

# Math 309 Quiz 3

April 28, 2017

**Problem 1.** TRUE or BANANAS? A fundamental matrix for the system of equations

$$\frac{d}{dt}\vec{y}(t) = A\vec{y}(t)$$

will necessarily be invertible.

**Problem 2.** TRUE or BANANAS? If the Wronskian

$$W[\vec{f}_1, \dots, \vec{f}_N]$$

of a collection of vector-valued functions  $\vec{f}_1, \dots, \vec{f}_N$  is zero, then the functions  $\vec{f}_1, \dots, \vec{f}_N$  are linearly dependent.

**Problem 3.** Suppose that  $A$  is a  $2 \times 2$  matrix with two distinct, *real* eigenvalues  $\lambda_1$  and  $\lambda_2$ . Under what conditions on  $\lambda_1$  and  $\lambda_2$  is the critical point at the origin exponentially stable, exponentially unstable, or a saddle?

**Problem 4.** Find a real basis for the solution space of the system of differential equations

$$\begin{aligned}y_1' &= 3y_1 + y_2 \\y_2' &= -y_1 + 3y_2\end{aligned}$$