INSTRUCTIONS: Books, notes, and electronic devices are **not** permitted. Write (1) **your name**, (2) **1350/EXAM 1**, (3) **lecture number/instructor name** and (4) **FALL 2013** on the front of your bluebook. Also make a **grading table** with room for 4 problems and a total score. **Start each problem on a new page.** $\boxed{\textbf{Box}}$ **your answers.** A correct answer with incorrect or no supporting work may receive no credit, while an incorrect answer with relevant work may receive partial credit. **SHOW ALL WORK**

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1. (3 pts each) **True/False**

   (a) (T/F) If f is undefined at $x = c$, then the limit of $f(x)$ as x approaches c does not exist.

   (b) (T/F) If the limit of $f(x)$ as x approaches c is 0, then there must be a number k such that $f(k) < 0.0001$.

   (c) (T/F) $\lim_{x \to 0} \sin\left(\frac{|x|}{x}\right) = 0$

   (d) (T/F) If f is an even function and $\lim_{x \to 2^-} f(x) = 7$ then $\lim_{x \to -2^-} f(x) = 7$

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2. Evaluate the following: you may not use l'Hospital's Rule, justify your answers (5 points each):

   (a) $\lim_{x \to 1} \frac{\sin(2x)}{\sin(3x)}$ (b) $\lim_{x \to 1^+} \frac{\sqrt{2x}(x-1)}{|x-1|}$ (c) $\lim_{x \to 0} \sqrt{x} \sin\left(\frac{1}{x}\right)$

   (d) $f(b^2 + 1) = ?$ given that $f(x) = \begin{cases} |x| + 1, & \text{if } x < 1 \\ -x + 1, & \text{if } x \geq 1 \end{cases}$

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3. (12 pts) For what value(s) of k is the function $f(x) = \begin{cases} \sin(kx), & \text{if } x \leq 0 \\ 3x, & \text{if } x > 0 \end{cases}$ continuous at $x = 0$.

   A complete answer will include the definition of continuity.

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4. (10 pts) Show the equation $x + 2\cos(4x) = 0$ has at least one solution. Explain your work.

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5. Consider the function $f(x) = \frac{2}{3x + 3}$.

   (a) (10 pts) Find the rate of change of $f(x)$ at $x = a$.

   (b) (3 pts) Using part (a) find the rate of change of $f(x)$ at $x = -1$.

   (c) (3 pts) Using part (a) find the rate of change of $f(x)$ at $x = 0$.

   (d) (12 pts) Using the above information find the equation of two different tangent lines that are parallel to the line that goes through the points $(-2, 4)$ and $(-5, 6)$. Write your answer in $y = mx + b$ form.

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6. The function $g(x) = x|x|$ is differentiable everywhere. Show this by

   (a) (5 pts) Define $g(x)$ as a piecewise function.

   (b) (12 pts) Using the definition of the derivative consider the left and right hand limits of the difference quotient at 0.

   (c) (1 pt.) Explain why the function is differentiable everywhere else.

$\boxed{\textbf{— END —}}$