Simpson's Rule

#55 Trapezoid rule ($n=6$)

$$\int_{-2}^{4} x^2\,dx = \frac{1}{2}\cdot 1\left[(-2)^2 + 2(-1)^2 + 2(0)^2 + 2(1)^2 + 2(2)^2 + 2(3)^2 + 4^2\right]$$

$$\approx 25$$

$\frac{1}{2}\cdot\frac{b-a}{n}$

$\frac{b-a}{2n}$

Simpson's Rule ($n=6$) n must be even

$$\int_{-2}^{4} x^2\,dx \approx \frac{4-(-2)}{3(6)}\left[(-2)^2 + 4(-1)^2 + 2(0)^2 + 4(1)^2 + 2(2)^2 + 4(3)^2 + 4^2\right]$$

$$= 24$$

$\frac{b-a}{3n}$

(7) (a) $\int_{-1}^{8} f(x)\,dx \approx 2(4) + 3(6) + 1(2) + 3(0)$

Δx Δx Δx Δx

$= 28$

heights

(b) $2(3) + 3(4) + 1(6) + 3(2) = 30$

(c) 2 Trapezoids

$[-1, 4]$ $[4, 8]$

$\frac{1}{2}(3+6)(5) + \frac{1}{2}(6+0)(4) = 34.5$

Δx

(d) 4 Trapezoids

$[-1, 1]$ $[1, 4]$ $[4, 5]$ $[5, 8]$

$\frac{1}{2}(3+4)(2) + \frac{1}{2}(4+6)(3) + \frac{1}{2}(6+2)(1) + \frac{1}{2}(2+0)(3)$

$= 29$

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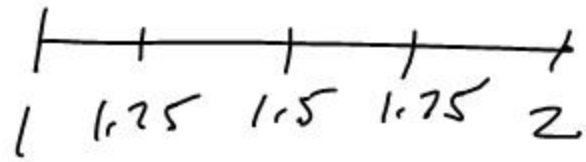
(9) (a) $\int_{2}^{3} f(x)\,dx$ (b) $\int_{0}^{-1} f(x)\,dx$ (c) 0

#6a



1st Fundamental theorem of Calculus

$$\frac{d}{dx}\int_{a}^{x} f(t)\,dt = f(x)$$

a function of x

Leibniz's Rule

$$\frac{d}{dx}\int_{u(x)}^{v(x)} f(t)\,dx = f(v(x))\cdot\frac{dv}{dx} - f(u(x))\cdot\frac{du}{dx}$$

Ex. $\frac{d}{dx}\int_{x^2}^{x^3} t^5\,dt$

function

$= (x^3)^5 \cdot 3x^2 - (x^2)^5 \cdot 2x$

$= 3x^{17} - 2x^{11}$

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① $F(-3) = \int_3^{-3} (t-1)\,dt = +6$

$F(-2) = \int_3^{-2} (t-1)\,dt = 2.5$