Problem 1. Suppose \( d(x) = x^4 - 4x^2 + 2 \). Find the absolute maximum and minimum values of \( d(x) \) on \([-3, 1]\).

Problem 2. Let \( f(x) = 5x^{2/3} - x^{5/3} \). Show that \( f \) satisfies the hypotheses of the Mean Value Theorem on \([0, 5]\), and find all numbers \( c \) which satisfy the conclusion of the Mean Value Theorem for \( f \) for this same interval.

Problem 3. Classify all critical points of \( f(t) = \frac{3}{5}t^5 - \frac{1}{2}t^4 - 2t^3 \).

Problem 4. Let \( p(x) = e^{\frac{x}{2}}, x \neq 0 \).
   i. On what interval(s) is \( p(x) \) increasing? Decreasing?
   ii. Classify all local extrema of \( p(x) \).
   iii. On what interval(s) is the graph of \( p(x) \) concave up? Concave down?
   iv. Find all inflection points of the graph of \( p(x) \).

Problem 5. A particle is released from the point \((-1, 0)\) at time \( t = 0 \) with an acceleration of \( \sin(t) + \cos(t) \) units/s\(^2\). Suppose the particle is initially moving to the left at 1 units/s.
   i. Find the position of the particle after \( \pi \) seconds.
   ii. Find the total distance traveled by the particle in \( 0 \leq t \leq \pi \).

Problem 6. Calculate the \( L_4 \) and \( R_4 \) for \( h(x) = x^3 + x + 1 \) on \([-2, 6]\).
Problem 7. Find $g(x)$ if $g'(x) = x\sqrt{x + 1}$ and $g(4) = 7$.

Problem 8. Evaluate $\lim_{x \to 0^+} \frac{\int_0^x t^2 \csc^2(t) \, dt}{5x}$.

Problem 9. A power line runs in an east-west direction through the countryside. Two new buildings will be built, and they will draw power from this power line by running lines from a single point on the existing line to each of the new buildings. If one building lies 6 miles south of the existing line and the other building lies 10 miles to the east and 2 miles south of the other other building, where on the existing line should the connections to these buildings be made?

Problem 10. Find an equation of the line through the point $(3, 5)$ that cuts off the least area from the first quadrant.

Problem 11. Compute the following integrals.

i. $\int_1^2 \frac{\sqrt{t^3} - \sqrt{t + t^3}}{2t^2} \, dt$

ii. $\int_0^1 x^3 \sqrt{x^2 + 3} \, dx$

iii. $\int_{-2}^2 (3 + \sqrt{4 - t^2}) \, dt$

iv. $\int \frac{\ln(\ln(x))}{x \ln(x)} \, dx$

Problem 12. A large rock is dropped from the top of a 128 foot tall building. At the same time, a ball is thrown straight upwards from ground level from a point directly below the rock. With what initial velocity should the ball be thrown so that the ball meets the rock when the rock is halfway, in terms of height, to the ground?