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☆ Course / Unit 2: Geometry of Derivatives / Problem Set 2B



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Problem Set B due Aug 18, 2021 20:30 IST Completed



Explore

Problem 4

1/1 point (graded)

Consider the (partial differential) equation $f_{tt}-v^2f_{xx}=0$. This is known as a **wave equation** .

Which of the following functions satisfy this partial differential equation? (Choose all that apply.)

- $\leq \sin(x+vt)$
- $\leq \sin(x-vt)$
- $ightharpoonup \sin (x+vt)+\sin (x-vt)$
- $\leq \sin(x)\cos(vt)$
- $igspace{\begin{picture}(100,0) \put(0,0){\line(0,0){100}} \put(0,0){\lin$
- $ec{f}\left(x+vt
 ight)$ for an arbitrary (differentiable) function f



Solution:

Note that $f\left(x\pm vt
ight)$ satisfies

$$f_{xx} = f''(x \pm vt) \tag{3.153}$$

$$f_{tt} = v^2 f'' \left(x \pm vt \right) \tag{3.154}$$

$$\longrightarrow f_{tt} - v^2 f_{xx} = 0 ag{3.155}$$

Similarly, if we take sums of any functions of this type, they will also satisfy the differential equation. The only one we need to check is $\sin(x)\cos(vt)$.

$$\frac{\partial^2}{\partial x^2} \sin(x) \cos(vt) = -\sin(x) \cos(vt) \tag{3.156}$$

$$\frac{\partial^2}{\partial t^2} \sin(x) \cos(vt) = -v^2 \sin(x) \cos(vt)$$
 (3.157)

$$\longrightarrow f_{tt} - v^2 f_{xx} = 0 ag{3.158}$$

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You have used 2 of 7 attempts

1 Answers are displayed within the problem

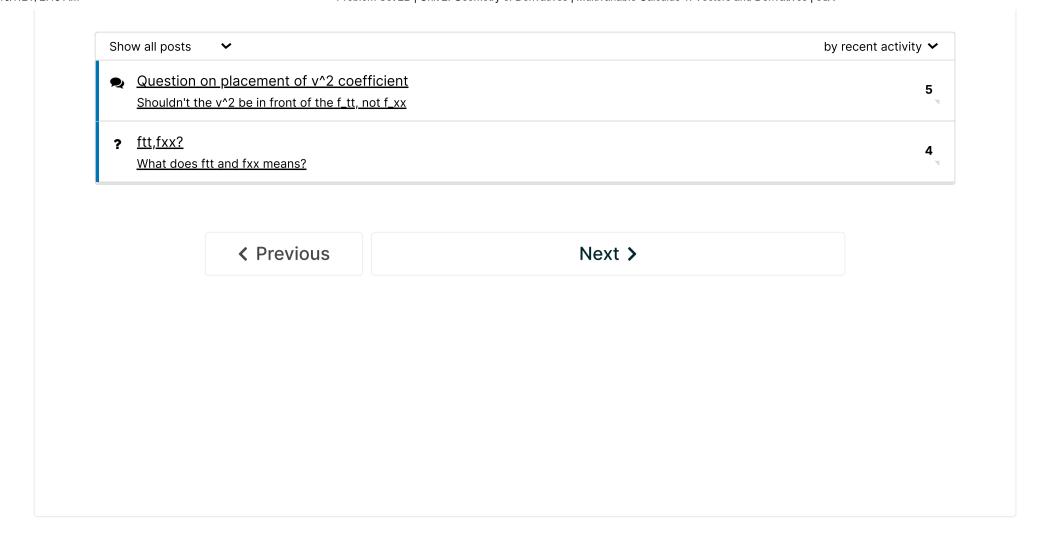
4. The wave equation

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