EXAM 1 - MATH 112 Friday, September 23

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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. Consider the function $f(x) = -x^2 + 6x - 5$.

   (a) Find the vertex.

   (b) Give the opening direction. (Explain.)

   (c) Find the y-intercept.

   (d) Find the x-intercepts.

   (e) Sketch the graph of $y = f(x)$.

2. Compute the following limit:

$$\lim_{x\to 5} \frac{\frac{1}{x+1} - \frac{1}{6}}{x^2 - 25}.$$

3. Consider the function

$$f(x) = \begin{cases} \dfrac{x^2 - 2x - 3}{x + 1}, & \text{if } x < -1 \\ \sqrt{x+5} - 6, & \text{if } x \geq -1. \end{cases}$$

Compute the following:

(a) $f(-1) =$

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

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

(d) Is $f(x)$ continuous at $x = -1$? Explain.

4. Use the **limit definition of the derivative** to compute the slope of the tangent line to the graph of $f(x) = \sqrt{19 - 5x}$ at $x = 2$.

5. Use your formulas to find an equation for the tangent line to $f(x) = \frac{1}{8}x^3 - 2\sqrt{x}$ at $x = 4$.