EXAM 1 - MATH 112   Friday, September 20

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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. Let $f(x) = x^2 + 2x - 3$.

   (a) Find the location of the vertex:

   (b) What is the opening direction (justify):

   (c) Find the y-intercept:

   (d) Find the x-intercepts:

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

2. Let $f(x) = \dfrac{3x^3 - 3x^2 - 6x}{x^2 + x}$. Calculate the following limits:

   (a) $\lim\limits_{x \to -1} f(x) =$

   (b) $\lim\limits_{x \to 0} f(x) =$

3. Consider the piece-wise function $f(x) = \begin{cases} \dfrac{x}{x-2}, & \text{if } x < 1 \\ 3, & \text{if } x = 1 \\ \dfrac{x^2 + x - 2}{2x^2 - 3x + 1}, & \text{if } x > 1 \end{cases}$

   (a) Find $\lim\limits_{x \to 1^-} f(x)$

   (b) Find $f(1) =$

   (c) Find $\lim\limits_{x \to 1^+} f(x)$

   (d) Is f continuous at $x = 1$? If not, is it left continuous or right continuous? Justify your answer.

4. Use the **limit definition of the derivative** to compute $f'(5)$, if $f(x) = 2x^2 - x$;

5. Suppose the temperature T in degrees at a certain point in space is given by $T(t) = \sqrt{1-t}$, where t is time in minutes. Find the instantaneous rate of change of the temperature, at $t = \dfrac{3}{4}$ minutes.