$$\int_2^5 6x^2\,dx \qquad \Delta x = \frac{5-2}{n} = \frac{3}{n}$$

$$x_k = 2 + k\Delta x = 2 + k\left(\frac{3}{n}\right) = \frac{2n}{n} + \frac{3k}{n} = \frac{3k+2n}{n}$$

$$f(x_k) = 6x_k^2 = 6\left(\frac{3k+2n}{n}\right)^2 = 6\left[\frac{(3k)^2 + 2(3k)(2n) + (2n)^2}{n^2}\right]$$

$$= \frac{6}{n^2}\left[9k^2 + 12kn + 4n^2\right]$$

$$\Rightarrow \sum_{k=1}^{n} f(x_k)\Delta x = \Delta x \sum f(x_k) = \frac{3}{n}\sum \frac{6}{n^2}\left[9k^2 + 12kn + 4n^2\right]$$

$$= \frac{18}{n^3}\left[9\sum_{k=1}^{n} k^2 + 12n\sum_{k=1}^{n} k + 4n^2\sum_{k=1}^{n} 1\right]$$

$$= \frac{18}{n^3}\left[9\left(\frac{n^3+\cdots}{3}\right) + 12n\left(\frac{n^2+\cdots}{2}\right) + 4n^2(n)\right]$$

$$= \frac{18}{n^3}\left[(3n^3+\cdots) + (6n^3+\cdots) + 4n^3\right]$$

$$\frac{18(3)(n^3+\cdots)}{n^3} + \frac{18}{n^3}(6n^3+\cdots) + \frac{18}{n^3}(4n^3)$$

$$\xrightarrow{n\to\infty} 54 + 108 + 72 = 162 + 72 = 234$$

$$\int_2^5 6x^2\,dx = \frac{6}{3}x^3\Big]_2^5 = 2x^3\Big]_2^5 = 2\left[125 - 8\right]$$

$$= 2[117] = 234\ !$$

$$\sum_{k=1}^{n} k^5 = \frac{n^6+\cdots}{6}$$

$$\lim_{x\to 4} \frac{x^2-5x+4}{|x-4|} = \lim_{x\to 4} f(x) \qquad \frac{x^2-5x+4}{x-4} = \frac{(x-1)(x-4)}{x-4}$$

$$f(x) = \begin{cases} \dfrac{x^2-5x+4}{x-4} & \text{if } x > 4 \\ \dfrac{x^2-5x+4}{-(x-4)} & \text{if } x < 4 \end{cases} = \begin{cases} x-1 & \text{if } x > 4 \\ -(x-1) & \text{if } x < 4 \end{cases}$$

$$\begin{cases} \xrightarrow{x\to 4^+} 3 \\ \xrightarrow{x\to 4^-} -3 \end{cases}$$

So, $\lim_{x\to 4} f(x) \nexists$ b/c

$$\lim_{x\to 4^-} f(x) = -3 \neq 3 = \lim_{x\to 4^+} f(x)$$

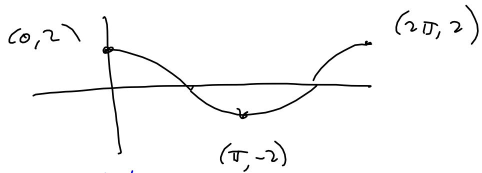
$$|x-4| = \begin{cases} x-4 & \text{if } \overset{x \geq 4}{x-4 \geq 0} \\ -(x-4) & \text{if } x-4 < 0 \end{cases}$$

Define continuity of $f(x)$ @ $x=a$.

$f(x)$ is cnt^s at $x=a$ means.

