

Nov 26/09

§ 5.1

→ 5.2 RULES (SHEET)

$$\int f(x) dx \quad \text{MEANS}$$

(1) FIND $(F(x))$ SUCH THAT $F'(x) = f(x)$
ANTIDERIVATIVE

(2) ADD AN UNSPECIFIED CONSTANT OF INTEGRATION
 C

$$\int f(x) dx = F(x) + C$$

EXAMPLES FIND $\int f(x) dx$.

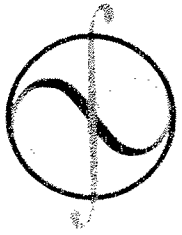
$$1) \int x^{1.8} dx = \frac{x^{2.8}}{2.8} + C$$

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

$$3) \int \sin x dx = -\cos x + C$$

$$4) \int \sec^2 x dx = \tan x + C$$

$$5) \int \frac{1}{x} dx = \int x^{-1} dx = \ln|x| + C$$



6. $\int f'(x) dx = f(x) + C$

7. $\int f''(x) dx = f'(x) + C$

8. $\int v(t) dt = s(t) + C$

9. $\int a(t) dt = v(t) + C$

? WHAT ABOUT INTEGRALS LIKE:

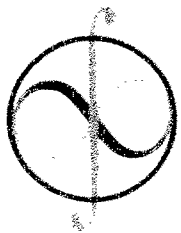
1) $\int (3x^2 - 2x + 1) dx$

Rule 2) $\int -7 \sin x dx$

3) $\int x^2(1+x) dx$

4) $\int \cos(3x+1) dx$

NOT IN
TABLE 1



TYPE I, II, III INDEFINITE INTEGRALS

TYPE I $\int f(x) dx$ or $\int f(mx+b) dx$ IS

TYPE I IF $\int f(x) dx$ APPEARS IN TABLE 1
(TABLE 1 OR RULE 3)

TYPE II AN INTEGRAL IS TYPE II IF RULES
1 ~~AND~~ AND/OR 2 APPLY. (RULES 1 OR 2)

TYPE III NO RULE APPLIES. BUT, SOME
LEGAL ALGEBRA CONVERTS THE INTEGRAL TO
A TYPE I OR TYPE 2.

EXAMPLES

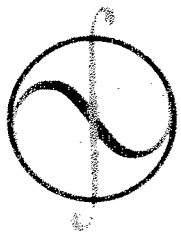
$$1) \int (3x^2 - 2x + 1) dx = \int 3x^2 dx - \int 2x dx + \int 1 dx$$

TYPE II

$$= 3 \int x^2 dx - 2 \int x dx + \int 1 dx$$

$$= 3 \cdot \frac{1}{3} x^3 - 2 \cdot \frac{1}{2} x^2 + x + C$$

$$= x^3 - x^2 + x + C$$



② $\int -7 \sin x \, dx$

Table 1.

SOLN TYPE II

$$\int -7 \sin x \, dx = -7 \int \sin x \, dx$$

$$= -7 (-\cos x) + C$$

$$= 7 \cos x + C$$

③ $\int x^2 (1+x) \, dx$

SOLN TYPE III "ALGEBRA"

$$\int x^2 (1+x) \, dx = \int (x^2 + x^3) \, dx \quad \text{TYPE II}$$

$$= \frac{1}{3} x^3 + \frac{1}{4} x^4 + C$$

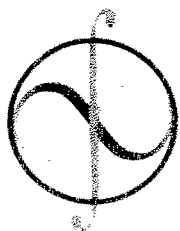
④ $\int \cos(3x+1) \, dx$

SOLN TYPE I.

$$\int \cos(3x+1) \, dx = \frac{1}{3} \sin(3x+1) + C \quad \text{RULE 3}$$

$m=3$

Guess & Check $\int \cos(3x+1) \, dx = \frac{1}{3} \sin(3x+1) + C$



METHOD 3

$$\int \cos(3x+1) dx$$

SOL'N

SUBSTITUTION METHOD

$$\begin{aligned} u &= 3x+1 \\ du &= 3dx \end{aligned}$$

$$\int \cos(3x+1) \textcircled{dx} = \int \cos u \left(\frac{1}{3} du\right)$$

$$= \frac{1}{3} \int \cos u du$$

$$= \frac{1}{3} \sin u + C$$

$$= \frac{1}{3} \sin(3x+1) + C$$

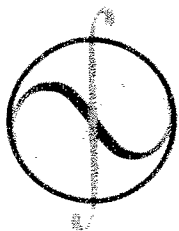
⑤ $\int e^{-2x+1} dx$

SOL'N TYPE I

$$\int e^x dx = e^x + C$$

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

$m = -2$



6. $\int \sin x \cos x \, dx$

SIN TYPE III

$$\sin 2\theta = 2 \sin \theta \cos \theta$$

$$\int \sin x \cos x \, dx = \int \frac{1}{2} \sin 2x \, dx \quad \text{TYPE II}$$

$$= \frac{1}{2} \int \sin 2x \, dx$$

TYPE I.

$$= -\frac{\cos(2x)}{4} + C$$