

• Absolute error

خطا مطلق

$$|e_r| = |X_e - X_a|$$
$$e_r = \frac{|\pi - 3.14|}{X_e} = \underline{0.00159}$$

$\pi$

3.14  
 $X_a$

• Relative error

$$|e_r|_{rel} = \left| \frac{X_e - X_a}{X_e} \right|$$
$$= \left| \frac{X_e - X_a}{X_a} \right|$$

خطا نسبي

$$X_e = 1000300$$

$$X_a = 1000000$$

$$= \left| \frac{300}{1000000} \right| = 0.0003$$

١٤٥، خفضاً، اُصلو

$|er| \leq \frac{1}{2} * 10^{-k}$

1.25  $k=2$

1.025 k=

$$X^* = 3.14$$

$$|e_r| \leq \frac{1}{2} \times 10^{-2}$$

$$-0.005 \leq e_r \leq +0.005$$

$$f(x) = \sqrt{e^{3x} - 1} \quad x^* = 1.25$$

- Bound of Single Variable Function Error  
 $f(x)$

$$|e_f| \leq \frac{1}{2} * 10^{-2} * |f'(1.25)|$$

$$f'(x) = \frac{3e^{3x}}{2\sqrt{e^{3x} - 1}}$$

$$|e_f| \leq \frac{1}{2} * 10^{-2} * 9.89$$

$$f'(1.25) = 9.89 \quad -0.014 \leq e_f \leq 0.014$$

$$|e_f| \leq \frac{1}{2} * 10^{-k} * |f'(x^*)|$$

$$\frac{d\sqrt{f(x)}}{dx} = \frac{f'(x)}{2\sqrt{f(x)}}$$

• Bound of Error for Multi variables functions

$$f(x_1, x_2, \dots, x_n)$$

$$|e_F| \leq \frac{1}{2} * \sum_{i=1}^n 10^{-k_i} \left| \frac{\partial f(x_i^*)}{\partial x_i} \right|$$

$$\approx f(x_1, x_2) = x_1^2 + x_1^3 x_2^4$$

$$\frac{\partial f}{\partial x_1} = 2x_1 + 3x_2^4 x_1^2$$

$$\frac{\partial f}{\partial x_2} = 0 + 4x_1^3 x_2^3$$

$$\hookrightarrow x_1^* = 2.13, k_1 = 2$$

$$\hookrightarrow x_2^* = 4.0153, k_2 = 3$$

$$|E_F| \leq \frac{1}{2} * \left[ 10^{-2} * \left[ 2 * 2.13 + 3(4.0153)^4 (2.13)^2 \right] + 10^{-3} * 4(2.13)^3 (4.0153)^3 \right]$$

$$\leq E_F \leq +$$