

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)

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

(b)

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

(c)

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

(d)

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

Problem 2 (M2). (a) Explicitly justifying each step and naming each derivative rule you use, compute $\frac{d}{dx} \frac{\sin(x)+1}{2x^2-5}$.

(b) Using any methods we've developed in class, compute the derivative of $g(x) = \tan(x) \sqrt[3]{2x+1}$.

(c) Using any methods we've developed in class, compute the derivative of $h(x) = \sec^3\left(\frac{x^3+1}{x-1}\right)$.

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 $a = 2$.