MAT 175 — MOCK EXAM 1

Problem 1. Find the limit, given it exists: $\lim_{x\to 2} \dfrac{x^2+x-6}{2x-4}$.

Problem 2. Find the limit, given it exists: $\lim_{x\to 1} \dfrac{1-x}{2-\sqrt{5x-1}}$.

Problem 3. Let $f(x) = \dfrac{3-6x}{4x^3-x}$. Find all discontinuities and determine which ones are removable.

Problem 4. Let $f(x) = \begin{cases} \frac{x^2-3x+2}{x-1} & \text{if } x \neq 1 \\ k & \text{if } x = 1 \end{cases}$
Determine for which value of k the function f is continuous on all of $\mathbb{R}$.

Problem 5. Find all vertical asymptotes of $f(x) = \tan x$.

Problem 6. Find the one-sided limits $\lim_{x\to 2^-} \dfrac{3x-6}{|x-2|}$ and $\lim_{x\to 2^+} \dfrac{3x-6}{|x-2|}$.

Problem 7. Show that the derivative of $f(x) = 3x^2$ is $f'(x) = 6x$ by using the definition of the derivative as the limit of a difference quotient.

Problem 8. Find the derivative of $f(x) = 2x^3 - \frac{1}{2}x^2 + 9x - 42$.

Problem 9. Find the derivative of $f(x) = 6\sqrt[3]{x^2} + \dfrac{10}{\sqrt[5]{x^2}} - \dfrac{4}{3\sqrt[4]{x^3}} + \dfrac{1}{\sqrt{7}}$.

Problem 10. Find the derivative of $f(x) = \sin x + 3e^x - 3\ln x + e^3$.

Problem 11. Find the derivative of $f(x) = x^2 \cos x$.

Problem 12. Find the derivative of $f(x) = \frac{2x+1}{x^2+1}$.

Problem 13. Find the derivative of $f(x) = e^{x^2+x-5}$.

Problem 14. Find the derivative of $f(x) = \dfrac{1}{2}\sin(x^2)\cos(x^2)$.

Problem 15. Find the derivative of $f(x) = \ln((x-1)(x-2)(x-3)(x-4))$.

Problem 16. A banjo falls on the Moon from a height of 36 meters. Its height, as a function of time in seconds, above the surface is given by the position function $s(t) = -0.81t^2 + 36$. What is the velocity of the banjo when it hits the surface?