November 10, 2025

Marine Corps Day

Today in History:

Sesame Street debuts (1969)

Edmund Fitzgerald sinks in Lake Superior (1975)

Number of the Day: 5356

5356 = 2 x 2 x 13 x 103

5356 is the 103rd triangular number.

Fun Fact:

Law in Helena Montana states women can’t dance on a table unless she has on 3 pounds, 2 oz. of clothing.

Quote of the Day:

“If everyone is thinking alike, then somebody isn't thinking.”

-George S. Patton

Today’s Weather:

Windy with snow showers, high of 36^{o}.

Math 121 - Quiz #37

Find

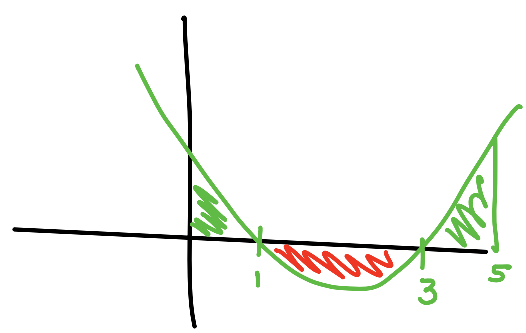
$$\int_1^3 \frac{x^2+1}{x^2}\,dx = \int_1^3 \left(\frac{x^2}{x^2} + \frac{1}{x^2}\right) dx$$

$$= \int_1^3 \left(1 + \frac{1}{x^2}\right) dx = x - \frac{1}{x}\Big|_1^3$$

$$\left(3 - \frac{1}{3}\right) - (1 - 1) = \frac{8}{3}$$

$$\int_0^5 |x^2 - 4x + 3|\,dx$$

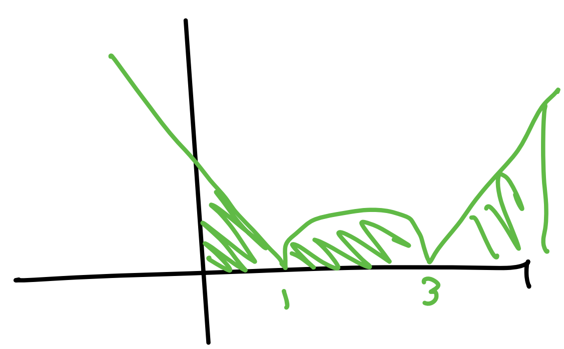
$$y = x^2 - 4x + 3$$



$$\int_0^1 |x^2 - 4x + 3|\,dx$$

$$+ \int_1^3 |x^2 - 4x + 3|\,dx$$

$$+ \int_3^5 |x^2 - 4x + 3|\,dx$$



$$\int_0^1 (x^2 - 4x + 3)\,dx + \left| \int_1^3 x^2 - 4x + 3 \;\; dx \right|$$

$$+ \int_3^5 (x^2 - 4x + 3)\,dx$$

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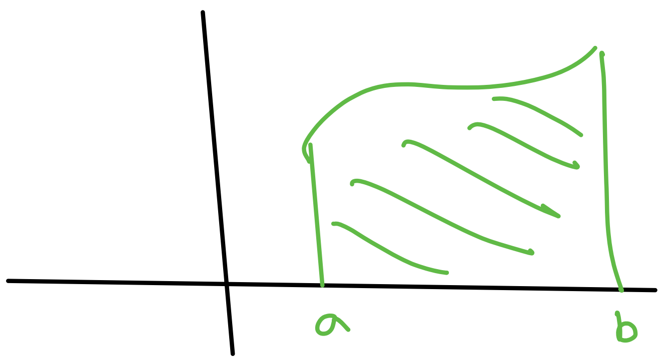
5. $$\int_3^5 \frac{6}{x^3}\,dx = \int_3^5 6x^{-3}\,dx$$

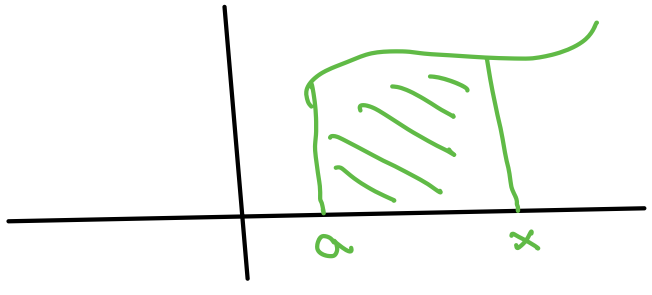
$$= 6\,\frac{x^{-2}}{-2} = -3x^{-2}\Big|_3^5$$

