Homework 3.1: Fokker-Planck equation

2nd derivative with respect to "x"

1/1 point (graded)

Consider

$$u(t,x) = \begin{cases} \frac{1}{\sqrt{4\pi t}} e^{-t-\frac{(x-x_0)^2}{4t}} & \text{t} > 0 \\ 0 & \text{t} <= 0 \end{cases}$$

Take the second derivative of $u(t,x)$ with respect to x for $t > 0$. The result is $\frac{d^2}{dx^2}u(t,x) = f(t,x)\,u(t,x)$ What is $f(t,x)$?

- $-\frac{1}{2t} + \frac{(x-x_0)^2}{4t^2}$
- $-\frac{1}{4t^2} - 1 - \frac{x-x_0}{2t}$
- $\frac{1}{2t} - \frac{(x-x_0)^2}{4t^2}$
- $-\frac{1}{4t^2} + \frac{x-x_0}{2t}$
- $\frac{1}{4t^2} - \frac{x-x_0}{2t}$
- $\frac{1}{2t} - 1 + \frac{(x-x_0)^2}{4t^2}$

Submit You have used 1 of 1 attempt

✔ Correct (1/1 point)

1st derivative with respect to "t"

1/1 point (graded)

Take the first derivative of $u(t,x)$ (see first equation) with respect to t for $t > 0$. The result is $\frac{d}{dt}u(t,x) = g(t,x)\,u(t,x)$ What is $g(t,x)$?

- $\frac{1}{t} - 2 + \frac{(x-x_0)^2}{2t^2}$
- $-\frac{1}{2t} - 1 + \frac{(x-x_0)^2}{4t^2}$
- $-\frac{1}{2t} + 1 - \frac{(x-x_0)^2}{4t^2}$
- $-\frac{1}{8t^2} + 0.5 + \frac{x-x_0}{4t}$
- $\frac{1}{2t^2} - 2 - \frac{x-x_0}{t}$

- $-\frac{1}{8t^2} - 0.5 - \frac{x-x_0}{4t}$

✔

Submit You have used 1 of 1 attempt

✔ Correct (1/1 point)

Solution to the Fokker-Planck equation

2/2 points (graded)
Considering the above derivatives, the equation is a solution to

$\lambda^2 \frac{d^2}{dx^2} u(t,x) = \tau_m \frac{d}{dt} u(t,x) + u(t,x) - u^{ext}(t,x)$where,

- $\lambda^2 = \tau_m = 2$
- $\lambda^2 = -\tau_m = 1$
- $\lambda^2 = \tau_m = 1$
- $\lambda^2 = -\tau_m = 0.5$
- $\lambda^2 = -\tau_m = 2$
- $\lambda^2 = \tau_m = 0.5$

✔

and u^{ext} (=voltage change caused by the external input current) is:

- [x] $u^{ext}(t,x) = \delta(t)\,\delta(x - x_0)$
- [ ] $u^{ext}(t,x) = u_0$ for $t > 0$

✔

Submit You have used 1 of 1 attempt

✔ Correct (2/2 points)

Discussion

Topic: Week 3 / Homework 3.1: Fokker-Planck equation

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