1. Compute the second partials for \( f(x, y) = \frac{11x + 13}{18y - 8} \) (Section 7.2 - 14 pts.)

2. Compute the following limits \textit{algebraically} (Section 1.5 - 5 pts. each)
   
   (a) \( \lim_{x \to 4} \frac{x - 4}{x^2 - 4x} \)

   (b) \( \lim_{x \to 0} \frac{\sqrt{x + 1} - 1}{x} \)
3. Using the definition of derivative, compute $f'(x)$ for $f(x) = 3x^2 - 9x + 7$. NO CREDIT will be awarded if the definition of derivative is not used. (Section 2.1 - 10 pts.)

4. Find all $x$-coordinates where the tangent line to $f(x) = 3x^5 - 125x^3$ is horizontal. (Section 2.2 - 10 pts.)

5. Evaluate $f(x, y) = 2xye^x - x + 6y - 10$ at $(2, 5)$. (Section 7.1 - 5 pts.)
6. The marketing department of a certain company has determined the demand function for their product is \( D(x) = -0.04x + 800 \) where \( x \) denotes the number of units demanded.

(a) Find the company’s revenue function \( R(x) \). (Section 2.5 - 2 pts.)

(b) Find the company’s marginal revenue function. (4 pts.)

(c) What does \( R'(5000) \) represent? (4 pts.) (Note, DO NOT compute \( R'(5000) \), just state what it represents.)
7. Differentiate the function \( f(x) = (2x + 5)^{15}(3x + 7)^{10} \). Simplify your answer as much as possible (Section 2.4 - 15 pts.)

8. Suppose a local sports store carries two kinds of tennis rackets. The consumer demand for each brand depends not only on its own price, but also on the price of the competing brand. Sales figures indicate that if brand A sells for \( x \) dollars per racket and brand B sells for \( y \) dollars per racket, the demand for brand A will be \( D_1 = 370 - 30x + 50y \) rackets per year and the demand for brand B rackets will be \( D_2 = 220 + 60x - 38y \) rackets per year. Express the store’s total annual revenue \( R \) from the sale of these rackets as a function of the prices \( x \) and \( y \). (Section 7.1 - 10 pts.)
9. Consider the function \( f(x) = \frac{x+1}{e^x} \)
(a) Over which intervals is \( f(x) \) increasing? decreasing? (Section 3.1 - 6 pts.)

(b) Classify all critical points of \( f(x) \) as relative maxima, relative minima, or neither. (4 pts.)

(c) Determine the intervals of concavity for \( f(x) \). (Section 3.2 - 6 pts.)

(d) Determine any inflection points for \( f(x) \). (4 pts.)
10. A closed cylindrical can has surface area $120\pi$ square inches. Express the volume of the can as a function of its radius. (Section 1.4 - 10 pts.) The following formulas may be helpful:

- $V = \pi r^2 h$ (volume of a cylinder with radius $r$ and height $h$)
- $S = 2\pi rh$ (lateral or side surface area of a cylinder of radius $r$ and height $h$)
- $A = \pi r^2$ (area of a circle with radius $r$)

11. A rectangular page is to contain 30 square inches of print. The margins at the top and bottom of the page are to be 2 inches wide. The margins on each side are to be 1 inch wide. Find the dimensions of the page such that the least amount of paper is used. (Section 3.4 - 20 pts.)
12. Differentiate the function \( f(x) = \ln(\sqrt{x^2(x^2 + 2x)}) \). Simplify your answer as much as possible. (Section 4.3 - 10 pts.)

13. Describe the difference between an indefinite integral and a definite integral. (Section 5.3 - 6 pts.)

14. Given a function \( f(x) \) such that \( f(x) \geq 0 \) on \([a, b]\), what is the interpretation of the quantity \( \int_a^b f(x) \, dx \)? (Section 5.4 - 5 pts.)
15. Compute the following integrals. (Section 5.2 - 10 pts. each)

(a) \[ \int \frac{3x^3 + 2x^2 + x}{x^4} \, dx \]

(b) \[ \int \frac{e^x}{1 + e^x} \, dx \]

(c) \[ \int 5x \sqrt{1 - x^2} \, dx \]
16. Let \( f(x) \) be a function such that \( \int_3^1 f(x)\,dx = 5 \) and \( \int_3^0 f(x)\,dx = 3 \). What is \( \int_1^0 f(x)\,dx \)? (Section 5.3 - 5 pts.)

17. The marginal profit of a certain commodity is \( P'(q) = 100 - 2q \) when \( q \) units are produced. When 10 units are produced, the profit is $700. Find the profit function \( P(q) \). (Section 5.4 & 5.5 - 10 pts.)
18. Find the area bounded by the curves $y = x^2$ and $y = 9x$. (10 pts.)

19. Find the Gini index for a society whose Lorenz curve is given by $L(x) = x^4$. Recall the Gini index is given by $2 \int_0^1 (x - L(x)) \, dx$. Is wealth equitably or inequitably distributed in that society? (10 pts.)