

# Integrations

التكامل هو عملية العكس لعملية الاشتقاق

Integration is the process of finding the function whose derivative is known.

i.e.: It is the reverse process of finding the derivative.

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There are two types of integration:-

Type one :- definite integration

It is calculated as follows:-

$$\int_a^b f(x) dx$$

Type two :- Indefinite integration

It is calculated as follows:-

$$\int f(x) dx$$

The basic formula for integration is:-

Add one to the exponent and divide by the new exponent, As shown in the following:-

$$\int u^m du = \frac{u^{m+1}}{m+1} + C$$

The properties of integration are:-

1. If  $f(x) = k$ , when  $k$  is constant, then

$$\int f(x) dx = k \int dx = kx + C$$

2. If  $f(x)$  and  $g(x)$  any functions, then:

$$\int (f(x) \mp g(x)) dx = \int f(x) dx \mp \int g(x) dx$$

$$3. \int k f(x) dx = k \int f(x) dx$$

Ex

$$1. \int x dx = \frac{x^2}{2} + C$$

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

$$3. \int (x^3 + 4x) dx = \int x^3 dx + \int 4x dx$$

$$= \frac{x^4}{4} + \frac{4x^2}{2} + C$$

$$4. \int_0^1 (3x^2 + 2) dx = \int_0^1 3x^2 dx + \int_0^1 2 dx$$

$$= \frac{3x^3}{3} \Big|_0^1 + 2x \Big|_0^1 = (1-0) + (2-0)$$

$$= 1 + 2 = 3$$

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

$$= x - \ln|1+e^x| + C$$

$$9. \int 7 \cos x dx = 7 \sin x + C$$

$$10. \int (5x^4 + 2x) dx = \int 5x^4 dx + \int 2x dx$$

$$= \frac{5x^5}{5} + \frac{2x^2}{2} = x^5 + x^2 + C$$

H.w

$$1. \int (3x^2 - 9x + 1)^{\frac{1}{2}} (2x - 3) dx$$

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

$$3. \int (ax^2 + bx^3 + c) dx$$

$$4. \int \sqrt{2x+1} dx$$

$$5. \int \frac{1}{x} dx = \ln|x| + C$$

$$6. \int \frac{3}{3x+1} dx = \ln|3x+1| + C$$