

# PRACTICE EXAM 1 - MATH 112

DATE: Tuesday, September 20

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Read each problem very carefully before starting to solve it. Each question is worth 3 points. It is necessary to show your work. Correct answers without explanations are worth 0 points.

GOOD LUCK!!

1. Find the following limits:

(a)  $\lim_{x \rightarrow 1} \frac{x^2+x-2}{x^2-1}$

(b)  $\lim_{x \rightarrow 0} \frac{\sqrt{x+3}-\sqrt{3}}{x}$

(c)  $\lim_{x \rightarrow -3} \frac{x^3+27}{x+3}$

2. (a) Give the *formal* (not geometric) definition of a function  $y = f(x)$  being continuous at  $x = a$ .

- (b) Consider the function  $f(x) = \begin{cases} \frac{1}{2}x + 1, & \text{if } x < 2 \\ 3 - x, & \text{if } x > 2 \end{cases}$  Does  $\lim_{x \rightarrow 2} f(x)$  exist? Is  $f(x)$  continuous at  $x = 2$ ? Explain your answers *formally*.

- (c) Determine  $a$  and  $b$  so that the function  $f(x) = \begin{cases} 3x + 5 & \text{if } x \leq -1 \\ ax + b, & \text{if } -1 < x < 3 \\ -2, & \text{if } x \geq 3 \end{cases}$  be continuous on  $\mathbb{R}$ .

3. Use the limit definition of the derivative to compute the derivative of the function  $f(x) = x + \frac{1}{x}$  at the point  $x = 2$ .

4. Use the rules for derivatives to compute the derivatives of the following functions:

(a)  $f(x) = 3x^5 - 4x^3 + x^2 - 10$

(b)  $g(x) = (2x + 1)\sqrt{4x + 5}$

(c)  $h(x) = \frac{3x-2}{x^3+1}$

5. Find the position and the velocity function of a diver who jumps from a board 15 feet high with initial velocity 20 feet per second. Assume that the acceleration of gravity is  $-32$  feet per second squared.

6. Find the equation of the tangent line to the graph of  $f(x) = (\frac{4x-3}{12-5x})^3$  at  $x = 3$ .