

MA 302: Review 1**Name:** _____

This review concerns the notion of linear (or affine) approximation. You may wish to review this concept in a Calculus 1 or 2 book before attempting these problems. Answer these questions on a separate sheet of paper.

- (1) Consider the function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = \sin x$.
 - (a) Find the equation of the line tangent to the graph of f at the point $(\pi/4, \sqrt{2}/2)$.
 - (b) Find a linear (technically “affine”) function $L: \mathbb{R} \rightarrow \mathbb{R}$ such that L is a “good approximation” to f near $x = \pi/4$.
 - (c) Use your answer to the previous part to find an approximation to $\sin(\pi/5)$, without using a calculator.
- (2) Suppose that $f: \mathbb{R} \rightarrow \mathbb{R}$ is differentiable at a point $a \in \mathbb{R}$. What is the general equation of the linear (or affine) approximation to f at $x = a$?
- (3) Consider the function $f: \mathbb{R}^2 \rightarrow \mathbb{R}$ defined by $f(x, y) = ye^x$.
 - (a) Find the equation of the plane tangent to the graph of f at the point $(1, 2)$.
 - (b) Find a linear (or affine) function $L: \mathbb{R}^2 \rightarrow \mathbb{R}$ such that L is a “good approximation” to f near $(x, y) = (1, 2)$.
 - (c) Use your answer to the the previous part to find an approximation to $2.3e^{1.0005}$.
- (4) What is the general form of a linear approximation to a differentiable function $f: \mathbb{R}^2 \rightarrow \mathbb{R}$ at a point $(a, b) \in \mathbb{R}^2$?