

Physics 7412, Fall 2013

Problem set 2

Due date: 9/25/13

Note: These problems can be addressed with a hand-held calculator, Mathematica, Maple, etc. Either that or writing a computer code is acceptable as answer.

1. Use the following values to construct a Lagrange polynomial of degree three interpolating the function $\sin(x)$. Using the formula given in class find the error estimate for the approximation. Compare with the exact value. Is the error bound useful in this case?

x	$\sin(x)$
0.30	0.29552
0.32	0.31457
0.33	0.32404
0.35	0.34290

2. Construct a free cubic spline to approximate $f(x) = \cos \pi x$ by using the values at $x = 0, 0.25, 0.5, 0.75$ and 1.0 . Use the derivatives of the spline to approximate $f'(0.5)$ and $f''(0.5)$. Compare these approximations to the actual values.

3. Use Von Neumann rejection to generate points with a distribution $w(x) = (4 - 2x)/3$ and use it to compute the integral

$$\int_0^1 \frac{dx}{1+x^2} = \frac{\pi}{4} \quad (1)$$

with the Monte Carlo method.