Physics 116A

Practice Midterm
Posted on Feb 8, 2018
Midterm in Class Feb 13, 2018
100 Points, Each Problem 25 points

§**For practice think of these as open book problems. In the exam you can only consult one handwritten page of notes.**

1. Determine if the following series absolutely converge, conditionally converge, or diverge and explain why. Find the error bound for the alternating series after $2n$ terms if convergent:

   a)

   $$S = \frac{1}{5^2} - \frac{1}{7^2} + \frac{1}{6^2} - \frac{1}{8^2} + \frac{1}{7^2} - \frac{1}{9^2} + \cdots \ ,$$

   b)

   $$S = \frac{1}{2} - \frac{1}{4} + \frac{1}{3} - \frac{1}{5} + \frac{1}{4} - \frac{1}{6} + \cdots \ .$$

2. Find the radius of convergence for the power series

   $$\sum_{n=0}^{\infty} \frac{(x-3)^n}{5^n \sqrt{n+3}} \ ,$$

   and use the special comparison test and alternating series test to check the convergence of the end points. Find an error bound for the series after 4 terms.

3. The circuit in Fig. (1) is connected in series to an AC power source producing voltages V_A and V_B at points A and B, respectively. We can think of current in a circuit like water flow in a pipe, where the voltage difference in a circuit corresponds to the pressure difference in a pipe. For example, when the water flow meets a junction in a pipe, the water flow will divide amoung the branches, but the total amount of water flow will remain constant.
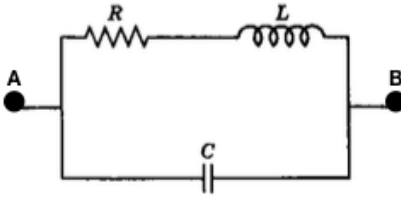
Figure 1:

a) Use the generalization of Ohm's law to find the ratio (I_{RL}/I_C) of current going through the LR branch with respect to the C branch.

b) Use the result of part $a)$ to find the impedence in terms of Z_R, Z_L and Z_C.

c) Express ω in terms of R, L, and C if the angle of Z is $30°$.

d) Find the resonance frequency ω.

4. Express this set of equations as an augmented matrix and use row reduction to determine if it is consistent:

$$\begin{cases} x + 5y - 3z = 7 \\ -3x - 14y + 5z = -44 \\ 8x + 38y - 15z = 109 \\ 3x + 15y - 8z = 28 \end{cases}.$$

If it is consistent find the solution or solutions to the equations, and find the rank of the *augmented* matrix.