Assignment 1. Computation of Elementary Function Values

Objective:
To gain practical experience in analyzing computational errors when calculating the values of elementary functions.

1. Based on the specified accuracy (ε = 10^{-6}), solve the inverse problem of error theory for the given function $z(x) = \sqrt{(1+x^2)}(\sin(3x+0.1)+\cos(2x+0.3))$.
2. Develop a program to compute the values of the function $z(x)$ over the specified interval [0.2, 0.3], h = 0.01. Where x = a (h) b, and $x_{i+1} = x_i + h$.
   Note:
   To compute the values of elementary functions, use their power series expansions (see Appendix 1).
   For the square root (√c), use Heron's formula: $\rho_{i+1} = \frac{1}{2}\left(\rho_i + \frac{c}{\rho_i}\right)$, where ρ_0 is an approximate value of √c taken with an excess.
3. For the function $z(x)$ = $f(\varphi(x), \psi(x), \omega(x), \dots)$ (and all its component functions $\varphi(x)$, $\psi(x)$, $\omega(x)$, …), construct the table **"Final Results"** showing the computed values at the nodes $x = x_i$, i = 1,…,k, with the required precision.
   Note:
   Δ_ϕ — the error estimate obtained in item 1;
   $\overline{\phi}(x_i)$ — the value of the function Δ_ϕ at point x_i, computed using the built-in programming language functions;
   $\overline{\Delta_\phi}$ — the absolute error of computing $\phi(x)$.
   For error analysis, the "exact" solution is taken as $\overline{\phi}(x_i)$.
   Analogous notation applies to the functions $z(x)$, $\psi(x)$, $\omega(x)$, etc.
4. Evaluate the obtained results by comparing the function values computed using your program with those obtained using built-in functions.

Table "Final Results"

x	$\phi(x)$	Δ_ϕ	$\overline{\phi}(x)$	$\overline{\Delta_\phi}$	**…**	**$z(x)$**	$\Delta_z = \varepsilon$	$\overline{z}(x)$	$\overline{\Delta}_z$
$x_1 = a$									
…									
$x_{i+1} = x_i + h$									
…									
$x_k = b$									