

YOUR NAME: _____

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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. (a) Write an equation for the line ℓ that passes through the point $(-8, 5)$ and is perpendicular to the line ℓ' with equation $x + 7y = 14$.

- (b) Find the domain of the function $f(x) = \frac{x - 3}{x^3 + 3x^2 - 10x}$.

2. Consider the function $f(x) = -x^2 + 6x + 7$. Do the following by hand showing all work.

(a) Find the vertex.

(b) Find the opening direction.

(c) Find the y -intercept.

(d) Find the x -intercepts.

(e) Sketch the graph of f labeling all points found above. (Please, be neat.)

3. Compute

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

4. Consider the function $f(x) = \begin{cases} \frac{x^2 + 6x + 5}{x + 1}, & \text{if } x < -1 \\ -1, & \text{if } x = -1 \\ \frac{\frac{1}{x+2} - 1}{x + 1}, & \text{if } x > -1 \end{cases}$. Compute the following:

(a) $f(-1) =$

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

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

(d) Tell what type of continuity f has at $x = -1$ (if any).

5. Use the *limit definition of the derivative* to find the equation of the tangent line to the graph of $f(x) = 2x^2 - 5$ at $x = 2$.