Tutorial Interpolation

A. Newton's Divided-Difference interpolating polynomials

1. Estimate the natural logarithm of 2 using linear interpolation. First perform the computation by interpolating between ln 1 = 0 and ln 6 = 1.791759. Then repeat the procedure, but use a smaller interval from ln 1 to ln 4 (1.386294). Note that the true value of ln 2 is 0.6931472.

2. Fit a second-order polynomial to the three points and use it to evaluate ln 2
   $X_0 = 1$ $f(x_0)=0$
   $X_1 = 4$ $f(x_1)=1.386294$
   $X_2 = 6$ $f(x_2)=1.791759$

3. Referring to question 2 above, add the fourth point as follows
   $X_3 = 5$ f(x3) = 1.609438
   Estimate ln 2 with a third order Newton's interpolating polynomial

4. For the function cos (-x), given that

x	0.5	1.0	1.5	2.0
f(x)	0.8776	0.5403	0.0707	-0.4161

   By using linear interpolation with h=1.0 and h=0.5 estimate cos (-1.0287)

5. For the function e^{-x}, given that

x	0.91	0.92	0.93	0.94
f(x)	0.4025	0.3985	0.3946	0.3906

   By using quadratic interpolation, estimate $e^{-0.9321}$

6. For the function e^{-x}, given that

x	0.91	0.92	0.93	0.94
f(x)	0.4025	0.3985	0.3946	0.3906

   By using cubic interpolation, estimate $e^{-0.9321}$

B. Lagrange interpolating polynomials

7. Use a Lagrange interpolating polynomial of the first and second order to evaluate ln 2 on the basis of the following data:

   $X_0 = 1 \quad f(x_0)=0$
   $X_1 = 4 \quad f(x_1)=1.386294$
   $X_2 = 6 \quad f(x_2)=1.791759$

8. Given that (2,5) and (3,7). Use a first order Lagrange interpolating polynomial to evaluate f(2.5).

9. Given that (1,2) , (2,5) and (3,7). Use a second order Lagrange interpolating to evaluate f(2.5).