

Ch-7 (Integration)
ALL formulas

Category 1

$$(1.) \int x^n dx = \frac{x^{n+1}}{n+1} + C$$

$$(9) \int \sec^2 x dx = \tan x + C$$

$$(2) \int e^x dx = e^x + C$$

$$(10) \int \csc^2 x dx = -\cot x + C$$

$$(3) \int a^x dx = \frac{a^x}{\log a} + C$$

$$(4) \int \sin x dx = -\cos x + C$$

$$(5) \int \cos x dx = \sin x + C$$

$$(6) \int \sec x \tan x dx = \sec x + C$$

$$(7) \int \csc x \cot x dx = -\csc x + C$$

$$(8) \int \frac{1}{x} dx = \log|x| + C$$

Category 2 → Tricks

$$\underline{1.} \int \sin^2 x dx = \int \frac{1 - \cos 2x}{2} dx$$

$$\underline{2.} \int \cos^2 x dx = \int \left(\frac{1 + \cos 2x}{2} \right) dx$$

$$\underline{3.} \int \tan^2 x dx = \int (\sec^2 x - 1) dx$$

$$\underline{4.} \int \cot^2 x dx = \int (\csc^2 x - 1) dx$$

Category 3

$$\underline{1.} \int \frac{1}{x^2 - a^2} dx = \frac{1}{2a} \log \left| \frac{x-a}{x+a} \right| + C$$

$$\underline{2.} \int \frac{1}{a^2 - x^2} dx = \frac{1}{2a} \log \left| \frac{a+x}{a-x} \right| + C$$

$$\underline{3.} \int \frac{1}{x^2 + a^2} dx = \frac{1}{a} \tan^{-1} \left(\frac{x}{a} \right) + C$$

$$\underline{4.} \int \frac{1}{\sqrt{x^2 - a^2}} dx = \log |x + \sqrt{x^2 - a^2}| + C$$

$$\underline{5.} \int \frac{1}{\sqrt{a^2 - x^2}} dx = \sin^{-1} \left(\frac{x}{a} \right) + C$$

$$\underline{6.} \int \frac{1}{\sqrt{x^2 + a^2}} dx = \log |x + \sqrt{x^2 + a^2}| + C$$

Category 4

Useful for chapter 8 and 10

$$\underline{1.} \int \sqrt{x^2 - a^2} dx = \frac{x}{2} \sqrt{x^2 - a^2} - \frac{a^2}{2} \log |x + \sqrt{x^2 - a^2}| + C$$

$$\underline{2.} \int \sqrt{x^2 + a^2} dx = \frac{x}{2} \sqrt{x^2 + a^2} + \frac{a^2}{2} \log |x + \sqrt{x^2 + a^2}| + C$$

$$\underline{3.} \int \sqrt{a^2 - x^2} dx = \frac{x}{2} \sqrt{a^2 - x^2} + \frac{a^2}{2} \sin^{-1} \frac{x}{a} + C$$

Category 5

By Parts [Product rule of Integration]

$$\underline{1.} \int \underbrace{f(x)}_I \underbrace{g(x)}_II dx = I \int II dx - \int (I' \int II dx) dx$$

$$\underline{2.} \int e^x [f(x) + f'(x)] dx = e^x f(x) + C$$

Category 6 Partial fraction

$$1. \int \frac{Px+Q}{(x-a)(x-b)} dx = \frac{A}{x-a} + \frac{B}{x-b}$$

$$2. \int \frac{Px+Q}{(x-a)(x-b)(x-c)} dx = \frac{A}{x-a} + \frac{B}{x-b} + \frac{C}{x-c}$$

$$3. \int \frac{Px+Q}{(x-a)^2(x-b)} dx = \frac{A}{x-a} + \frac{B}{(x-a)^2} + \frac{C}{x-b}$$

$$4. \int \frac{Px+Q}{(x^2+bx+c)(x-d)} dx = \frac{Ax+B}{x^2+bx+c} + \frac{C}{x-d}$$

$$5. \int \frac{Px+Q}{(x^2+bx+c)(x-d)^2(x+c)} dx = \frac{Ax+B}{x^2+bx+c} + \frac{C}{x-d} + \frac{D}{(x-d)^2} + \frac{E}{x+c}$$

Category 7

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

OR

$$-\cos^{-1}x + C$$

$$2. \int \frac{1}{\sqrt{1+x^2}} dx = \tan^{-1}x + C \text{ or } -\cot^{-1}x + C$$

$$3. \int \frac{1}{x\sqrt{x^2-1}} dx = \sec^{-1}x + C \text{ or } -\operatorname{cosec}^{-1}x + C$$

Category 8

$$1. \int \tan x dx = -\log|\cos x| \text{ or } \log|\sec x|$$

$$2. \int \cot x dx = \log|\sin x| \text{ or } -\log|\operatorname{cosec} x|$$

$$3. \int \sec x dx = \log|\sec x + \tan x|$$

$$4. \int \operatorname{cosec} x dx = \log|\operatorname{cosec} x - \cot x|$$

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