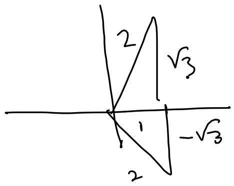
$$\lim_{x\to a} f(x) = f(a)$$

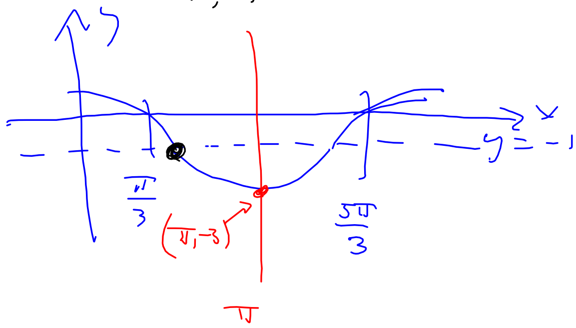
$$\int_0^{\pi} |2\cos x - 1|\, dx$$



$$2\cos x - 1 = 0$$

$$\cos x = \frac{1}{2}$$





$$= \int_0^{\frac{\pi}{3}} (2\cos x - 1)\,dx - \int_{\frac{\pi}{3}}^{\pi} (2\cos x - 1)\,dx$$

on $[0, 2\pi]$,

$$|2\cos x - 1| = \begin{cases} 2\cos x - 1 & \text{if } \cos x - 1 \geq 0 \\ -2\cos x + 1 & \text{if } \cos x - 1 < 0 \end{cases}$$

$$= \begin{cases} 2\cos x - 1 & \text{if } 0 \leq x \leq \frac{\pi}{3} \text{ OR } \frac{5\pi}{3} \leq x \leq 2\pi \\ -2\cos x + 1 & \text{if } \frac{\pi}{3} < x < \frac{5\pi}{3} \end{cases}$$

$$= \left[2\sin x - x\right]_0^{\frac{\pi}{3}} - \left[2\sin x - x\right]_{\frac{\pi}{3}}^{\pi}$$

$$= \boxed{\left(2\sin\frac{\pi}{3} - \frac{\pi}{3}\right)} - \left(2\sin(0) - 0\right) - \left[\left(2\sin\pi - \pi\right) - \boxed{\left(2\sin\frac{\pi}{3} - \frac{\pi}{3}\right)}\right]$$

$$= 2\left[2\frac{\sqrt{3}}{2} - \frac{\pi}{3}\right] + \pi \quad = 2\sqrt{3} - \frac{2\pi}{3} + \frac{3\pi}{3} = 2\sqrt{3} + \frac{\pi}{3}$$

$$\int_0^{\pi} = \int_0^{\frac{\pi}{3}} + \int_{\frac{\pi}{3}}^{\pi}$$

$$\int_0^{\pi} |f| = \int_0^{\frac{\pi}{3}} f + \int_{\frac{\pi}{3}}^{\pi} -f = \int_0^{\frac{\pi}{3}} f - \int_{\frac{\pi}{3}}^{\pi} f$$

$$|f| = |\,2\cos x - 1\,|$$

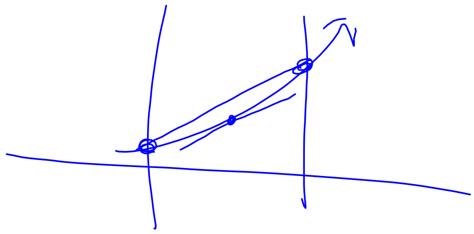
Mean Value Theorem requires:

f is cnt^s on $[a,b]$

f is difb^{le} on (a,b)

$\Longrightarrow \exists\, c \in (a,b) \ni f'(c) = \dfrac{f(b)-f(a)}{b-a}$

Deriv = Avg Slop

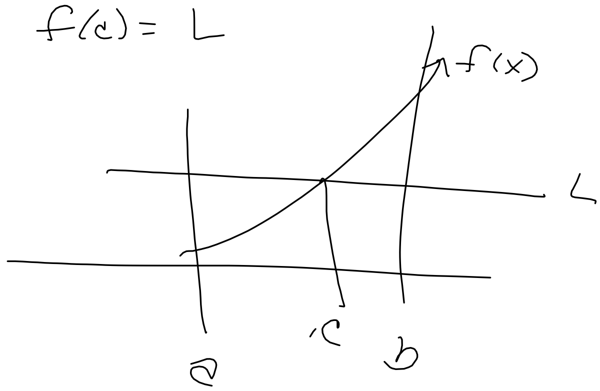


what's the maximum of $\dfrac{x}{x-2}$ on $[0,5]$?

IVT f cnt^s on $[a,b]$ & $f(a) < f(b)$

Let $L \ni f(a) < L < f(b) \Longrightarrow$

$\exists\, c \in (a,b) \ni f(c) = L$



EVT

FTC I & II