Definition of Antiderivative: A function F is called an antiderivative of the function f if for every x in the domain of f

$F'(x) = f(x)$ so, $dy = f(x)\,dx$

Integration is denoted by an integral sign $\int$.

$$y = \int f(x)dx = F(x) + C$$

Constant of Integration

Integrand

Variable of Integration

$F'(x)$ also $= f(x)$ (first derivative)

Basic Integration Formulas

$$\int 0\,dx = C$$

$$\int k\,dx = kx + C$$

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

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

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

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

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

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

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

Integrate

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

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

$$\int \sqrt{x}\,dx = \int x^{1/2}dx = \frac{x^{3/2}}{3/2} + C \quad = \frac{2x^{3/2}}{3} + C$$

$$\int 2\sin x\,dx = 2\int \sin x\,dx = 2(-\cos x) + C = -2\cos x + C$$

$$\int 1\,dx = x + C$$

$$\int (x+2)dx \quad = \frac{x^2}{2} + 2x + C$$

$$\int \left(3x^4 - 5x^2 + x\right)dx = \frac{3x^5}{5} - \frac{5x^3}{3} + \frac{x^2}{2} + C$$

Find the general solution of the equation F'(x) = $\frac{1}{x^2}$ and find the particular solution given the point F(1) = 0.

$$F(x) = \int \frac{1}{x^2} dx = \int x^{-2} dx$$

$$= \frac{x^{-1}}{-1} + C = -\frac{1}{x} + C$$

$$\therefore y = -\frac{1}{x} + C$$

Now plug in (1,0) and solve for C.

0 = -1 + C

C = 1

Final answer.

$$\boxed{y = -\frac{1}{x} + 1}$$

$$\int 12e^{4x}\,dx = 12\frac{e^{4x}}{4} + C$$

$$= 3e^{4x} + C$$

$$
\begin{aligned}
z &= \int \left(6x^2 + \frac{3}{x} \right) dx \\
&= \int 6x^2 dx + \int \frac{3}{x} dx \\
&= \frac{6x^3}{3} + 3\ln x + C \\
&= 2x^3 + 3\ln x + C
\end{aligned}
$$

$$
\begin{aligned}
I &= \int_0^1 8xe^{-2x}dx \\
&= 8\frac{e^{-2x}}{(2)^2}\left[-2x-1\right]_0^1 \\
&= 2e^{-2}\left[-2(1)-1\right]-2e^{-0}\left[0-1\right] \\
&= -6e^{-2}+2 = 1.188
\end{aligned}
$$