

YOUR NAME: _____

George Voutsadakis

Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. Sketch the graph of the following piece-wise defined function:

$$f(x) = \begin{cases} x^2 + 6x + 5, & \text{if } x < 0 \\ x - 1, & \text{if } x \geq 0 \end{cases}$$

Show clearly and label all points of interest.

2. Compute the limit

$$\lim_{x \rightarrow 7} \frac{7 - x}{\sqrt{3x + 4} - 5}.$$

3. Consider the function

$$f(x) = \begin{cases} \frac{x^2 - 4x + 3}{x^2 - 3x + 2}, & \text{if } x < 1 \\ 3, & \text{if } x = 1 \\ -x^2 + 2, & \text{if } x > 1 \end{cases}.$$

Find the following (showing all your work):

(a) $f(1) =$

(b) $\lim_{x \rightarrow 1^-} f(x) =$

(c) $\lim_{x \rightarrow 1^+} f(x) =$

(d) $\lim_{x \rightarrow 1} f(x) =$

(e) Circle whichever of the following applies for f at $x = 1$:

left continuous

right continuous

continuous

limit exists

4. Find an equation for the tangent line to the graph of $f(x) = \frac{1}{x+4}$ at $x = -3$.

5. An object moving on a straight line is at position $s(t) = -t^2 + 5t$ meters away from the origin at time t seconds into its motion. Find the instantaneous velocity of the object at time $t = 2$ seconds into its motion.