# Finite and divided differences. Taylor polynomial

**A**

1. Complete the following finite difference table:

| $f$ | $\Delta f$ | $\Delta^2 f$ | $\Delta^3 f$ | $\Delta^4 f$ |
|---|---|---|---|---|
| 3 | - | - | - | -10 |
| -4 | 6 | - | - 21 | |
| 2 | - | -19 | | |
| - | -11 | | | |
| - | | | | |

2. Construct the divided difference table for the information:

| $x$ | 1 | 3 | 4 | 6 | 7 |
|---|---|---|---|---|---|
| $f(x)$ | 5 | 6 | 3 | 7 | 4 |

3. Compute a quadratic Taylor polynomial for $f(x) = \sqrt{x}$ around $x_0 = 1$.

4. Find a bound of the error for the Taylor polynomial of degree 4 corresponding to the function $f(x) = \cos x$, around $x_0 = 0$, on the interval $\left[-\frac{\pi}{4}, \frac{\pi}{4}\right]$.

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**B**

1. Complete the following finite difference table:

| $f$ | $\Delta f$ | $\Delta^2 f$ | $\Delta^3 f$ | $\Delta^4 f$ |
|---|---|---|---|---|
| 1 | - | - | - | -88 |
| 4 | -16 | - | -41 | |
| -12 | - | -13 | | |
| - | -1 | | | |
| - | | | | |

2. Construct the divided difference table for the information:

| $x$ | 1 | 3 | 5 | 9 | 10 |
|---|---|---|---|---|---|
| $f(x)$ | 3 | 0 | 5 | 7 | 1 |

3. Compute a quadratic Taylor polynomial for $f(x) = \sin x$ around $x_0 = \frac{\pi}{4}$.

4. Find a bound of the error for the Taylor polynomial of degree 3 corresponding to the function $f(x) = \ln x$, around $x_0 = 1$, on the interval $\left[\frac{1}{2}, \frac{3}{2}\right]$.