Math 1231 Practice Midterm Solutions

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Problem 1 (M1)**.** Compute the following limits if they exist. Show enough work to justify your computation, or your claim that the limit does not exist.

(a)

$$\lim_{x \to 9} \frac{3 - \sqrt{x}}{9 - x}$$

(b)

$$\lim_{x \to -\infty} \frac{3x^3 + \sqrt[3]{x}}{\sqrt{9x^6 + 2x^2 + 1} + x}$$

(c)

$$\lim_{x \to 1} \frac{\sin^2(x - 1)}{(x - 1)^2} =$$

(d)

$$\lim_{x \to 3} \frac{x - 5}{(x - 3)^2} =$$

Problem 2 (M2)**.** Compute the derivatives of the following functions using methods we have learned in class. Show enough work to justify your answers.

(a) $f(x) = \sec\left(\frac{\sqrt{x^2 + 1}}{x + 2}\right)$

(b) $g(x) = \sqrt[4]{\frac{x^3 + \cos(x^2)}{\sin(x^3) + 1}}$

Problem 3 (S1)**.**

Suppose $f(x) = x^2 - 6x$, and we want an output of approximately -9. What input a should we aim for? Find a δ so that if our input is $a \pm \delta$ then our output will be -9 ± 2. Justify your answer.

Problem 4 (S2)**. Directly from the definition of derivative,** compute the derivative of $f(x) = x^2 + \sqrt{x}$ at $a = 2$.

Problem 5 (S3)**.** Give equation for the linear approximation of the function $f(x) = x \sin(x)$ near the point $a = \pi/2$. Use it to estimate $f(1.5)$.