$h(x) = \int_a^x f(t)\,dt = F(x) - F(a)$

$F(x) + C$

$\boxed{\int f(x)\,dx = F(x) + C}$

$g(x) = \int_b^x f(t)\,dt = F(x) - F(b)$

$F(x) + C$

$k(x) = \int_c^x f(t)\,dt = F(x) - F(c)$

$F(x) + C$

Let $F(x)$ be an antiderivative of $f(x)$

FTC

Part 2 Then $\int_a^b f(x)\,dx = F(b) - F(a)$

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

Part 1

$$\frac{d}{dx}\left[F(x) - F(a)\right] = f(x) + 0 = f(x)$$

$F'(x) = f(x)$

$F(x)$	$f(x)$
$\sin x$	$\cos x$
$\cos x$	$-\sin x$
$\tan x$	$\sec^2 x$
$\sec x$	$\sec x \tan x$
$\cot x$	$-\csc^2 x$
$\csc x$	$-\csc x \cot x$
$\ln x$	$\frac{1}{x}$
$\log_a x$	$\frac{1}{x \ln a}$ $\left(\frac{1}{x} \cdot \frac{1}{\ln a}\right)$
e^x	e^x

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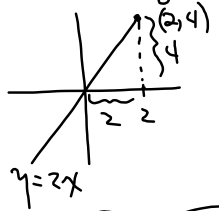
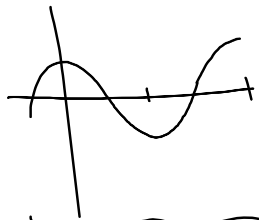
$$\int_0^2 2x\,dx = x^2\Big|_0^2$$



$$= 2^2 - 0^2$$
$$= 4$$

$$\int_0^1 x^2\,dx = \frac{x^3}{3}\Big|_0^1$$
$$= \frac{1}{3} - 0$$
$$= \frac{1}{3}$$

$$\int_\pi^{2\pi} \cos x\,dx = \sin x\Big|_\pi^{2\pi}$$
$$= 0 - 0$$
$$= 0$$



$$\int_0^1 e^x\,dx = e^x + c\Big|_0^1$$
$$= e^1 + c - (e^0 + c)$$
$$= e^1 - 1$$
$$= e - 1$$

$$\int e^x\,dx = e^x + c$$

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

$$\frac{d}{dx}\int_{-5}^x \cos t\,dt = \cos x$$

$$\frac{d}{dx}\int_{-\frac{\pi}{e}}^x \cos\left(\sqrt{e^t+2}\right)dt = \cos\left(\sqrt{e^x+2}\right)$$

$$\frac{dy}{dx} = \frac{dy}{du}\cdot\frac{du}{dx}$$

$$\frac{dy}{dx}\quad \boxed{\frac{d}{dx}\int_0^{2x} t^2+3\,dt}$$

$$y = \int_0^{2x} t^2+3\,dt$$

$$u = 2x \qquad y = \int_0^u t^2+3\,dt$$

$$\frac{du}{dx} = 2 \qquad \frac{dy}{du} = \frac{d}{du}\left(\int_0^u t^2+3\,dt\right)$$

$$\frac{dy}{dx} = (u^2+3)\cdot 2$$

$$= ((2x)^2+3)2$$

$$= 8x^2+6$$

$$\frac{d}{dx}\int_0^{x^2} \cos t\,dt \qquad \text{Let } u = x^2$$

$$\frac{du}{dx} = 2x$$

$$\frac{d}{du}\left(\int_0^u \cos t\,dt\right)\cdot\frac{du}{dx}$$

$$\cos u \cdot 2x$$

$$2x\cos x^2$$