

Key Formulae

Standard Integrals

$f(x)$	$\int f(x) dx$	$f(x)$	$\int f(x) dx$
x^n	$\frac{1}{n+1} x^{n+1} + c$	$\operatorname{cosec} x \cot x$	$-\operatorname{cosec} x + c$
e^x	$e^x + c$	$\operatorname{cosec}^2 x$	$-\cot x + c$
a^x	$\frac{1}{\ln a} a^x + c$	$\frac{1}{\sqrt{1-x^2}}$	$\arcsin x + c$
$\frac{1}{x}$	$\ln x + c$	$\frac{1}{1+x^2}$	$\arctan x + c$
$\sin x$	$-\cos x + c$	$\tan x$	$\ln \sec x + c$ ^{FB}
$\cos x$	$\sin x + c$	$\cot x$	$\ln \sin x + c$ ^{FB}
$\sec^2 x$	$\tan x + c$ ^{FB}	$\operatorname{cosec} x$	$\ln \tan \frac{1}{2} x + c$ ^{FB}
$\sec x \tan x$	$\sec x + c$	$\sec x$	$\ln \sec x + \tan x + c$ ^{FB}

Key Concepts

Integration Rules

1) Standard integrals - a straight application of the standard integrals.

2) $f(ax+b)$ -

$$f(ax+b) \xrightarrow{\text{integrated w.r.t. } x} \frac{1}{a} f(ax+b) + c$$

3) Reverse Chain Rule / Recognition

$$\int \frac{f'(x)}{f(x)} dx = \ln|f(x)| + c$$

$$\int f'(x) e^{f(x)} dx = e^{f(x)} + c$$

$$\int f'(x) (f(x))^n dx = \frac{1}{n+1} (f(x))^{n+1} + c$$

$$\int g'(x) f(g(x)) dx = f(g(x)) + c$$

4) Integration by Parts

$$\int u \frac{dv}{dx} dx = uv - \int v \frac{du}{dx} dx$$
 ^{FB}

5) Substitution

6) Partial Fractions

7) Parametric Integration

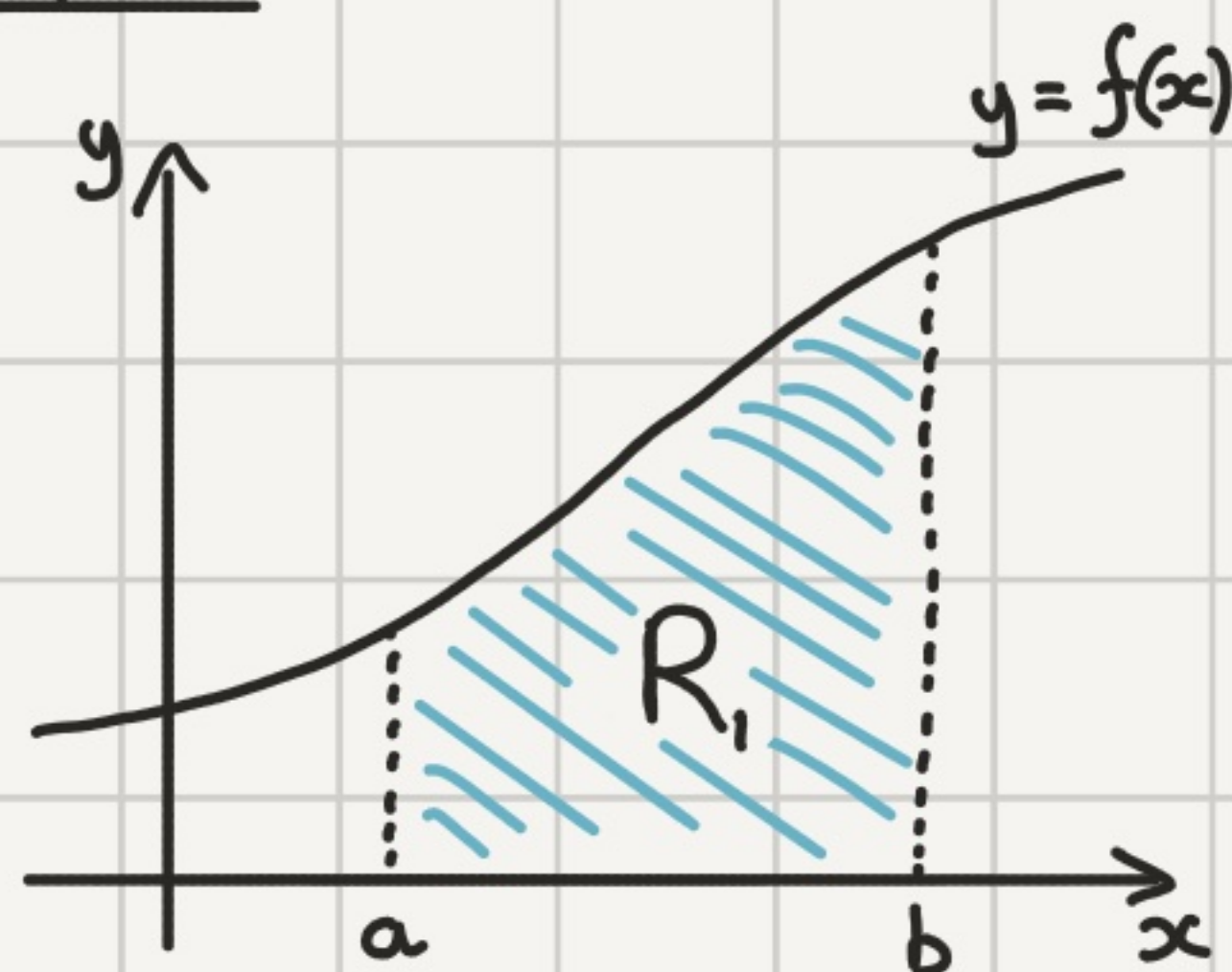
$$\int y dx = \int y \frac{dx}{dt} dt$$

Key Concepts (continued)

