

NAME:

Math 286 Spring 2009 Test 1

Total points: **75**. **Explain** all answers. No notes, books, or electronic devices.

1 (6 points). Write down general solutions for the following equations. No explanation required.

- $\frac{dP}{dt} = -4t$

- $\frac{dP}{dt} = -4P$

- $\frac{d^2P}{dt^2} = -4P$

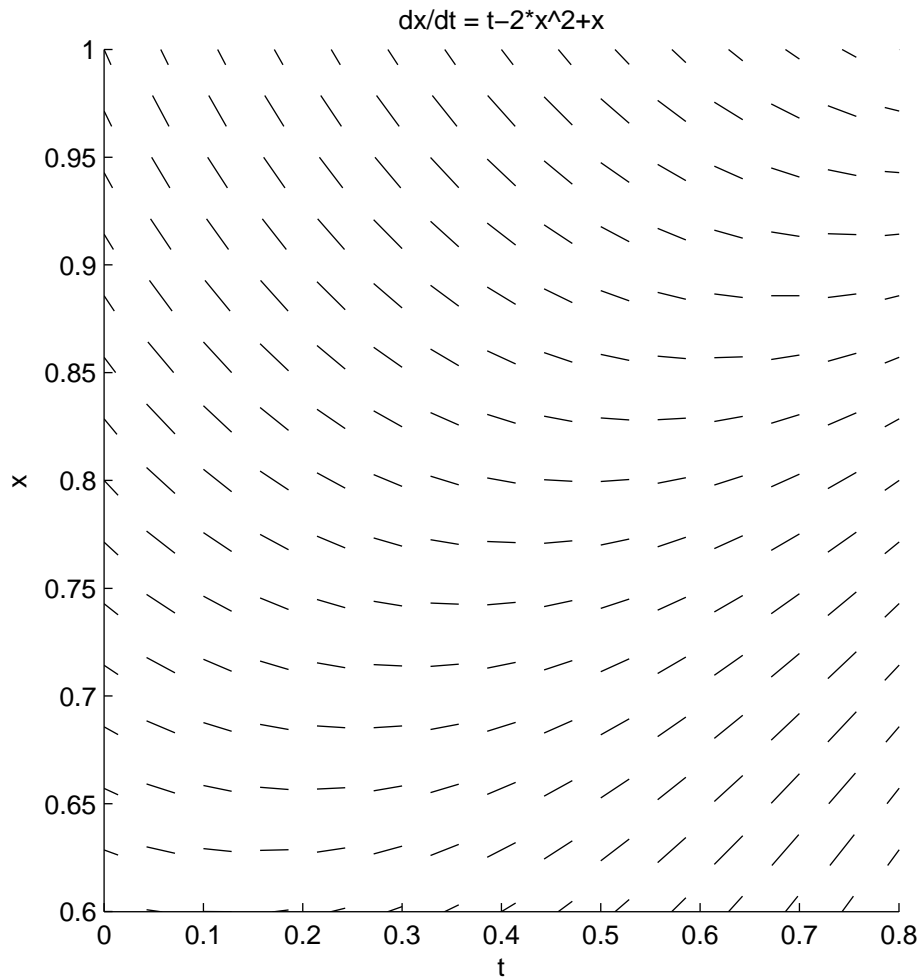
2 (4 points). Find an example of a function f for which the directional field of $\frac{dy}{dx} = f(x, y)$ shows a vertically repeating pattern. Explain.

3 (4 points). True/False and Explain: if the directional field of $\frac{dy}{dx} = f(x, y)$ shows a horizontally repeating pattern, then each solution $y(x)$ must be periodic.

5 (14 points). *Solve*

$$(\sec^2 y)y' + (\sec^2 x) \tan y = e^{-\tan x}.$$

6 (15=9+2+4 points). Consider the first order differential equation $\frac{dx}{dt} = t - 2x^2 + x$.



- “Halving the step size halves the error in Euler’s method.” Illustrate the meaning of this principle with a suitable sketch above (take $(t_0, x_0) = (0, 1)$).
- State the Euler update formula. Not the Improved Euler update!
- Consider $\frac{dx}{dt} = \sin(x - t^2)$, with $(t_0, x_0) = (0, 0)$ and $h = 0.1$. Evaluate t_1, x_1, t_2, x_2 .

