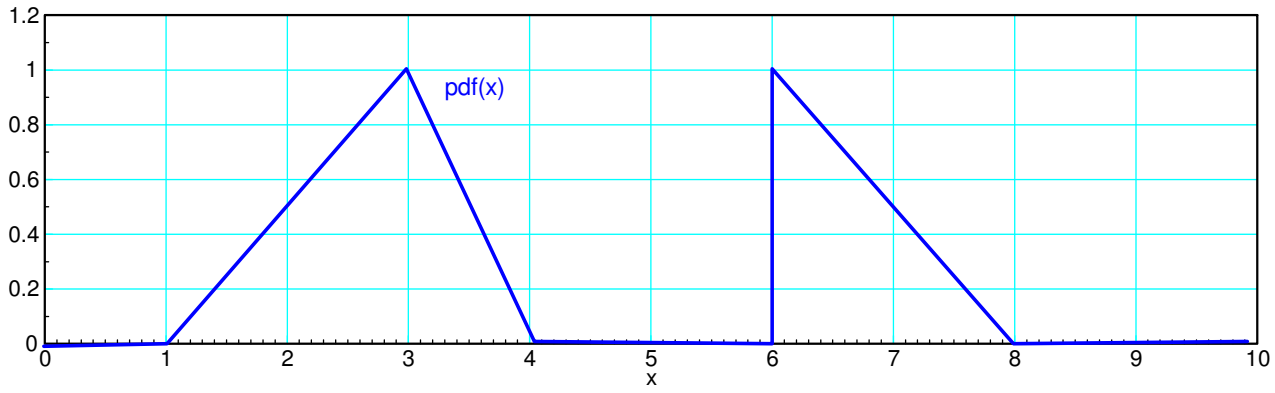
ECE 341 - Test #2

Continuous Probability

1) Continuous PDF

For the following probability density function



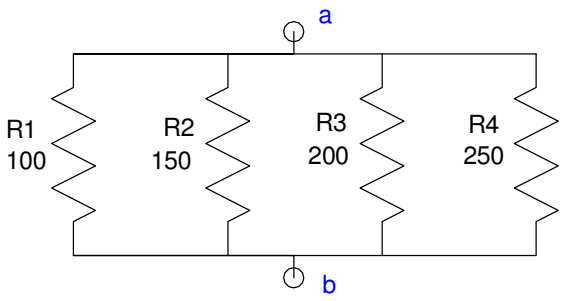
a) Determine the scalar to multiply this curve so that it is a valid pdf (i.e. the total area = 1.0000)

b) Determine the moment generating function (i.e. LaPlace transform)

2) Uniform PDF

Assume each resistor has 5% tolerance and a uniform distribution. For example:

- R1 = 100 * (1 + (2*rand-1) * 0.05);



Using Matlab and a Monte-Carlo simulation, find

- 10 values for Rab for random resistances R1..R4
- The mean of the resulting Rab, and
- The standard deviation of the resulting Rab

Include

- Your Matlab code
- The ten resistances Rab
- The mean and standard deviation

Note: Resistors in parallel add as the sum of the inverses, inverted

$$R_{ab} = \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4} \right)^{-1}$$

3) Gamma CDF

Let A, and B be continuous exponential distributions:

- A has a mean of 7 and
- B has a mean of 8

Determine the cdf of Y = A + B using moment generating functions (LaPlace transforms)

Note: The cdf is the pdf times 1/s (integrate)

$$cdf = \left(\frac{1}{s}\right) \cdot A(s) \cdot B(s)$$

4) Central Limit Theorem

Let A be a continuous uniform distribution over the range of (1,5)

Let Y be the sum of five samples from population A

- $Y = a_1 + a_2 + a_3 + a_4 + a_5$

a) Determine the mean and variance of A

b) Determine the mean and variance of Y

c) Using a normal approximation, determine

- the z-score for the probability that $Y > 15$ and
- the probability that $Y > 15$

5) Testing with Normal PDF

Assume A and B have normal distributions

Population	mean	standard dev
A	100	50
B	150	60

Let W be a random variable which is the difference between A and B

$$W = A - B$$

a) Determine the mean and standard deviation of W

b) Determine the probability that W > 0

- i.e. the probability that a random sample from A will be larger than a random sample from B