

$$e^x \sin 2x - e^x 2 \cos 2x - \int e^x 2 \sin 2x dx$$
$$\int e^x \sin 2x dx = e^x 2 \sin 2x - \int e^x 2 \cos 2x dx - \int e^x 2 \sin 2x dx$$

$$\text{Let } I = \int e^x 2 \sin 2x dx$$

$$I = e^x 2 \sin 2x - e^x 2 \cos 2x - I$$

$$2I = e^x 2 \sin 2x - e^x 2 \cos 2x$$

$$I = \frac{e^x 2 \sin 2x - e^x 2 \cos 2x}{2}$$

$$\therefore \int e^x \sin 2x dx = \frac{1}{2} [e^x 2 \sin 2x - e^x 2 \cos 2x] + C$$

$$\text{H) } \int e^x \sin 2x \, dx$$

$$u = \sin 2x \quad dv = e^x$$

$$du = 2 \cos 2x \, dx \quad v = e^x$$

$$\int u \, dv = uv - \int v \, du$$

$$\sin 2x (e^x) - \int e^x 2 \cos 2x \, dx$$

$$e^x \sin 2x - \int e^x 2 \cos 2x \, dx$$

$$\int u = 2 \cos 2x \quad dv = e^x$$

$$\int du = -2 \sin 2x \quad v = e^x$$

$$\int e^x 2 \cos 2x \, dx$$

$$\int e^x 2 \cos 2x \, dx$$

$$\int 2 \cos 2x (e^x) - \int e^x (-2 \sin 2x)$$

$$\int e^x 2 \cos 2x + 2 \sin 2x e^x \, dx$$

$$1) y = (2 \cos 3x) / x^3$$

$$\ln y = \ln 2 \cos 3x - \ln x^3$$

$$\frac{d}{dx} (\ln y) = \frac{d}{dx} (\ln 2 \cos 3x) - \frac{d}{dx} (\ln x^3)$$

$$\frac{1}{y} \left(\frac{dy}{dx} \right) = \frac{2 \cos 3x (-6 \sin 3x)}{2 \cos 3x} - \frac{1}{x^3} (3x^2)$$

$$\frac{1}{y} \cdot \frac{dy}{dx} = \frac{-6 \sin 3x}{2 \cos 3x} - \frac{3x^2}{x^3}$$

$$\frac{dy}{dx} = y \left(-3 \frac{\sin 3x}{\cos 3x} - \frac{3}{x} \right)$$

$$\frac{dy}{dx} = \frac{2 \cos 3x}{x} \left(-3 \frac{\sin 3x}{\cos 3x} - \frac{3}{x} \right)$$

$$2) y = x e^{2x} \quad u = x, \quad v = e^{2x}$$

$$\frac{dy}{dx} = u \frac{dv}{dx} + v \frac{du}{dx}$$

$$= x \frac{d e^{2x}}{dx} + e^{2x} \frac{d x}{dx}$$

$$= x \cdot e^{2x} \cdot 2 + e^{2x} \cdot 1$$

$$2x e^{2x} + e^{2x}$$

$$\frac{d^2 y}{dx^2} = 2x \frac{d e^{2x}}{dx} + e^{2x} \frac{d 2x}{dx} + \frac{d e^{2x}}{dx}$$

$$= \varphi x e^{2x} + 2\varphi e^{2x} - 2\varphi e^{2x}$$

$$= \varphi x e^{2x} + \varphi e^{2x}$$

$$d^2y/dx^2 - \varphi dy/dx + \varphi y = 0$$

$$\varphi x e^{2x} + \varphi e^{2x} - \varphi - \varphi(2x e^{2x} + e^{2x}) + \varphi(x e^{2x})$$

$$\varphi x e^{2x} + \varphi e^{2x} - 2x\varphi e^{2x} + \varphi e^{2x} + \varphi x e^{2x}$$

$$6x\varphi e^{2x} - 2x\varphi e^{2x} + \varphi e^{2x} - \varphi e^{2x} = 0$$

$$2y/dx^2 - \varphi dy/dx + \varphi y = 0$$