$$\lim_{\|\Delta\| \to 0} \sum_{i=1}^{n} (c_i^2 + 5)\Delta x_i \longrightarrow \int_a^b f(x)\,dx$$

$$= \int_2^3 (x^2+5)\,dx$$

$$\int_a^b f(x)\,dx = \lim_{n\to\infty} \sum_{i=1}^{n} f(c_i) \cdot \Delta x_i$$

any pt in ith interval

c_i: $a + \frac{b-a}{n} i$

Δx_i: width of ith interval

$\left(\frac{b-a}{n}\right.$ for all same w. ith$\left.\right)$

$0 \le t \le 10$, days ; P is population

$P(0) = 1000$; $P(1) = 1100$

$\frac{dP}{dt} = k\sqrt[3]{t}$ growth rate $P(10)$

$$\int dP = \int k\, t^{1/3}\, dt$$

$$P(t) = \frac{3k}{4} t^{4/3} + C$$

$$1000 = \cancel{\frac{3k}{4} \cdot 0^{4/3}} + C$$

$$P(t) = \frac{3k}{4} t^{4/3} + 1000$$

$$1100 = \frac{3k}{4} \cdot 1 + 1000$$

$$100 = \frac{3k}{4} \quad k = \frac{400}{3}$$

$$P(t) = \frac{\cancel{3}}{\cancel{4}} \cdot \frac{\cancel{400}}{\cancel{3}} t^{4/3} + 1000$$

$$P(10) = 100\,(10)^{4/3} + 1000$$

$$= \boxed{47{,}415}$$

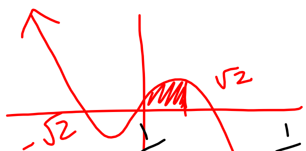
$y = 2x - x^3, \; [0, 1]$

$y = x(2 - x^2)$

$x = 0 \qquad 2 - x^2 = 0$

$2 = x^2$

$\pm\sqrt{2} = x$



$= 0 \quad \leq \frac{1}{n} \quad \leq \frac{1}{n}$

$f\left(a + \frac{b-a}{n} i\right) \cdot \frac{b-a}{n} = \frac{1}{n} f\left(\frac{i}{n}\right)$

$$\int_0^1 (2x - x^3)\,dx = \lim_{n \to \infty} \sum_{i=1}^{n} \frac{1}{n} \cdot \left[2 \cdot \frac{i}{n} - \left(\frac{i}{n}\right)^3\right]$$

$$= x^2 - \frac{1}{4}x^4 \Big|_0^1 \qquad \sum\left(\frac{2i}{n^2} - \frac{i^3}{n^4}\right)$$

$$= \lim_{n \to \infty} \left[\sum \frac{2i}{n^2} - \sum \frac{i^3}{n^4}\right]$$

$$= \lim_{n \to \infty} \left[\frac{2}{n^2} \sum i - \frac{1}{n^4} \sum i^3\right] =$$

$$= \lim_{n \to \infty} \left[\frac{2}{n^2} \cdot \frac{n(n+1)}{2} - \frac{1}{n^4} \cdot \frac{n^2(n+1)^2}{4}\right]$$

$$= \lim_{n \to \infty} \left(\frac{\cancel{2n^2}}{\cancel{2n^2}} - \frac{\cancel{n^4}}{4\cancel{n^4}}\right) = \boxed{\frac{3}{4}}$$

area between x-axis & function on $[a, b]$ $= \int_a^b f(x)\,dx = \lim_{n \to \infty} \sum_{i=1}^{n} f(c_i) \cdot \Delta c_i$

$$= \lim_{n \to \infty} \sum_{i=1}^{n} f\left(\underbrace{a + \frac{b-a}{n} i}\right) \cdot \frac{b-a}{n}$$

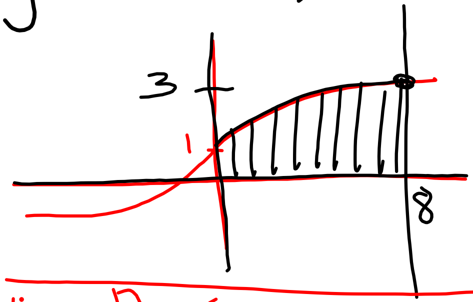
$f(x) = 2x - x^3, \; [0, 1] \qquad f\left(0 + \frac{1}{n} \cdot i\right) \cdot \frac{1}{n}$

$a = 0, \; b = 1 \implies \frac{b-a}{n} = \frac{1-0}{n} = \frac{1}{n}$

Find the area of the region bounded by

$y = 1 + \sqrt[3]{x}$, $x = 0$, $x = 8$, $y = 0$

$x^{m/n} = (\sqrt[n]{x})^m = \sqrt[n]{x^m}$



$$\int_0^8 (1 + x^{1/3})\,dx = x + \frac{3}{4}x^{4/3}\Big|_0^8$$

$$= 8 + \frac{3}{4}(\sqrt[3]{8})^4 - 0$$

$$= 8 + \frac{3}{4}\cdot 2^4 = 8 + 12 = \boxed{20}$$

$$\lim_{n\to\infty} \sum_{i=1}^{n} \left(1 + \sqrt[3]{\frac{8i}{n}}\right)\cdot \frac{8}{n}$$

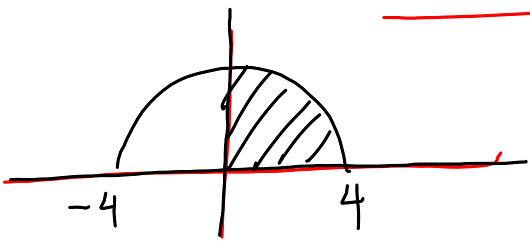
replace x w/ $a + \frac{b-a}{n}\cdot i$

Find the area of the region bounded by x=0, y=0, x=4, and $y = \sqrt{16 - x^2}$

$x^2 + y^2 = r^2$

$y^2 = r^2 - x^2$

$y = \pm\sqrt{r^2 - x^2}$



$$\frac{1}{4}\pi r^2 = \frac{1}{4}\pi(4)^2 = \boxed{4\pi}$$

$$\lim_{n\to\infty} \sum_{i=1}^{n} \left(\frac{2i}{n}\right)\left(\frac{2}{n}\right)$$

$$= \lim_{n\to\infty} \frac{4}{n^2} \sum_{i=1}^{n} i = \lim_{n\to\infty} \frac{4}{n^2} \cdot \frac{n(n+1)}{2}$$

$$= \lim_{n\to\infty} \frac{4n^2}{2n^2} = \boxed{2}$$