SAMPLE TEST # 1

1. Write an equation of the line that
   • passes through a point $(2, -7)$ and is perpendicular to a line $2x + 3y = 17$.
   • is tangent to $f(x) = 10 - (5 - x)^2$ and passes through a point $(4, f(4))$.

2. Use the limit laws and the consequences of the continuity to find the following limits. Show all steps.
   • $\lim_{t \to -2} \frac{t^3 - t^2 - t + 10}{t^2 + 2t + 2} = \phantom{0}
   • \lim_{x \to 1} \frac{x^2 + x - 2}{x^2 - 3x + 2} = \phantom{0}
   • \lim_{x \to 1} \frac{2 - \sqrt{5 - x}}{\sqrt{x} - 1} = \phantom{0}
   • \lim_{x \to 4^+} \frac{x^2 - 16}{|4 - x|} = \phantom{0}
   • \lim_{z \to 0} \frac{\tan 2z}{\sin 5z} = \phantom{0}
   • \lim_{x \to 3^+} \frac{1}{3 - x} = \phantom{0}

3. Find the constant $c$ that makes $g$ continuous on $(-\infty, \infty)$. Show your work.
   $g(x) = \begin{cases} x^2 - c^2 & \text{if } x \leq 4 \\ cx + 20 & \text{if } x > 4 \end{cases}$

4. Apply the definition of the derivative to find $f'(x)$ for $f(x) = x^2 - \frac{1}{x}$.

5. Find all the points on the curve $y = 3x^2 - 12x + 87$ at which the tangent line is horizontal. You can use slope-predictor formula.