

# EXAM 1 - MATH 112

DATE: Friday, January 28

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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. Consider the function  $f(x) = \sqrt[3]{x^2 - 5}$ .
  - (a) Find the domain of  $f$ .
  - (b) Find a formula for the inverse  $f^{-1}(x)$  of  $f$ .
2. Determine the following limits showing all steps in your work:
  - (a)  $\lim_{x \rightarrow 4} \frac{x^2 - 16}{x - 4}$
  - (b)  $\lim_{x \rightarrow 9} \frac{x - 9}{\sqrt{x} - 3}$
  - (c)  $\lim_{x \rightarrow -1} f(x)$ , where  $f(x) = \begin{cases} x^3 + 1, & \text{if } x \leq 1 \\ -x^2 + 3, & \text{if } x > 1 \end{cases}$
3. Consider the function  $f(x) = \frac{x^2 - x - 6}{x + 2}$ . Notice that  $x = -2$  is not in the domain of  $f$ . Is it possible to define  $f$  at  $x = -2$  (i.e., find an  $a$  such that  $f(-2) = a$ ) so that the resulting function  $g(x) = \begin{cases} \frac{x^2 - x - 6}{x + 2}, & \text{if } x \neq -2 \\ a, & \text{if } x = -2 \end{cases}$  be continuous at  $x = -2$ ?
4. Use the definition of the derivative to find the derivative of the function  $f(x) = 3x^2$  at the point  $x = 1$ .
5. The height  $s$  in feet at time  $t$  in seconds of an object fired straight up from ground level is given by  $s(t) = -16t^2 + 64t$ . Determine
  - (a) the instantaneous velocity at time  $t = 1$ ,
  - (b) how long it will take the object to hit the ground,
  - (c) the velocity of the object when it hits the ground.
6. Find the equation of the tangent line to the graph of  $f(x) = \frac{x^4}{x^3 + 1}$  at  $x = 1$ .