



Ministry of Higher Education and
Scientific Research – Iraq
AL-Mustaqbal University

Department of Electrical Engineering techniques

الرياضيات التكاملية

2محاضرة

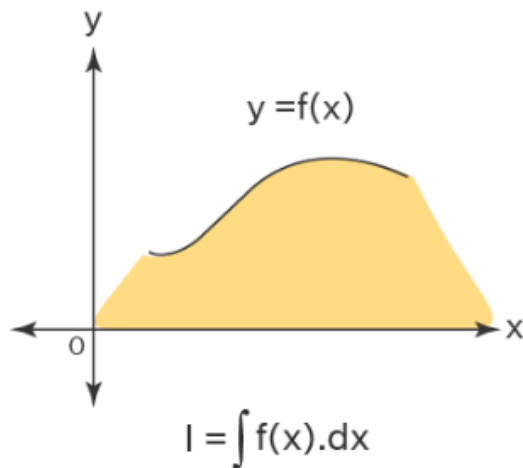
Integral calculus, Standard integration

التكاملات القياسية

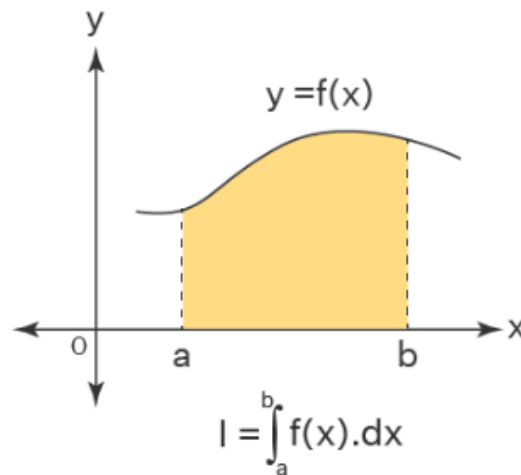
اعداد

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Difference Between Indefinite Integral & Definite Integral



Indefinite Integrals



Definite Integrals

Integral Calculus Formulas

Similar to differentiation formulas, we have [integral formulas](#) as well. Let us go ahead and look at some of the integral calculus formulas.

- $\int a \, dx = ax + C$
- $\int \frac{1}{x} \, dx = \ln |x| + C$
- $\int e^x \, dx = e^x + C$
- $\int a^x \, dx = \frac{e^x}{\ln a} + C$
- $\int \ln x \, dx = x \ln x - x + C$
- $\int \sin x \, dx = -\cos x + C$
- $\int \cos x \, dx = \sin x + C$



- $\int \tan x \, dx = \ln |\sec x| + C \text{ or } -\ln |\cos x| + C$
- $\int \cot x \, dx = \ln |\sin x| + C$
- $\int \sec x \, dx = \ln |\sec x + \tan x| + C$
- $\int \csc x \, dx = \ln |\csc x - \cot x| + C$
- $\int \sec^2 x \, dx = \tan x + C$
- $\int \sec x \tan x \, dx = \sec x + C$
- $\int \csc^2 x \, dx = -\cot x + C$
- $\int \tan^2 x \, dx = \tan x - x + C$
- $\int \frac{dx}{\sqrt{a^2 - x^2}} = \arcsin\left(\frac{x}{a}\right) + C$
- $\int \frac{dx}{\sqrt{a^2 + x^2}} = \frac{1}{a} \arcsin\left(\frac{x}{a}\right) + C$

