Please provide details and steps of your work!!!

Name:
Student ID or Lucky No.:

1. (8 points) Let $f(x) = x^{1/5}$, find
   (a) $f'(x)$
   (b) the partition numbers for $f'(x)$
   (c) the critical values of $f(x)$.

2. (10 points) Let $f(x) = x^3 - 12x + 12$ on the interval $[-3, 5]$. Identify the critical points and find the absolute maximum value and absolute minimum value on the given interval $[-3, 5]$.

3. (16 points) Evaluate the following limits
   (a) $\lim\limits_{x\to 0} \frac{e^{3x}-1}{x}$
   (b) $\lim\limits_{x\to \infty} \frac{e^{3x}}{x^2}$
   (c) $\lim\limits_{x\to 3} \frac{e^{x}-e^{3}}{x-3}$
   (d) $\lim\limits_{x\to 0} \frac{e^{x}-1-x}{x^2}$

4. (8 points) Use the second-derivative test to find any local extrema for
$$f(x) = x^3 - 6x^2 - 15x + 12$$

5. (10 points) Let $f(x) = x^2(x-1) = x^3 - x^2$. Summarize all the pertinent information obtained by applying the graphing strategy to f, and then sketch the graph of f as follows.
   (a) Analyze $f(x)$: find the domain, intercepts, symmetry(if exists), asymptotes(if exists).
   (b) Analyze $f'(x)$: find local extrema, increasing and decreasing intervals.
   (c) Analyze $f"(x)$: find inflection points, concavity.
   (d) Sketch the graph of f.

6. (15 points) Find each indefinite integral:
   (a) $\int 2dx$
   (b) $\int (\frac{3}{x} - 4e^x)dx$
   (c) $\int (8\sqrt{x} - \frac{6}{\sqrt{x}})dx$
   (d) $\int \frac{7}{4x+7}dx$
   (e) $\int \frac{(\ln x)^3}{x}dx$

7. (8 points) Find the particular antiderivative of the following derivative that satisfies the given initial condition:
   $F'(x) = 6x^2 - 4x; F(0) = 3$

8. (8 points) Find the derivative or indefinite integral of the following:
   (a) $\frac{d}{dx}(\int e^{-x^2}dx)$
   (b) $\int \frac{d}{dx}(\sqrt{4+5x})dx$

9. (5 points) Calculate the Riemann sum $S_n = \sum_{i=1}^{n} f(c_i)\Delta x_i$ when $f(x) = 2x$; the partition is $P_5 : 0 < 0.5 < 1.25 < 1.75 < 2.5 < 3$; and sample points are $c_1 = 0, c_2 = 0.5, c_3 = 1.75, c_4 = 2, c_5 = 3$.

10. (12 points) Evaluate the following definite integrals:
    (a) $\int_1^1 (x+2)^{10}dx$
    (b) $\int_1^2 x^3 dx$
    (c) $\int_0^1 (4-x^2)dx$ (d) $\int_0^1 \sqrt{x}dx$

    Bonus (20 Points)

11. (10 points) A homeowner has $ 320 to spend on building a fence around a rectangular garden. Three sides of the fence will be constructed with wire fencing at a cost of $ 2 per linear foot. The fourth side will be constructed with wood fencing at a cost of $ 6 per linear foot. Find the dimensions and the area of the largest garden that can be enclosed with $ 320 worth of fencing.

12. (10 points) Let $f(x) = 2x$ on the interval $[1, 2]$. Calculate the left Riemann sum S_n, when partition the interval $[1, 2]$ into n subintervals of equal length.