Name: _____   **TA's Name:** _____

page	1	2	3	4	total
score					

Instructions: You must show supporting work as much as possible to receive full and partial credits. No text book, notes, formula sheets allowed.

1(18pts) Find the limits analytically. Numerical or graphical work will not be credited.

(a) $\lim\limits_{x \to 1} \dfrac{2x - 2}{x^2 + x - 2}$

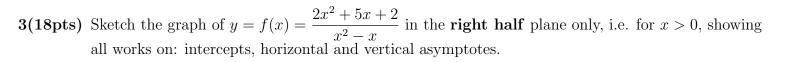(b) $\lim\limits_{x \to +\infty} \dfrac{2x^{3/2} + x}{x\sqrt{x} + 2}$

(c) Let $f(x) = \begin{cases} 3 - x, & x < 2 \\ 2, & x = 2. \\ \frac{x}{2}, & x > 2 \end{cases}$ Find the side limit $\lim\limits_{x \to 2^-} f(x)$.

2(14pts) (a)(4pts) A function f is given by the table below.

x	0	0.2	0.4	0.6	0.8	1.0	1.2
$f(x)$	1.1	0.9	0.8	1	1.3	1.4	1.2

Estimate the derivative $f'(0.4)$.

(b)(10pts) Use definition to find the derivative function $f'(x)$ of $f(x) = \dfrac{1}{x+1}$. (Any other method receives no credit.)

3(18pts) Sketch the graph of $y = f(x) = \dfrac{2x^2 + 5x + 2}{x^2 - x}$ in the **right half** plane only, i.e. for $x > 0$, showing all works on: intercepts, horizontal and vertical asymptotes.

4(16pts) (a) (8pts) Find all points x at which the curve $y = x^3 - 12x + 1$ has a horizontal tangent line.

(b)(8pts) Use long division to find the oblique asymptote of the curve $y = \dfrac{2x^2 - 5x - 2}{x - 3}$.

5(8pts) (a) If $f(2) = 9$, $f'(2) = 4$, and $g(x) = (f(x) + 1)^2$, find $g'(2)$.

(b) Determine at which point function $y = \dfrac{x^2 - 8x - 9}{x + 1}$ is not continuous. Determine if the discontinuity is removable or non-removable, and show your work.

6(8pts) If the position of a particle is given as $x(t) = 2\sqrt{t} - t + 2$ meters from a reference point with t in second.

(a) Find its speed at $t = 4$ sec.

(b) Find its acceleration at $t = 4$ sec.

7(18pts) Find the derivatives of the following functions. (No need to simplify.)

(a) $f(x) = (x^2 + \sqrt{x}) \cos x - 4 \sin(x^2)$

(b) $g(x) = \dfrac{2e^x + x}{e^x + 1}$

(c) $h(x) = 5e^{(2x + \sin x)^2}$

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2 Bonus Points: Einstein's theory of special relativity was derived using: (a) high school trigonometry; (b) pre-calculus algebra; (c) calculus; (d) Newtonian mechanics. (... *The End*)