Basic Integration Problems

I. Find the following integrals.

1. $\int (5x^2 - 8x + 5) dx$

2. $\int (-6x^3 + 9x^2 + 4x - 3) dx$

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

4. $\int \left(\frac{8}{x} - \frac{5}{x^2} + \frac{6}{x^3} \right) dx$

5. $\int \left(\sqrt{x} + \frac{1}{3\sqrt{x}} \right) dx$

6. $\int (12x^{\frac{3}{4}} - 9x^{\frac{5}{3}}) dx$



$$7. \int \frac{x^2 + 4}{x^2} dx$$

$$8. \int \frac{1}{x\sqrt{x}} dx$$

$$9. \int (1 + 3t)t^2 dt$$

$$10. \int (2t^2 - 1)^2 dt$$

$$11. \int y^2 \sqrt[3]{y} dy$$

$$12. \int d\theta$$

$$13. \int 7 \sin(x) dx$$

$$14. \int 5 \cos(\theta) d\theta$$

$$15. \int 9 \sin(3x) dx$$

$$16. \int 12 \cos(4\theta) d\theta$$

$$17. \int 7 \cos(5x) dx$$

$$18. \int 4 \sin\left(\frac{x}{3}\right) dx$$

$$19. \int 4e^{-7x} dx$$

$$20. \int 9e^{\frac{x}{4}} dx$$

$$21. \int -5 \cos \pi x dx$$

$$22. \int -13e^{6t} dt$$



solutions

I. Find the following integrals.

$$1. \int (5x^2 - 8x + 5)dx = \boxed{\frac{5x^3}{3} - 4x^2 + 5x + C}$$

$$2. \int (-6x^3 + 9x^2 + 4x - 3)dx = \boxed{\frac{-3x^4}{2} + 3x^3 + 2x^2 - 3x + C}$$

$$3. \int (x^{\frac{3}{2}} + 2x + 3)dx = \boxed{\frac{2x^{\frac{5}{2}}}{5} + x^2 + 3x + C}$$

$$4. \int \left(\frac{8}{x} - \frac{5}{x^2} + \frac{6}{x^3} \right) dx = \int \left(\frac{8}{x} - 5x^{-2} + 6x^{-3} \right) dx$$
$$= 8\ln(x) - \frac{5x^{-1}}{-1} + \frac{6x^{-2}}{-2} = \boxed{8\ln(x) + \frac{5}{x} - \frac{3}{x^2} + C}$$



$$\begin{aligned} 5. \quad \int (\sqrt{x} + \frac{1}{3\sqrt{x}}) dx &= \int \left(x^{\frac{1}{2}} + \frac{1}{3} x^{-\frac{1}{2}} \right) dx \\ &= \frac{x^{\frac{3}{2}}}{\frac{3}{2}} + \frac{1}{3} \frac{x^{\frac{1}{2}}}{\frac{1}{2}} = \boxed{\frac{2}{3} x^{\frac{3}{2}} + \frac{2}{3} x^{\frac{1}{2}} + C} \end{aligned}$$

$$6. \quad \int (12x^{\frac{3}{4}} - 9x^{\frac{5}{3}}) dx = \boxed{\frac{48x^{\frac{7}{4}}}{7} - \frac{27x^{\frac{8}{3}}}{8} + c}$$

$$7. \quad \int \frac{x^2 + 4}{x^2} dx = \int 1 + 4x^{-2} dx = \boxed{x - \frac{4}{x} + C}$$

$$8. \quad \int \frac{1}{x\sqrt{x}} dx = \int x^{-\frac{3}{2}} dx = \boxed{-\frac{2}{\sqrt{x}} + C}$$

$$9. \quad \int (1 + 3t)t^2 dt = \int t^2 + 3t^3 dt = \boxed{\frac{t^3}{3} + \frac{3t^4}{4} + C}$$

$$10. \quad \int (2t^2 - 1)^2 dt = \int 4t^4 - 4t^2 + 1 dt = \boxed{\frac{4t^5}{5} - \frac{4t^3}{3} + t + C}$$



$$11. \int y^2 \sqrt[3]{y} dy = \int y^{\frac{7}{3}} dy = \frac{3y^{\frac{10}{3}}}{10} + C$$

$$12. \int d\theta = \theta + C$$

$$13. \int 7 \sin(x) dx = -7 \cos(x) + C$$

$$14. \int 5 \cos(\theta) d\theta = 5 \sin(\theta) + C$$

$$15. \int 9 \sin(3x) dx = -3 \cos(3x) + C$$

$$16. \int 12 \cos(4\theta) d\theta = 3 \sin 4\theta + C$$

$$17. \int 7 \cos(5x) dx = \frac{7 \sin(5x)}{5} + C$$

$$18. \int 4 \sin\left(\frac{x}{3}\right) dx = -12 \cos\left(\frac{x}{3}\right) + C$$

$$19. \int 4e^{-7x} dx = -\frac{4e^{-7x}}{7} + C$$

$$20. \int 9e^{\frac{x}{4}} dx = 36e^{\frac{x}{4}} + C$$

$$21. \int -5 \cos \pi x dx = -\frac{5 \sin(\pi x)}{\pi} + C$$

$$22. \int -13e^{6t} dt = -\frac{13e^{6t}}{6} + C$$

Thanks for lessening ..

Any questions?