1) u-substitution

2) PVAJ

3) Average value

4) 1st and 2nd FTC

5) U-substitution (change of variable)

6) Derivative rules/anti-derivative rules (Product rule)

$y = x\ln x$

$$\int_1^4 x\sqrt{x^2+1}\,dx$$

$$\frac{1}{2}\int_2^{17} u^{1/2}\,du$$

$u = x^2+1$

$u(1) = 2$

$u(4) = 17$

$$\int_{x=0}^{x=4} \frac{1}{\sqrt{2x+1}}\,dX$$

change back to x | leave the u

$$\frac{1}{2}\int u^{-1/2}\,du$$

$$\frac{1}{2}\cdot\frac{u^{1/2}}{1/2} = \sqrt{2x+1}\,\Big]_0^4$$

$$\sqrt{9}-\sqrt{1}$$

$$2$$

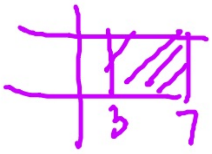
$$\frac{1}{2}\int_1^9 u^{-1/2}\,du = \frac{1}{2}\cdot\frac{u^{1/2}}{1/2}$$

$$u^{1/2}\Big]_1^9$$

$$\sqrt{9}-\sqrt{1}$$

$$2$$

$$\int_3^7 f(x)\,dx = 6$$



$$\int_3^7 (f(x)+2)\,dx = \int_3^7 f(x)\,dx + \int_3^7 2\,dx \to \Big[2x\Big]_3^7$$

$$= 6 + 8$$

$$\int \left(e^{4x} - \frac{1}{3x+1}\right) dx$$

$$\int e^{4x} dx - \int \frac{1}{3x+1} dx$$

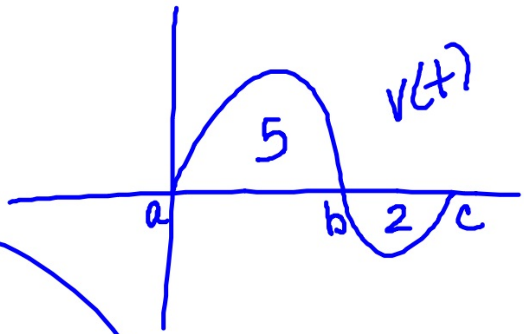
$$\frac{1}{4} e^{4x} - \frac{1}{3} \ln|3x+1| + C$$

$$\int \tan x \, dx = -\ln|\cos x| + C$$

$$\int \cot x \, dx = \ln|\sin x| + C$$

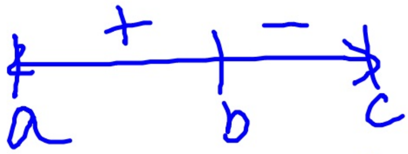
$$\int \sec x \, dx = \ln|\sec x + \tan x| + C$$

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



total distance $[a, c]$

$$\int_a^c |v(t)|\,dt$$



$$\int_a^b v(t)\,dt - \int_b^c v(t)\,dt$$

$$+ \int_c^b v(t)\,dt$$

14.) $\int_0^1 x^3 e^{x^4}\,dx = \frac{1}{4}\int e^u\,du$

$u = x^4$
$du = 4x^3\,dx$

$= \frac{1}{4}e^u = \frac{1}{4}e^{x^4}\Big]_0^1$

$= \frac{1}{4}e^1 - \frac{1}{4}\cdot 1$

$\frac{e-1}{4}$

2.) $y = x^2 + e^{-2x}$ $\quad x = 0$

$y' = 2x - 2e^{-2x}$

$y'(0) = 0 - 2e^0$

$= -2$

15.) $f(x) = x^2 e^x$ $\quad$ f is decreasing?

$f'(x) = x^2 \cdot e^x + e^x \cdot 2x$

$0 = xe^x(x+2)$

11.) $f(x) = 10^{x^2-1}$ $\qquad \frac{d}{dx}[a^u]$

$f'(x) = \ln 10 \cdot 10^{x^2-1} \cdot 2x \qquad \ln a \cdot a^u \cdot u'$

25.) $\int_{\pi/4}^{\pi/2} \frac{\cos x}{\sin x}\,dx = \int_{\pi/4}^{\pi/2} \cot x\,dx = \ln|\sin x| \Big]_{\pi/4}^{\pi/2}$

$\int \frac{1}{u}\,du$ $\qquad = 0 - \ln\frac{\sqrt{2}}{2}$

$\ln\left(\frac{\sqrt{2}}{2}\right)^{-1} = \ln\frac{2}{\sqrt{2}}$

$\ln\sqrt{2}$

$$W(x) = \int_{1}^{g(x)} f(t)\,dt$$

$$W'(x) = f(g(x)) \cdot g'(x)$$

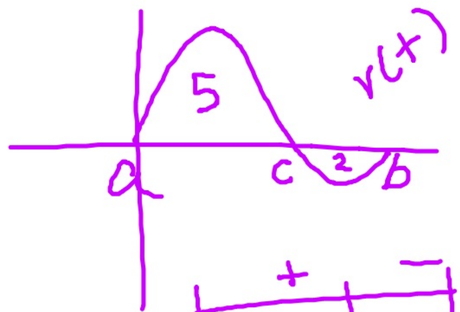
$$W'(3) = f(g(3)) \cdot g'(3)$$

$$\int \tan x \, dx = -\ln|\cos x| + C$$

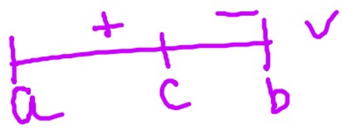
$$\int \sec x \, dx = \ln|\sec x + \tan x| + C$$

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

$$\int_a^b |v(t)| \, dt$$



$$\int_a^c v(t) \, dt - \int_c^b v(t) \, dt$$



4b. $\frac{d}{dt}\left(y = 2e^{\cos x}\right)$

$\frac{dy}{dt} = 5$

$\frac{dx}{dt} = ?$

when $x = \frac{\pi}{2}$

$$\frac{dy}{dt} = 2 \cdot e^{\cos x}(-\sin x)\frac{dx}{dt}$$

$$5 = 2e^{0}\left(-\sin\frac{\pi}{2}\right)\frac{dx}{dt}$$

$$\frac{d}{dx}\left[\ln\left(\frac{1}{1-x}\right)\right]$$

$$\frac{d}{dx}\left[\cancel{\ln 1}^{\,0} - \ln(1-x)\right]$$

$$- \cdot \frac{-1}{1-x}$$

$$\frac{1}{1-x} = \frac{-1}{x-1}$$

26.) $$\int_1^e \frac{x^2-1}{x}\,dx = \int_1^e \left(x - \frac{1}{x}\right)dx$$

$$= \frac{1}{2}x^2 - \ln|x| \Big]_1^e$$

$$\int_a^b f'(x)\,dx = f(x)\Big]_a^b$$

$$= f(b) - f(a)$$

7.) $\int \frac{1}{2} e^{t/2} dt = \int e^u du$

$u = \frac{t}{2} = \frac{1}{2}t \quad = e^u + C$

$du = \frac{1}{2} dt$

$= e^{t/2} + C$

$\int \sin 4x \, dx = \frac{1}{4} \int \sin u \, du$

$u = 4x$

$du = 4dx$

$= -\frac{1}{4} \cos 4x + C$

4.) $\int \tan x \, dx$

$-\ln|\cos x| + C$

$\ln|\cos x|^{-1} + C$

$\ln|\sec x| + C$