CS ASSIGNMENT

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Q) Evaluate $\int_0^4 e^x dx$ using trapezoidal & simpson's $\frac{1}{3}$ rule & compare with the actual value.

Sol^n

x	0	1	2	3	4
$f(x)$	1	2.7182	7.389	20.0855	54.5981

⇒ By Trapezoidal Rule

$$\int_0^4 e^x dx = \frac{h}{2}\left[y_0 + y_4 + 2(y_1 + y_2 + y_3)\right]$$

$$= \frac{1}{2}\left[1 + 54.5981 + 2(2.7182 + 7.389 + 20.0855)\right]$$

$$= \frac{1}{2}\left[115.9835\right] = 57.99175$$

⇒ By Simpson's $\frac{1}{3}$ Rule

$$\int_0^4 e^x dx = \frac{h}{3}\left[(y_0 + y_4) + 4(y_1 + y_3) + 2(y_2)\right]$$

$$= \frac{1}{3}\left[(1 + 54.5981) + 4(2.7182 + 20.0855) + 2(7.389)\right]$$

$$= \frac{1}{3}(161.5909) = 53.8636\overline{3}$$

⇒ Acutal Value :-

$$I = \int_0^4 e^x \, dx$$

$$= [e^x]_0^4 = (e^4 - e^0) = 54.5981 - 1$$
$$= 53.5981$$

So, ~~error~~ difference from Trapezoidal rule is.

$$\rightarrow 53.5981 \sim 57.99175 = 4.39365$$

& difference from Simpson's $\frac{3}{8}$ Rule is

$$\rightarrow 53.5981 \sim 53.86363 = 0.26553$$