1. (10 pts.) The graph $y = f'(x)$ of the derivative of a function $f(x)$ is shown. Answer the questions about $f(x)$.

(a) State the intervals on which the function $f(x)$ increases.
(b) State the intervals on which the function $f(x)$ decreases.
(c) State the intervals on which the function $f(x)$ is concave up.
(d) State the intervals on which the function $f(x)$ is concave down.
(e) Suppose $f(0) = 0$. Using the above information (and coordinate axis), sketch the graph of $f(x)$.

2. (15 pts.) Find and identify all relative extrema of the function $f(x) = 2 - 3x^4 - 8x^3 - 6x^2$ on the interval $\mathbb{R} = (-\infty, \infty)$. State the extrema in the coordinate form $(x, y)$. 


3. (15 pts.) US Postal Service regulations state that the length plus girth of a package cannot exceed 108 inches. You must mail a package whose width and height are equal, and with the greatest possible volume. Find the dimensions of the package.

Answer:
length = ____________
width = height = __

4. (20 points) Evaluate the following limits.

   (a) \( \lim_{x \to \pi} \frac{1 + \cos x}{(\pi - x)^2} = \)

   (b) \( \lim_{x \to \infty} xe^{-x} = \)
5. (24 points) Find the indicated indefinite integrals.

(a) \[ \int \left( 7 + 7x + \frac{5}{\sqrt{x^2}} \right) \, dx = \]

(b) \[ \int \left( e^{4x} + 4 \cos x + 20 \right) \, dx = \]

(c) \[ \int \frac{2x}{x^2} \, dx = \]

6. (8 pts.) Is the equation \[ \int (1 + \ln x) \, dx = x + \ln x + C \] true or false? Justify your answer.

7. (8 pts.) Suppose \( f(x) \) is a function for which \( f'(x) = -\sin(x) \) and \( f(2\pi/3) = -3 \). Find \( f(x) \).