

NPTEL lectures on  
**Elementary Numerical Analysis**

by

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**Quiz 1**

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Time: 20 minutes

Marks: 10

**Use of calculators is not permitted.**

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1. Let

$$f(x) = 198x^4 + 27x^3 - 10x^2 + 47x + 13.$$

Find the divided difference  $f[1 \ 2 \ 3 \ 4 \ 5]$ . (1 mark)

**Ans.:** .....

2. Let

$$x_0 = 1, x_1 = \frac{4}{3}, x_2 = \frac{5}{3}, x_3 = 2$$

and for  $i = 0, 1, 2, 3$ , let  $\ell_i(x)$  be the Lagrange interpolation polynomial of degree 3 such that

$$\ell_i(x_i) = 1, \ell_i(x_j) = 0, \text{ for } i \neq j.$$

Evaluate

$$l_0\left(\frac{3}{2}\right) + l_1\left(\frac{3}{2}\right) + l_2\left(\frac{3}{2}\right) + l_3\left(\frac{3}{2}\right).$$

(1 mark)

**Ans.:** .....

3. Let  $f : [0, 1] \rightarrow \mathbb{R}$  be such that

$$f(0) = 1, f'(0) = 3, f(1) = 7, f'(1) = 10,$$

where  $f'(x)$  denotes the derivative of  $f$  at  $x$ . Find the cubic polynomial which interpolates  $f$  and  $f'$  at 0 and at 1. (2 marks)

**Ans.:** .....

4. Let  $f : [0, 7] \rightarrow \mathbb{R}$  be such that

$$f(0) = 3, f(1) = 16, f(3) = 108, f(7) = 724.$$

Find

(a) a polynomial of degree  $\leq 2$  which interpolates  $f$  at 0, 1, 3,

**Ans.:** .....

(b) a polynomial of degree  $\leq 3$  which interpolates  $f$  at 0, 1, 3, 7.

**Ans.:** .....

(1+1 marks)

5. Let  $f(x) = \frac{1}{x}$ ,  $x \in [1, 3]$  and  $p_2(x)$  be the quadratic polynomial which interpolates  $f$  at 1, 2, 3. Find the best possible upper bound for  $\|f - p_2\|_\infty = \max_{x \in [1, 2]} |f(x) - p_2(x)|$ . (2 marks)

**Ans.:** .....

6. Evaluate

$$\int_0^4 (x - 1)(x - 2)(x - 4)dx.$$

(2 marks)

**Ans.:** .....