MA 497 – Numerical Analysis
Final Project
Due: 2 May, 2008

The solution to all problems should be typeset using LaTeX, and the LaTeX source file (and all supporting files, e.g., graphics, etc.) should be submitted electronically via email. The submitted source file will be compiled using `pdflatex`, and the success of this process will represent the initial assessment step. All source code for numerical computations should also be submitted electronically.

A skydiver falls from a plane a certain distance above the ground, and his velocity is recorded periodically during the fall (both before and after his parachute opens). The total fall time (i.e., the time until the diver touches the ground) is 130 seconds, and the recorded velocity $v(t)$ is shown in the table(s) below.

Time (s)	Velocity (ft/s)
0.00	0.00
2.78	−68.57
5.56	−107.91
8.33	−130.49
11.11	−143.44
13.89	−150.87
16.67	−155.13
19.44	−157.58
22.22	−158.98
25.00	−159.79
30.00	−160.47
35.00	−160.72
40.00	−160.82
45.00	−160.85
50.00	−160.86
55.00	−160.87

Time (s)	Velocity (ft/s)
60.00	−160.87
60.12	−138.73
60.25	−120.15
60.38	−104.55
60.50	−91.45
60.62	−80.46
60.75	−71.23
60.88	−63.49
61.00	−56.98
61.12	−51.53
61.25	−46.94
61.38	−43.10
61.50	−39.87
61.62	−37.16
61.75	−34.88
61.88	−32.97

Time (s)	Velocity (ft/s)
62.00	−31.37
62.12	−30.02
62.25	−28.89
62.38	−27.94
62.50	−27.15
62.62	−26.48
62.75	−25.92
62.88	−25.44
63.00	−25.05
64.00	−23.49
75.00	−22.98
86.00	−22.98
97.00	−22.98
108.00	−22.98
119.00	−22.98
130.00	−22.98

1. Use natural cubic spline interpolation to approximate the velocity 10 seconds after the fall begins.
2. Graph the data, and estimate the time t for which the parachute was opened.
3. Recall that acceleration $a(t) = v'(t)$, approximate $a(t)$ for each t in the table above, and graph these approximations.
4. Recall that $v(t) = r'(t)$ where $r(t)$ is the position at time t, and approximate the altitude (position) of the plane at the moment the diver begins his dive.
5. Estimate the altitude of the diver at the time the parachute opens.
6. Estimate the time in which the diver's altitude is $1/2$ of his initial altitude.