INSTRUCTIONS: Books, notes, and electronic devices are **not** permitted. Write (1) **your full name**, (2) **1350/Exam 1**, (3) **lecture number/instructor name** and (4) **SPRING 2017** on the front of your bluebook. Make a **grading table** for 4 problems and a total. Do all problems. **Start each problem on a new page.** **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. **Justify your answers, show all work.**

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1. (30 pts) Consider the function $f(x) = \dfrac{\sqrt{6x+1}-5}{x-4}$.

   (a)(10 pts) Give the domain of the function $y = 1/f(x)$ in interval notation.

   (b)(10 pts) Find $\lim_{x\to 0^+} f(x)$. Show all work.

   (c)(10 pts) Classify all discontinuities of $f(x)$. If any of the discontinuities are removable, how would you redefine $f(x)$ as a *piece-wise* defined function at the discontinuity to make the function continuous there?

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2. (24 pts) The following problems are not related. Justify all answers.

   (a)(8 pts) Find all vertical asymptotes for the function $f(x) = \dfrac{3x^2-x-4}{x^2-1}$. Justify your answer with limits.

   (b)(8 pts) If $g(x) = \dfrac{(x+5)|x+2|}{(x+2)}$, find $\lim_{x\to -2^-} g(x)$ and $\lim_{x\to -2^+} g(x)$. Does $\lim_{x\to -2} g(x)$ exist? Why or why not?

   (c)(8 pts) Find all horizontal asymptotes of $h(x) = \begin{cases} x^2/(x^2+1), & \text{if } x < 0 \\ \dfrac{x-2}{x^2-4}, & \text{if } x \geq 0 \end{cases}$. Justify your answer with limits.

PROBLEMS #3 & #4 ON THE OTHER SIDE

3. (20 pts) Justify all answers.

(a)(10 pts) Show that the curves $s(x) = \cos(x)$ and $t(x) = x^2 - 2$ intersect at least once in the interval $[0, \pi]$. Note: A graph is not sufficient proof for this problem. (*Hint:* This can be done using one of the theorems we studied.)

(b)(10 pts) Write the function $f(x) = \dfrac{x+4}{|x|+2}$ as a *piece-wise* defined function without the absolute value symbol. Is $f(x)$ continuous at $x = 0$? Explain.

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4. (26 pts) Justify all answers.

(a)(10 pts) A ball thrown vertically upward from the ground at a velocity of 96 ft/sec reaches a height of $s(t) = -16t^2 + 96t$ feet in t seconds. Find the instantaneous velocity of the ball at any time t, $v(t)$, using the limit definition of the derivative.

(b)(8 pts) Find the following limit: $\lim\limits_{x \to 0} \dfrac{\tan(x)}{x}$ (You may <u>not</u> use L'Hôpitals Rule.)

(c)(8 pts) Suppose $f'(x) = \sec(x)$ and $f(\pi/4) = 1$, evaluate $\lim\limits_{x \to \pi/4} \dfrac{f(x) - 1}{x - \pi/4}$.

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