EXAM 1 - MATH 112 Friday, September 21

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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) Solve the polynomial equation $x^4 - 2x^3 - 35x^2 = 0$.

   (b) Find the domain of the function $f(x) = \sqrt{7 - 3x}$ and write your answer in interval notation.

2. (a) Consider the function $f(x) = -x^2 + 6x - 8$.

   (i) Find its vertex.

   (ii) Find its opening direction.

   (iii) Find its y-intercept.

   (iv) Find its x-intercept(s).

(b) (This part is related to Part (a)) Consider the function

$$h(x) = \begin{cases} -x+1, & \text{if } x < 1 \\ -x^2+6x-8, & \text{if} x \geq 1 \end{cases}$$

Use all information gathered in Part (a) to sketch the graph of $y = h(x)$, making sure to label all important points.

3. Consider the function $f(x) = \begin{cases} \frac{x+2}{x^2-x-6}, & \text{if } x < -2 \\ -\frac{1}{5}, & \text{if } x = -2 \\ \frac{x^2+5x+6}{x^2+7x+10}, & \text{if } x > -2 \end{cases}$. Find the following:

(a) $f(-2) =$

(b) $\lim_{x \to -2^-} f(x) =$

(c) $\lim_{x \to -2^+} f(x) =$

(d) $\lim_{x \to -2} f(x) =$

(e) Circle those properties that apply: At $x = -2$ the function $y = f(x)$ is:

left continuous   right continuous   continuous   none of these

4. Find the slope of the tangent line to the graph of $f(x) = \sqrt{x+2}$ at $x = -1$.

5. A car is approaching a "4-WAY STOP" intersection and, as its driver decelerates, its velocity is given as a function of time by $f(t) = \frac{20}{t+1}$ mph, where t is time in seconds.

(a) What is the velocity of the vehicle at $t = 0$ seconds (beginning of observations)?

(b) What is the velocity of the vehicle at $t = 3$ seconds?

(c) Find the average rate of change of the vehicle's velocity from $t = 0$ to $t = 3$ seconds (specify the units, if you can).

(d) Find the instantaneous rate of change of the vehicle's velocity at exactly $t = 3$ seconds.