Name: _____ Signature: _____

Student ID: _____ Section number: _____

- On the front of your blue book print (1) your name, (2) your student ID number, (3) your discussion section number, and (4) a grading table.
- Show all work in your blue book and BOX IN YOUR FINAL ANSWERS where appropriate.
- Please start each problem on a new page. There are a total of — problems on both sides of this paper and a total of 100 points.
- NO books, notes, crib sheets, calculators or any other electronic devices are allowed.

Show your reasoning clearly. A correct answer with no supporting work may receive no credit while an incorrect answer with some correct work may receive partial credit.

1. (23 points: 9, 7, 7)
$$f(x) = e^{x-1} + 2.$$
(a) Sketch the graph of $y = f(x)$. Indicate clearly all intercepts and all asymptotes, if they exist.
(b) What are the domain and range of $f(x)$?
(c) Is f invertible? If yes, find a formula for $f^{-1}(x)$. If not, explain why not.

2. (20 points) Consider the piecewise function $f(x)$ defined below. Where is this function continuous? Where is it not continuous? Explain why.
$$f(x) = \begin{cases} \sqrt{1+\cos(x)} & x \geq 0 \\ -2x, & x < 0 \end{cases}.$$

3. (20 points: 10 each) Find the following limits if they exist, either as numbers or $\pm\infty$. If a limit does not exist, explain why not.
(a) $\lim_{x\to\infty} \dfrac{x^2+1}{x^3-x+1}$ (b) $\lim_{x\to 1^+} \dfrac{1}{1-x}$

4. (17 points: 10, 7)
$$g(x) = \sqrt{1-x}.$$
(a) Using the definition of a derivative, find $g'(x)$.
(b) Find an equation of the tangent line to the graph $y = g(x)$ at $x = -3$.

5. (20 points) Sketch a possible graph of $y = f(x)$ if $f(x)$ satisfies all of the following properties. Your answer should be a SINGLE graph.
   - $f(x)$ is defined on the interval $(0, \infty)$.
   - $\lim_{x\to 0+} f(x) = \infty$.
   - $\lim_{x\to\infty} f(x) = 5$.
   - $f(x) = 0$ at $x = 1$ and $x = 3$.
   - $f'(x) < 0$ when $0 < x < 2$.
   - $f'(x) > 0$ when $2 < x$.
   - $f''(x) < 0$ when $4 < x$.
   - $f''(x) > 0$ when $0 < x < 4$.