Tutorial 6

1. The mass of a radioactive substance is measured at 2-day intervals till 8 days. Unfortunately, the reading could not be taken at 6 days due to equipment malfunction. The following table shows the other readings:

Time (d)	Mass (g)
0	1.0000
2	0.7937
4	0.6300
8	0.3968

(a) Estimate the mass at 6 days using cubic spline

(b) Using the table and the value obtained in (a), estimate the half-life of the substance using least squares regression after linearising the exponential decay equation.

2. The velocity of an object, travelling along a straight line, was measured at various times as follows:

Time (min)	0	1	2	3	4	5	6	7	8	9	10
Velocity (cm/min)	0.00	0.65	1.72	3.48	6.39	11.18	19.09	32.12	53.60	89.02	147.41

Estimate the acceleration at 5 minutes using (i) forward difference, $O(h^2)$, with h=1 min, (ii) backward difference, $O(h^2)$, with h=1 min, and (iii) central difference $O(h^2)$ with h=1, 2, and 3 min. Use Richardson extrapolation to obtain an $O(h^6)$ estimate from the three central difference estimates.