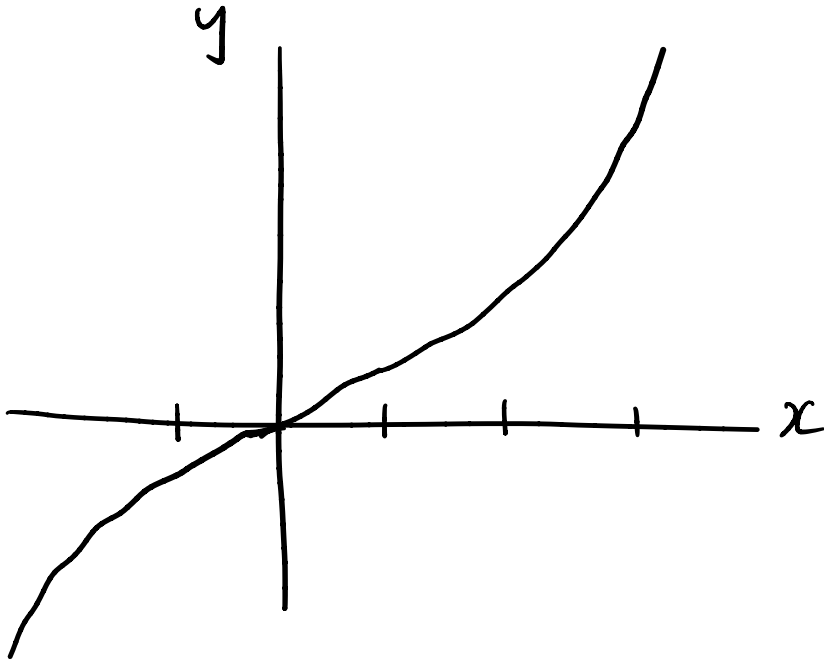
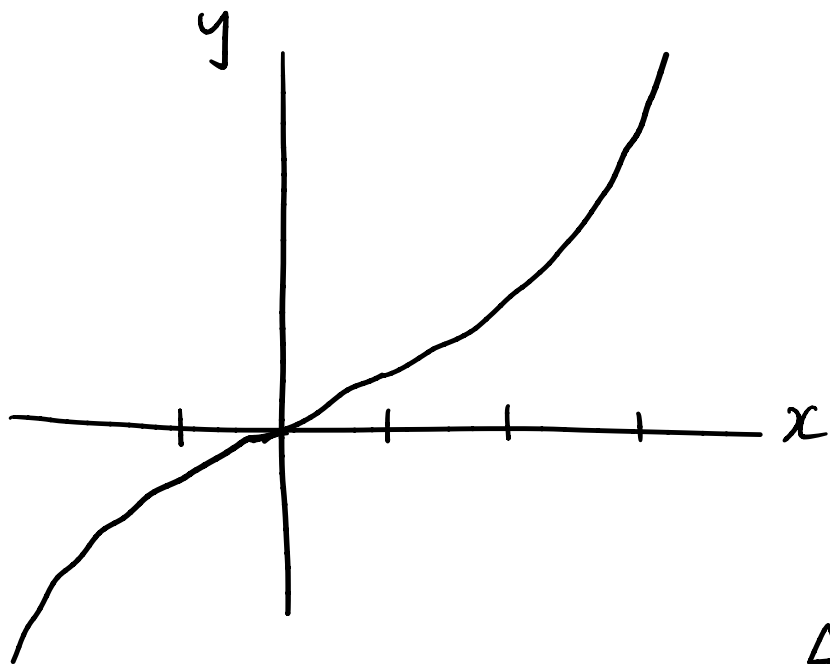


Using four subintervals and left endpoints, approximate $\int_{-1}^3 x^3 dx$.



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



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

$$\begin{aligned}\int_{-1}^3 x^3 dx &\approx \sum_{i=1}^4 f(c_i) \Delta x \\ &= \Delta x \sum_{i=1}^4 f(c_i) \\ &= 1(-1 + 0 + 1 + 8) \\ &= 8\end{aligned}$$

left endpoints

$$\begin{aligned}\Rightarrow c_i &= a + (i-1)\Delta x \\ &= -1 + (i-1)\Delta x \\ &= -2 + i\end{aligned}$$

$$\begin{aligned}f(c_i) &= \binom{3}{0}(-2)^3 i^0 + \binom{3}{1}(-2)^2 i^1 \\ &= \binom{3}{2}(-2)^1 i^2 + \binom{3}{3}(-2)^0 i^3 \\ &= -8 + 12i - 6i^2 + i^3\end{aligned}$$

$$f(c_1) = -1$$

$$f(c_2) = 0$$

$$f(c_3) = 1$$

$$f(c_4) = 8$$