

PHZ 3113, Problem Set No. 1. Due Wed, Jan. 14, 2009.

Problem 1

Find the zeros, the local maximum, and the local minimum of the function $f(x) = x - \frac{1}{3}x^3$. Obtain the values of $f(x)$ at its local maximum and minimum, and sketch the function.

Problem 2

Obtain the Taylor expansion of the function $f(x) = \cos(x)$ up to order $(x - x_0)^2$ for arbitrary x_0 . Then give the results for the special cases

i) $x_0 = 0$

and

ii) $x_0 = 3\pi/2$.

The Taylor expansion about x_0 to finite order can be seen as an approximation to $f(x)$ near x_0 . Sketch together in one figure $f(x)$ and the two approximations you obtained above.

Problem 3

Given the function $f(x, y) = x + xy^2 + x^2y + y$, find $\partial f/\partial x$, $\partial f/\partial y$, and $\partial^2 f/\partial x\partial y$.

Problem 4

Evaluate the integral $\int_a^b (x - \frac{1}{3}x^3) dx$ for general a and b . Then give the numerical result for

i) $a = -5$, $b = +5$ (How could you have predicted this result without explicitly performing the integration?)

and

ii) $a = 0$, $b = +2$.

Problem 5

W&A No. 6.1.1.

Problem 6

W&A No. 6.1.6.

Hint: Remember the sum of the finite geometric series,

$$\sum_{n=0}^{N-1} x^n = \frac{1 - x^N}{1 - x}.$$