

SAMPLE TEST # 1

1. Use the Limit Law(s) to find the following limits. Show all steps.

$$\bullet \lim_{t \rightarrow -2} \frac{t^3 - t^2 - t + 10}{t^2 + 2t + 2} =$$

$$\bullet \lim_{x \rightarrow 1} \frac{x^2 + x - 2}{x^2 - 3x + 2} =$$

$$\bullet \lim_{x \rightarrow 1} \frac{2 - \sqrt{5 - x}}{\sqrt{x} - 1} =$$

$$\bullet \lim_{x \rightarrow 4^+} \frac{x^2 - 16}{|4 - x|} =$$

2. Find the constant c that makes g continuous on $(-\infty, \infty)$. Show your work.

$$g(x) = \begin{cases} x^2 - c^2 & \text{if } x \leq 4 \\ cx + 20 & \text{if } x > 4 \end{cases}$$

3. Let $f(x) = x^4 - 2x^2 + 17$. Find $f'(x)$ using the limit definition for $f'(x)$. (Do not use differentiation formulas.) Show your work.

4. Find $f'(x)$ using the differentiation formulas (not the limit definition for $f'(f)$). Do not simplify your answer.

$$\bullet f(x) = 2x^{99} + \frac{1}{\sqrt[3]{x}} - \sin 1$$

$$\bullet f(x) = (x^{20} + 17x^3 - x^{-3} + 17)(x^5 - x^4 + x + 1)$$

$$\bullet f(x) = \frac{\sqrt{x} - 1}{\sqrt{x} + 1}$$

5. Find the equation of the tangent line to the curve $y = \sqrt{x}$ at the point $(4, 2)$. Use differentiation formulas to find the derivative.

6. Find all the points on the curve $y = 2x^3 - 3x^2 - 12x + 87$ at which the tangent line is horizontal. Use differentiation formulas to find the derivative.