Simpson + Trapezoidal

- approx area under a curve by trapezoid

Simpson Rule - More accurate
Divides area up into parabolas

$n=4$ $\int_0^1 x^2\,dx$

how many parabolas you divide it into

$$\frac{h}{3}\left[f(x_0)+4(x_1)+2(x_2)+4(x_3)\cdots\cdots 2f(x_n-2)+4(x_n-1)+(x_n)\right]$$

$\boxed{h=\frac{b-a}{n}}$ $n=$ always an even integer

$$\int_0^1 x^2\,dx = \frac{1}{4}/3\left[0^2+4\left(\tfrac{1}{4}\right)^2+2\left(\tfrac{1}{2}\right)^2+4\left(\tfrac{3}{4}\right)^2+1^2\right]$$

remember
$x_0=0$ $x_1=\frac{1}{4}$
$x_2=\frac{1}{2}$ $x_3=3/4$
$x_4=1$

Ex) $n=6$ $\int_{-1}^{2}\frac{dx}{x^2+2}$ $h=\frac{b-a}{n}=\frac{2-(-1)}{6}$

$x_0=-1$

★ **Trapezoidal Rule**
- same thing, but just h

$$\int_a^b f(x)\,dx = h\left[\tfrac{1}{2}f(x_0)+f(x_1)+\cdots f(x_n-1)+\tfrac{1}{2}\right]$$

Start + end w/ this

end #

Ex) $\int_0^1 (x)^2\,dx$ $n=4$ $h=\frac{b-a}{n}=\frac{1-0}{4}=$ length of base, over 4, up

- for all $x_1, x_2, x_3 \ldots$ add h each time to get it. finish wi
$\frac{1}{2}(1)^2$, start with $\frac{1}{2}$

(4) $\int_1^4 \frac{1\,dx}{x}$ $n=4$ $h=\frac{4-1}{4}=\frac{3}{4}$

$$=\frac{3}{4}\left[\frac{1}{2}\cdot\frac{1}{1}+\frac{1}{4/7}+\frac{1}{5/2}+\frac{1}{13/4}+\frac{1}{2}\left(\frac{1}{4}\right)\right]$$

$7/4$ $2/5$ $4/13$ $1/8$

$x_0=1$
$x_1=1\frac{3}{4}=\frac{7}{4}$
$x_2=\frac{5}{2}$
$x_3=\frac{13}{4}$
$x_4=16/4=4$

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