

## INTEGRATION

$$2 \sin a \cos b = \sin(a+b) + \sin(a-b)$$

$$\cos^2 x = \frac{1}{2}(1 + \cos 2x)$$

$$\int x^n = \frac{x^{n+1}}{n+1}$$

$$x^{-1} = \ln x$$

$$\sin x = -\cos x$$

$$\cos x = \sin x$$

$$e^x = e^x$$

$$\frac{dx}{a^2 + x^2} = \frac{1}{a} \tan^{-1} \frac{x}{a}$$

### 1. Parts

$$\int x + 3 dx = \frac{x^2}{2} + 3x + c$$

$$\int \sqrt{x} dx = \frac{2x^{\frac{3}{2}}}{\frac{3}{2}} + c$$

$$\int \frac{1}{x^3} dx = -\frac{1}{2x^2} + c$$

$$\int e^{5x} dx = \frac{1e^{5x}}{5} + c$$

$$\int \sin 2x dx = -\frac{\cos 2x}{2} + c$$

$$\int \cos 3x dx = \frac{\sin 3x}{3} + c$$

$$2. \int_0^3 \frac{x}{x^2 + 7} dx$$

$$\text{Take } u = x^2 + 7$$

$$du = 2x dx$$

$$\frac{1}{2} du = x dx$$

$$\therefore \frac{1}{2} \int \frac{du}{u}$$

$$\frac{1}{2} \int u^{-1} du$$

$$\frac{1}{2} \ln u = \frac{1}{2} \ln x^2 + 7 \Big|_0^3$$

$$\frac{1}{2} [(\ln 3^2 + 7) - (\ln 0^2 + 7)]$$

$$\frac{1}{2} \ln 16 - \frac{1}{2} \ln 7$$