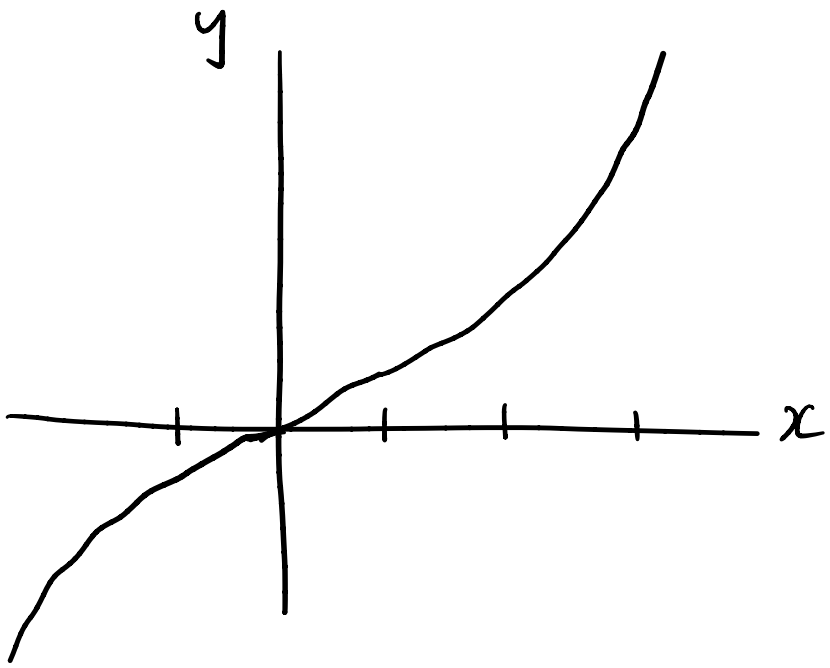
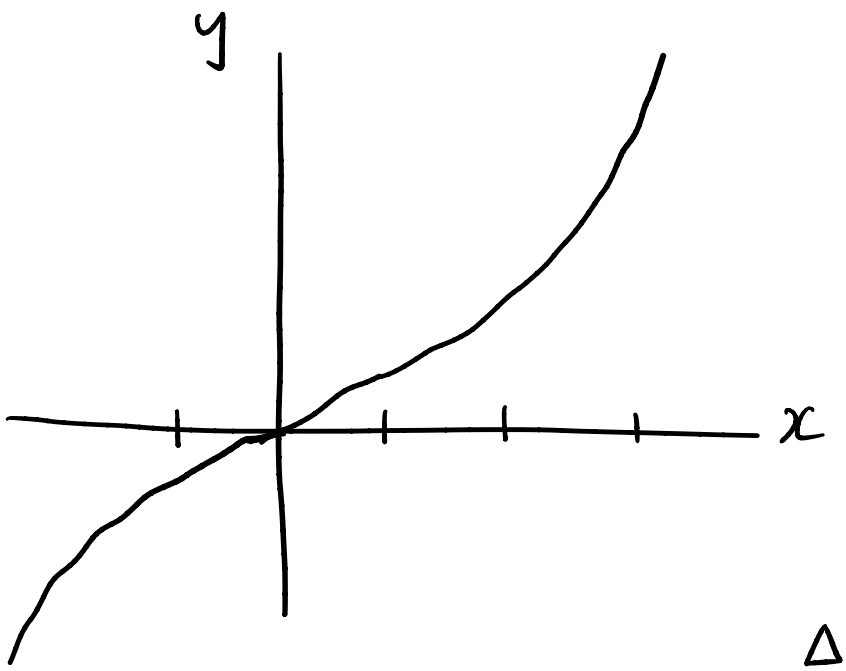
Using four subintervals and left endpoints, approximate $\int_{-1}^{3} x^3 \, dx$.



Using four subintervals and left endpoints, approximate $\int_{-1}^{3} x^3\,dx$. 6/8/25



$$\Delta x = \frac{b-a}{n} = \frac{3-(-1)}{4} = 1$$

$$\int_{-1}^{3} x^3\,dx \approx \sum_{i=1}^{4} f(c_i)\Delta x$$

$$= \Delta x \sum_{i=1}^{4} f(c_i)$$

$$= 1\,(-1+0+1+8)$$

$$= 8$$

left endpoints

$$\Rightarrow c_i = a + i\Delta x - \Delta x$$

$$= -1 + (i-1)\Delta x$$

$$= -2 + i$$

$$f(c_i) = \binom{3}{0}(-2)^3 i^0 + \binom{3}{1}(-2)^2 i^1$$

$$= \binom{3}{2}(-2)^1 i^2 + \binom{3}{3}(-2)^0 i^3$$

$$= -8 + 12i - 6i^2 + i^3$$

$f(c_1) = -1$

$f(c_2) = 0$

$f(c_3) = 1$

$f(c_4) = 8$