

Attempt all questions and show all your work. Due March 24, 2010 in class, by the end of class with a signed honesty declaration.

- For each function, find (a) the critical numbers, (b) the open intervals where the function is increasing, and (c) the open intervals where the function is decreasing.
 - $f(x) = \frac{2}{3}x^3 - x^2 - 4x + 2$
 - $f(x) = x\sqrt{9 - x^2}$
 - $f(x) = \ln \frac{5x^2+4}{x^2+1}$
 - $f(x) = x2^{-x^2}$
- Find the x -value of all points where the functions defined as follows have any local (relative) extrema. Find the value(s) of any local (relative) extrema as well.
 - $f(x) = x^2 + \frac{1}{x}$
 - $f(x) = \frac{x^2-6x+9}{x+2}$
 - $f(x) = 3xe^x + 2$
 - $f(x) = \frac{x^2}{\ln x}$
- Find $f''(x)$ for each function, and find the open intervals on which the function is concave upward or concave downwards. Find any inflection points.
 - $f(x) = -x^4 + 7x^3 - \frac{x^2}{2}$
 - $f(x) = \ln x + \frac{1}{x}$
 - $f(x) = -x(x - 3)^2$
 - $f(x) = x^2 + 8 \ln |x + 1|$
- Consider the curve given by the function

$$f(x) = \frac{-2x}{x^2 - 4}.$$

Note then that

$$f'(x) = \frac{2x^2 + 8}{(x^2 - 4)^2} \quad \text{and} \quad f''(x) = \frac{-4x^3 - 48x}{(x^2 - 4)^3}.$$

- Determine the domain of $f(x)$ and its x -intercepts.
- Find all vertical asymptotes of $f(x)$. (Show all your work).
- Find all critical points of $f(x)$ (that is, all critical numbers, together with their y values).
- Find the open intervals where $f(x)$ is increasing and the intervals where $f(x)$ is decreasing.
- Find the coordinates of points at which the local maxima and/or local minima occur.
- Determine the open intervals upon which $f(x)$ is concave up and the open intervals where $f(x)$ is concave down.
- Find the coordinates of the points of inflection.
- Use the above information to give a neat sketch of the graph $y = f(x)$.