

# Recitation # 11: Improper Integrals and Differential Equations

## Warm up:

True or False: It is possible for a region to be infinitely long but have a finite area.

## Group work:

**Problem 1** *Review of limits:*

(a)  $\lim_{x \rightarrow -\infty} \left( 3x^{-6} + e^{5x} + \frac{\sin x}{x^2 + 3} \right)$

(b)  $\lim_{x \rightarrow \infty} \frac{x}{\sqrt{9x^2 + 4}}$

(c)  $\lim_{x \rightarrow -\infty} \arctan x$

**Problem 2** *Determine if the given integral converges or diverges. If it converges, find the value.*

$$\int_{-1}^{\infty} \frac{3}{2x+1} dx$$

**Problem 3** *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.)

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

