Provide a presentation that is both clear and organized. Show all of your work, completely simplify all answers, and provide exact values only.

1.   (12 pts) Let $f(x) = \dfrac{\sqrt{12x^3 + 8x^2 - x - 1}}{3x^2 - 7x + 2}$. Determine the domain of f in interval notation.

2.   (7 pts) Let $f(x) = \begin{cases} \dfrac{x^3 - 1}{x - 1} & \text{if } x \neq 1 \\ 5 & \text{if } x = 1 \end{cases}$ Find a function g that agrees with f $\forall x \in R$ except at $x = 1$ but is continuous $\forall x \in R$

3.   (16 pts) Evaluate the following limits, if they exist. If they do not, state such. If a limit does not exist as a finite real number but the algebraic expression within the limit increases or decreases without bound, then state such with the appropriate notation.

i) $\displaystyle \lim_{x \to -\infty} \frac{x - 3}{2x + \sqrt{5x^2 + x}}$

ii) $\displaystyle \lim_{x \to 0} \frac{(x + 3)^5 - 243}{x}$

4. (16 pts) Evaluate the following limits, if they exist. If they do not, state such. If a limit does not exist as a finite real number but the algebraic expression within the limit increases or decreases without bound, then state such with the appropriate notation.

i) $\lim\limits_{x \to 0} \dfrac{\sqrt{2x+3} - \sqrt{3}}{x}$

ii) $\lim\limits_{x \to 2} \dfrac{x^2 - x - 2}{(x-2)^3}$

5.   (14 pts) Use our limit laws to establish that f is continuous over $(-\infty, 3]$ if

$f(x) = 2 - \sqrt{3-x}$ (include one-sided continuity).

6. (10 pts) Let $f(x) = \begin{cases} \dfrac{x^2}{2x-c} & \text{if } x \geq 2 \\ 2cx + 3 & \text{if } < 2 \end{cases}$ Determine all values of c for which f is continuous over $(-\infty, \infty)$

7.   (15 pts) Determine the equation of the tangent line to the graph of $y = f(x)$ at $x = -1$ if $f(x) = \sqrt{3 - 2x}$. Put your answer in *slope-intercept* form.

8. (10 pts) Using our precise definition of the limit, prove that $\lim_{x \to 2}\left(5x^2 - x + 2\right) = 20$