Antidifferentiation

Integration

Antiderivatives

Differential Eq.
Slope fields

Definite Integral ←

FTC → area
vol.
accumulations

Power Rule for Deriv $\longrightarrow$ x^{10}

$10x^9$

$f'(x) = x^3$

$f(x) = \dfrac{x^4}{4} + C$

$\int x^3\,dx = \frac{1}{4}x^4 + C$

$$\int (\sqrt{x} + x^5)\,dx = \int (x^{1/2} + x^5)\,dx$$

$$= \frac{2}{3}x^{3/2} + \frac{1}{6}x^6 + C$$

$$= \frac{2}{3}\sqrt{x^3} + \frac{1}{6}x^6 + C.$$

$$\int \frac{x^2+5x}{\sqrt{x}}\,dx = \int x^{-1/2}\left(x^2+5x\right)dx$$

$$= \int \left[x^{3/2} + 5x^{1/2} \right] dx$$

$$= \frac{2}{5}x^{5/2} + 5\cdot\frac{2}{3}x^{3/2} + C$$

$$= \frac{2}{5}\sqrt{x^5} + \frac{10}{3}\sqrt{x^3} + C.$$

$$\int x^{-1}\,dx = \frac{x^0}{0}$$

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

<u>Power Rule for Antideriv</u>

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

$$\int \left(t - \frac{1}{t}\right) dt = \frac{1}{2}t^2 - \ln|t| + C.$$

$$\int \left(e^x + 6\right) dx = e^x + 6x + C.$$

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

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

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

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

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

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

All "general" solns so far.

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

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

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

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

$$-2 = -7 + C$$

$$5 = C$$

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

$f'(1) = 2$
$f(1) = 3$

$f''(x) = 3x - 2$ find f.

$f'(x) = \frac{3}{2}x^2 - 2x + C$ ✓

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

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

At any pt (x,y) on a curve, the slope of a tangent is given by $\underline{4x-5}$. If curve passes thru $(\underline{3,7})$, find the eq. of the curve.

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

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

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

$$7 = 18 - 15 + C$$

$$4 = C$$

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