1. Find the absolute maximum and minimum values of \( f(x) = x^3 - 6x^2 + 9x + 2 \) over the interval \([0, 2]\).

2. Find the absolute maximum and absolute minimum values of \( f(x) = \frac{x^2 - 2}{3x^2 + 2} \) over the interval \([-1, 3]\).

3. Sketch the graph of \( f(x) = \frac{x}{1+x^2} \). Clearly indicate the location of all axis intercepts, asymptotes, and local extrema.

4. The graph of the derivative of a function \((y = f'(x))\) is shown.

\[ y = f'(x) \]

\[ -20 \quad -10 \quad 0 \quad 10 \quad 20 \quad 30 \]

\[ -2 \quad -1 \quad 0 \quad 1 \quad 2 \quad 3 \quad 4 \]

a) At what value(s) of \( x \) does the function \( f \) have a local maximum?

d) On what interval(s) is the graph of the function \( y = f(x) \) concave downward?

5. Find the interval(s) on which the function \( f(x) = 2 + 3x^2 - x^3 \) is concave upward.

6. Let \( g(x) = \sqrt{1 - x^2} \). Use the Mean Value Theorem to show that \( g'(c) = 1 \) for some \( c \) in the interval \([-1, 0]\) or explain why the Mean Value Theorem does not apply.

7. Use Newton’s method with initial approximation \( x_1 = -1 \) to find the second approximation, \( x_2 \), of a solution to the equation \( x^5 + 2 = 0 \).

8. Explain why \( x_1 = 1 \) is a poor starting guess when Newton’s method is used to find the root of the function whose graph is shown.

\[ y = f(x) \]

\[ -0.6 \quad -0.4 \quad 0 \quad 0.2 \quad 0.4 \]

\[ -2 \quad -1 \quad 0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \]

9. Find the most general form of an antiderivative of \( f(x) = \sqrt{x} - \frac{2}{x^2} \).

10. A particle in a magnetic field has velocity \( v(t) = \sin t \) m/s and at time 0 its position is 0. Find a function giving the position of the particle at time \( t \).

11. Find the dimensions of a rectangle with perimeter 80m whose area is as large as possible. Verify that your answer is a maximum.

12. A box with square base and an open top is to have a volume of 10m\(^3\). Material for the base costs $10 per square meter and material for the sides costs $8 per square meter. Determine the dimensions of the cheapest such container. Verify that your answer is a minimum.