

Recitation # 12: Basic ideas of differential equations

Warm up:

Which of the following is a solution to the differential equation $y'' + 9y = 0$?

- (a) $y = e^{3t} + e^{-3t}$
- (b) $y = C(t^2 + t)$
- (c) $y = \sin(3t) + 6$
- (d) $y = 5 \cos(3t) - 7 \sin(3t)$
- (e) $y = A \cos(3t) + B \sin(3t)$ (where A and B are real numbers.)

Group work:

Problem 1 Verify that, if $y(0) = 0$, that both $f(x) = 1 - (x^2 + 1)^2$ **and** $g(x) = 1 - (x^2 - 1)^2$ are solutions to the differential equation $\frac{dy}{dx} = 4x\sqrt{1-y}$.

Problem 2 Find a specific solution to the differential equation $\frac{dy}{dx} = x^{-2} \arctan(x)$ if $y(1) = 5$.

Problem 3 Find a specific solution to the initial value problem

$$\frac{dy}{dx} = x^2 \sin(x), \quad y(0) = 5.$$

Problem 4 Explain why the functions with the given graphs cannot be solutions of the differential equation $y' = e^x(y - 1)^2$.

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