

Antidifferentiation

↔ Integration

Antideriv.

Rect. mot.
Subst.

—

Summations Σ

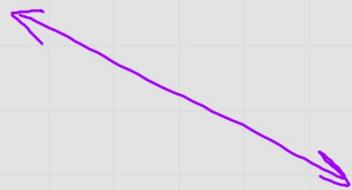
Approx areas

$\lim \Sigma$ — ext. area

Def. Int

FTC

Apps of Def Int.



$$f'(x) = x^2$$

$$f(x) = \frac{1}{3}x^3 + C$$

$$\int x^2 dx = \frac{1}{3}x^3 + C$$

$$\frac{dy}{dx} = x^2$$

$$\int dy = \int x^2 dx$$

$$y = \frac{1}{3}x^3 + C$$

$$\begin{aligned}\int \sqrt{x(x+3)} dx &= \int x^{1/2}(x+3) dx \\ &= \int \left[x^{3/2} + 3x^{1/2} \right] dx \\ &= \frac{2}{5} x^{5/2} + 3 \cdot \frac{2}{3} x^{3/2} + C \\ &= \frac{2}{5} \sqrt{x^5} + 2\sqrt{x^3} + C.\end{aligned}$$

$$\int x^{-1} dx = \frac{x^0}{0} \quad \text{nope.}$$

$$\int \frac{1}{x} dx = \ln|x| + C$$

Power Rule for Antideriv.

$$\int u^n du = \begin{cases} \frac{u^{n+1}}{n+1} & n \neq -1 \\ \ln|u| & n = -1 \end{cases}$$

$$\begin{aligned}\int \frac{x^2 + 3x}{\sqrt{x}} dx &= \int x^{-1/2} (x^2 + 3x) dx \\ &= \int [x^{3/2} + 3x^{1/2}] dx \\ &= \frac{2}{5} x^{5/2} + 3 \cdot \frac{2}{3} x^{3/2} + C \\ &= \frac{2}{5} \sqrt{x^5} + 2\sqrt{x^3} + C.\end{aligned}$$

$$\int e^x dx = e^x + C$$

$$\int \sin x dx = -\cos x + C$$

$$\int \cos x dx = \sin x + C$$

$$\int \sec x \tan x dx = \sec x + C$$

$$\int \sec^2 x dx = \tan x + C$$

$$\int \csc x \cot x dx = -\csc x + C$$

$$\int \csc^2 x dx = -\cot x + C$$

" + C " general soln.

Given $f'(x) = 12x^2 - 24x + 1$ and $f(1) = -2$, find $f(x)$.

$$f(x) = 4x^3 - 12x^2 + x + C$$

$$-2 = 4(1)^3 - 12(1)^2 + 1 + C$$

$$-2 = 4 - 12 + 1 + C$$

$$5 = C$$

$$\therefore f(x) = 4x^3 - 12x^2 + x + 5$$

↙ particular soln.

$$f''(x) = 3x + 2 \quad \text{find } f(x). \quad [\text{if } f'(1) = 3 \text{ \& } f(1) = 2]$$

$$f'(x) = \frac{3}{2}x^2 + 2x + C \quad \checkmark$$

$$f(x) = \frac{3}{2} \cdot \frac{1}{3}x^3 + 2 \cdot \frac{1}{2}x^2 + Cx + D$$

$$f(x) = \frac{1}{2}x^3 + x^2 + Cx + D.$$

At any pt (x, y) on a curve the slope of a tangent is given by $4x - 5$. If curve pass thru $(3, 7)$, find an eq. for the curve.

$$f'(x) = 4x - 5$$

$$f(x) = 2x^2 - 5x + C$$

$$7 = 2(3)^2 - 15 + C$$

$$7 = 18 - 15 + C$$

$$4 = C$$

$$\therefore f(x) = 2x^2 - 5x + 4$$

$$\frac{dy}{dx} = 4x - 5$$

$$\int dy = \int (4x - 5) dx$$

$$y = 4x - 5 + C$$

