The integral a.k.a. antiderivative is the inverse of the derivative.

$\therefore$ The integral reverses the process of the derivative.

Example $\frac{d}{dx}\, x^3+5 = 3x^2$

Then: $\int 3x^2\,dx = x^3 + C$

FYI more specifically called an "indefinite integral"

We don't know exactly what the constant is, so the value of the constant is unknow $\therefore$ C

C is required in your answer.

because these derivatives have the same answer

$$\frac{d}{dx}\, x^3 = 3x^2$$

$$\frac{d}{dx}\, x^3 - 7 = 3x^2$$

$$\frac{d}{dx}\, x^3 + \frac{9}{2} = 3x^2$$

When you take an indefinite integral must have +c as part of the answer.

Formula:

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

Definite Integral:

Integral process to find area under a curve

for $a \le x \le b$:

$$\int_a^b f(x)\,dx = F(x)\Big|_a^b = F(b) - F(a)$$

14.5 Homework:

#7 find area:

$f(x) = x + x^2 \quad 0 \le x \le 1$ $\boxed{A = \frac{5}{6}}$

Using integrals:

$$\int_0^1 (x + x^2)\,dx$$

$$= \frac{1}{2}x^2 + \frac{1}{3}x^3 \Big|_0^1$$

$$= \frac{1}{2}(1^2) + \frac{1}{3}(1^3) - \cancel{\left(\frac{1}{2}(0) + \frac{1}{3}(0)\right)}^{\,0}$$

$$= \frac{1}{2} + \frac{1}{3}$$

$$\frac{3}{6} + \frac{2}{6} = \boxed{\frac{5}{6}}$$

14.5 Homework $f(x) = 20 - 2x^2$

$2 \le x \le 3$

#8 $\int_2^3 20 - 2x^2 \, dx$

$\boxed{\text{Area} = \frac{22}{3}}$

$= 20x - \frac{2}{3}x^3 \Big|_2^3$

$= 60 - 18 - \left(40 - \frac{16}{3}\right)$

$= 42 - \left(\frac{120 - 16}{3}\right)$

$= \frac{126}{3} - \frac{104}{3}$

$= \boxed{\frac{22}{3}}$