Area Under a Graph

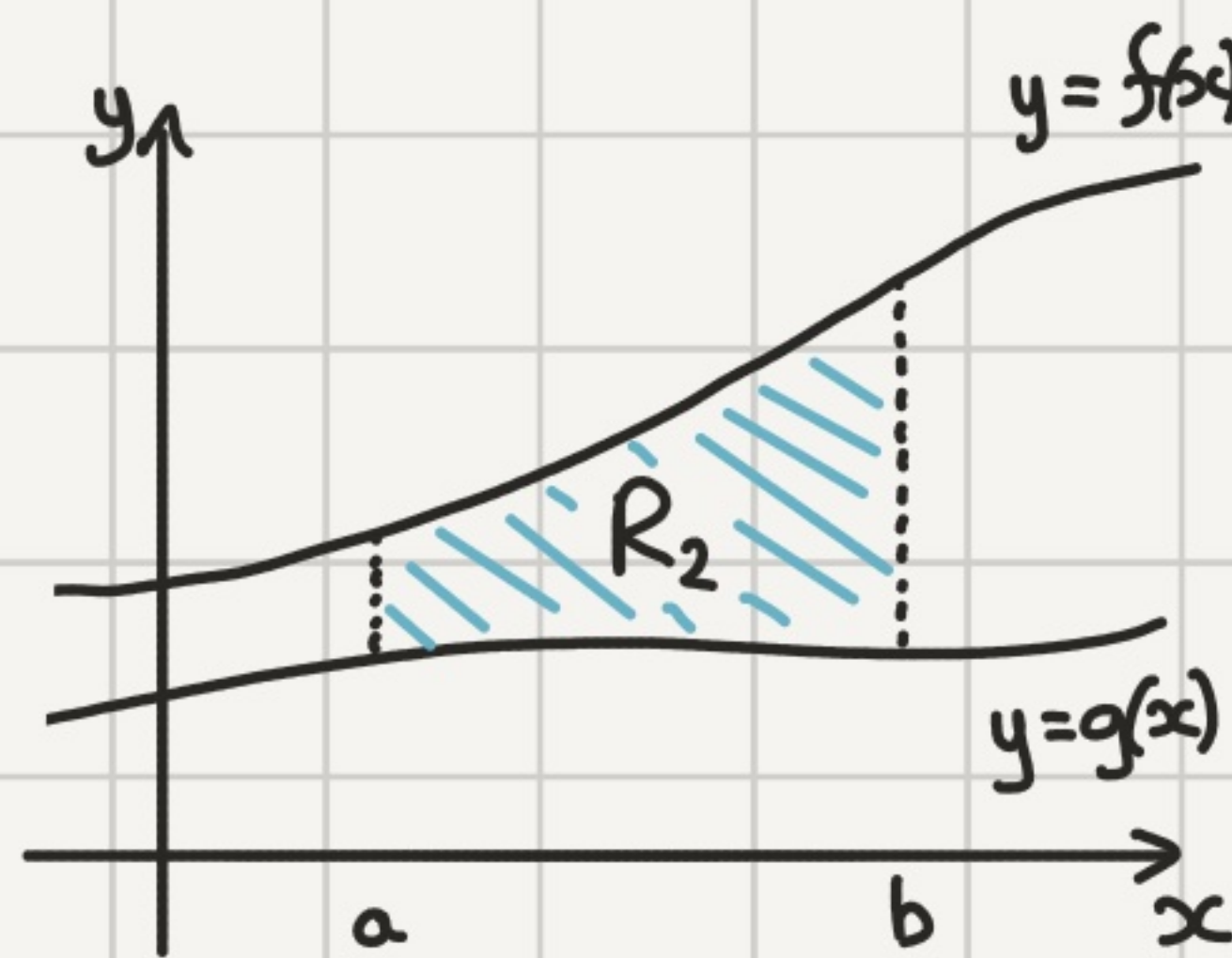
$$\bullet R_1 = \int_a^b f(x) dx$$

(shaded region)



$$\bullet R_2 = \int_a^b (f(x) - g(x)) dx$$

(shaded region)



Trapezium Rule

$$\bullet \int_a^b y dx \approx \frac{1}{2} h \{ (y_0 + y_n) + 2(y_1 + y_2 + \dots + y_{n-1}) \}$$

where $h = \frac{b-a}{n}$

Differential Equations

$$\bullet \text{ For } \frac{dy}{dx} = f(x)g(y),$$

$$\int \frac{1}{g(y)} dy = \int f(x) dx$$