1. What is truncation error?

Ans: Truncation error occurs when we change the mathematical procedure of finding approximate value, or error generated from mathematical model is called truncation error.

Ex:
From Maclaurin series we get,

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots\dots$$

Here, this equation tends to infinity. Let assume we calculate all this and get value of e^x is X. But if we calculate just $1 + x + \frac{x^2}{2!}$ from the series and neglect the other forms than we will not get X. We'll get something near to X. So depending on the mathematical model the value changed. We didn't get X. This is truncation error. To calculate error,

$$\text{Error} = e^x - \left(1 + x + \frac{x^2}{2!}\right)$$

e^x ↓ True value

$\left(1 + x + \frac{x^2}{2!}\right)$ ↓ approx value.

Ans.

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2) Apply BDD to find the numerical value of $\frac{d}{dx}(e^{0.5x})$ at $x = 2.5$ using step size of 1.5.

Here,

$x = 2.5$

$\Delta x = 1.5$

True value,

$$f'(2.5) = \frac{d}{dx} e^{0.5 \times 2.5}$$

$$= e^{0.5 \times 2.5}$$

$$= e^{1.25}$$

$$= 3.4903$$

Approx value

$$f'(x) = \frac{f(x) - f(x - \Delta x)}{\Delta x}$$

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$$f'(2.5) = \frac{f(2.5) - f(2.5 - 1.5)}{1.5}$$

$$= \frac{e^{0.5 \times 2.5} - f(1.0)}{1.5}$$

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$$= \frac{e^{1.25} - e^{0.5 \times 1}}{1.5}$$

$$= \frac{3.4903 - 1.6487}{1.5}$$

$$= 1.2277$$

Ans.

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