

Basic Integration

Integration = anti-derivative.

Standard form

$$(i) \int (x^a + x^b + x^c + \dots) dx$$

$$(ii) \int (\text{Tables}) dx$$

Rule \Rightarrow Increase power by 1 and divide by new power.

Find

$$(i) \int (x+5) dx$$

$$\frac{x^2}{2} + 5x + c$$

$$(ii) \int (x^3 + 5x^2) dx$$

$$\frac{x^4}{4} + \frac{5x^3}{3} + c$$

$$(iii) \int (x+1)(x+2) dx = \text{Mult out}$$

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

$$\frac{x^3}{3} + \frac{3x^2}{2} + 2x + C$$

$$(iv) \int \sqrt{x} dx = \text{Indices}$$

$$\int x^{\frac{1}{2}} dx$$

$$\frac{x^{\frac{3}{2}}}{\frac{3}{2}} + C$$

$$\frac{2}{3} x^{\frac{3}{2}} + C$$

$$\frac{2}{3} (x^{\frac{1}{2}})^3 + C$$

$$\frac{2}{3} (\sqrt{x})^3 + C$$

$$x^{\frac{p}{q}} = (\sqrt[q]{x})^p$$

$$(v) \int \frac{dx}{x^2}$$

$$\int \frac{1}{x^2} dx$$

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

$$= -\frac{1}{x} + C$$

$$(vi) \int \frac{dx}{x}$$

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

$$\left[\int x^{-1} dx = \frac{x^0}{0} + C \right]$$
$$= \infty$$

$$(vii) \int e^{3x} dx = \frac{1}{3} e^{3x} + C$$

$$(viii) \int 5^x dx = \frac{5^x}{\ln 5}$$

$$(ix) \int \frac{x^2 - 9}{x - 3} dx \quad \text{Factorize}$$

$$\int \frac{(x+3)\cancel{(x-3)}}{\cancel{x-3}} dx$$

$$\frac{x^2}{2} + 3x + C$$

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

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

$$\int \left(x + \frac{1}{x} \right) dx$$

$$\frac{x^2}{2} + \ln x + C$$