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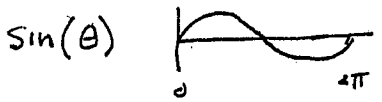
CWID $\sqrt{2}$

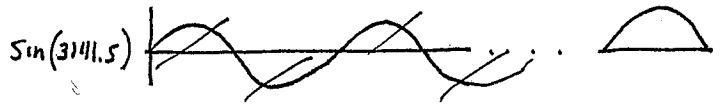
GES 554 HW 3 Quiz

10th Feb 2014

1) Does a solution exist to the following Laplacian PDE? If the solution exists, find the solution. Otherwise, explain why a solution cannot exist. [50 pts]

$$\nabla^2 u = 0 \qquad 0 < r < 1$$
$$u_r(1,\theta) = \sin(31415 \cdot \theta)$$





No Solution

2) Solve the following interior Dirchlet problem. Simplify your solution as much as possible. [50 pts]

$$\nabla^2 u = 0 \qquad 0 < r < 2$$
$$u(2,\theta) = \sin(\theta) + \cos(3\theta)$$

$$u(r,\theta) = \left(\frac{r}{R}\right)^n \left(a_n \sin n\theta + b_n \cos n\theta\right)$$

$$= \left(\frac{r}{2}\right)^n \left(a_n \sin n\theta + b_n \cos n\theta\right)$$

$$\boxed{u(r,\theta) = \frac{r}{2}\sin\theta + \left(\frac{r}{2}\right)^3 \cos 3\theta}$$

Exterior

$$\left(\frac{r}{2}\right)^{-1} \sin\theta + \left(\frac{r}{2}\right)^{-3} \cos 3\theta$$