Thus, this theorem enables us to compute the area under a curve!

$\boxed{\text{e.g.}}$ Find the area under $f(x) = x^2+1$ over $[0,1]$

Soln: Need to find $\int_0^1 f(x)\,dx$

$$\int f(x)\,dx = \int (x^2+1)\,dx = \int x^2\,dx + \int dx = \frac{x^3}{3} + x + C.$$

$$\int_0^1 f(x)\,dx = \left(\frac{x^3}{3} + x + C\right)\Bigg|_0^1 = \left(\frac{1}{3}+1\right) - (0+0) = \frac{4}{3}. \quad \square$$

(Note that C cancels out anyway, so we can remove it)

e.g. Calculate $\int_0^2 e^{3x}\,dx$

Soln. $\int e^{3x}\,dx = \dfrac{e^{3x}}{3} + C$ (using substitution

Thus, $\int_0^2 e^{3x}\,dx = \dfrac{e^{3x}}{3}\Bigg|_0^2$ ~~(Note that C anyway cancels out~~

$= \frac{1}{3}(e^6 - 1). \quad \square$