$$= \frac{-3}{x^2}\Big|_3^5 = \frac{-3}{25} + \frac{3}{9}$$

F.T.C. II



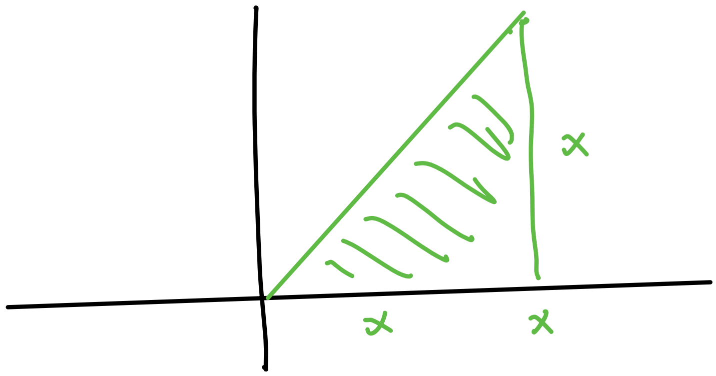
$$A = \int_a^b f(x)\,dx$$



$$A(x) = \int_a^x f(t)\;dt$$

EXAMPLE $f(x) = x$ $a = 0$

$$A(x) = \int_0^x t\,dt = \frac{t^2}{2}\Big|_0^x = \frac{x^2}{2}$$



$$A(1) = \int_0^1 t\,dt = \frac{t^2}{2}\Big|_0^1 = \frac{1}{2}$$

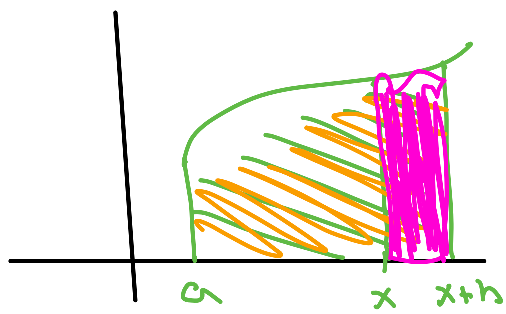
$$A(-1) = \int_{-1}^0 t\,dt = \frac{t^2}{2}\Big|_{-1}^0 = -\frac{1}{2}$$

$$A(0) = \int_0^0 t\,dt = \frac{t^2}{2}\Big|_0^0 = 0$$

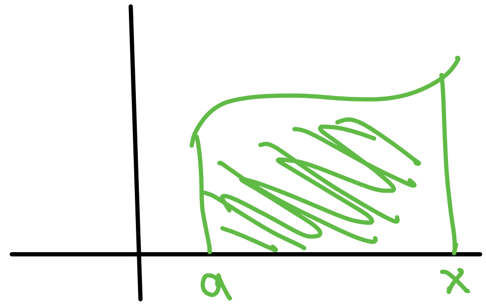
$$A(x) = \int_a^x f(t)\,dt$$

$$\frac{dA}{dx} = \lim_{h \to 0} \frac{(A(x+h) - A(x))}{h}$$

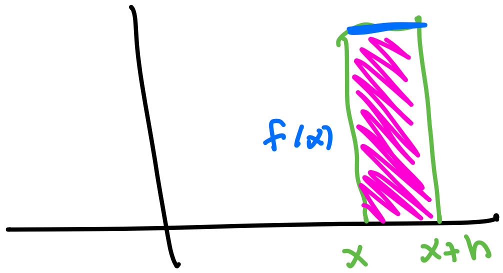
$$A(x+h) = \int_a^{x+h} f(t)\,dt =$$



$$A(x) = \int_a^x f(t)\,dt =$$



$$A(x+h) - A(x) =$$



$$= b \cdot h$$

$$b = x+h-x = h$$

$$h = f(x)$$

$$A(x+h) - A(x) = h\,f(x)$$

$$\frac{dA}{dx} = \lim_{h \to 0} \frac{A(x+h) - A(x)}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{h}\,f(x)}{\cancel{h}} = f(x)$$

F.T.C. II

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

EXAMPLES

① $A(x) = \int_1^x \sqrt{t^3+1}\, dt$.

$A'(x) = \sqrt{x^3+1}$

② $A(x) = \int_3^x \frac{t^3}{t^3+4t+5}\, dt$

$A'(x) = \frac{x^3}{x^3+4x+5}$

③ $\frac{d}{dx} \int_{-1}^x \frac{e^t}{\sin t + \cos t}\, dt = \frac{e^x}{\sin x + \cos x}$

④ $\frac{d}{dx} \int_x^1 \frac{e^t}{\sin t + \cos t}\, dt = - \frac{e^x}{\sin x + \cos x}$

$\int_x^1 \frac{e^t}{\sin t + \cos t}\, dx = - \int_1^x \frac{e^t}{\sin t + \cos t}\, dt$

⑤ $\frac{d}{dx}\left[\int_1^{e^x} \sin t\, dt \right]$

$= \frac{d}{dx}\left[-\cos t \Big|_1^{e^x} \right] = \frac{d}{dx}\left[-\cos e^x + \cos 1 \right]$

$= e^x \sin(e^x)$

$$\frac{d}{dx}\left[\int_1^{e^x} \sin t \, dt\right] = \underset{\substack{\uparrow \\ \text{CHAIN RULE}}}{e^x} \cdot \sin(e^x)$$

⑥
$$\frac{d}{dx}\left[\int_3^{\ln x} \frac{t^2}{t^3+1} \, dt\right] = \frac{(\ln x)^2}{(\ln x)^3+1} \cdot \frac{1}{x}$$

⑦
$$\frac{d}{dx}\left[\int_{\underline{x^3}}^{1} \tan(t^2) \, dt\right] = \underset{\substack{\uparrow \\ \text{BOTTOM}}}{-}\tan\left((x^3)^2\right) \cdot \underset{\substack{\uparrow \\ \text{CHAIN RULE}}}{3x^2}$$

⑧
$$\frac{d}{dx}\left[\int_{\sin x}^{\cos x} \frac{t^2+5}{e^t} \, dt\right]$$

$$= \frac{\cos^2 x + 5}{e^{\cos x}}(-\sin x) - \frac{\sin^2 x + 5}{e^{\sin x}} \cdot (\cos x)$$

⑨
$$\frac{d}{dx}\left[\int_5^{10} \frac{t^3+e^t}{\ln t - \sec t} \, dt\right] = 0$$