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1 $3te^{2t}$

Solution

Let $u = 3t$ and $dv = e^{2t}$

$\frac{du}{dt} = 3$

$du = 3dt$ $V = \frac{e^{2t}}{2}$

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

$= 3t\left(\frac{e^{2t}}{2}\right) - \int \frac{e^{2t}}{2} \times 3dt$

$3t\left(\frac{e^{2t}}{2}\right) - \frac{1}{2}\int 3e^{2t}dt$

$3t\left(\frac{e^{2t}}{2}\right) - \frac{1}{2} \times \frac{3e^{2t}}{2}$

$\left[\frac{3}{2}te^{2t} \cdot \frac{3e^{2t}}{4}\right] + C$ //

2 $\int x^2 \sin x$

Let $u = x^2$ and $dv = \sin x$

$\frac{du}{dx} = 2x$ and $v = -\cos x$

Using $uv - \int v du$

$(x^2)(-\cos x) - \int (-\cos x)(2x dx)$

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

~~$-2x$~~ Let $u = -2x$ and $dv = \cos x$

$(-2x)\sin x - \int (\sin x)(-2) dx$

$-2x \sin x - (-2)\int \sin x dx$

at $t = 1$

$\frac{d^2y}{dx^2} = 6(1) - 1$

$= 6 - 1$

$= 5$

at $(1, 5\frac{1}{2})$ there is minimum point

2 $2y^2 - 5x^4 - 2 - 7y^3 = 0$

$\frac{d}{dx}(2y^2) - \frac{d}{dx}(5x^4) - \frac{d}{dx}(2) - \frac{d}{dx}(7y^3) = 0$

$4y\frac{dy}{dx} - 20x^3 - 21y^2\frac{dy}{dx} = 0$

$4y\frac{dy}{dx} - 21y^2\frac{dy}{dx} = 20x^3$

$\frac{dy}{dx} = \frac{20x^3}{4y - 21y^2}$

3 $4x^2 + 2xy^3 - 5y^2 = 0$

$\frac{d}{dx}(4x^2) + \frac{d}{dx}(2xy^3) - \frac{d}{dx}(5y^2) = 0$

$8x + 2y^3 + 2x3y^2\frac{dy}{dx} - 10y\frac{dy}{dx} = 0$

$2x3y^2\frac{dy}{dx} - 10\frac{dy}{dx} = 8x + 2y^3$

$\frac{dy}{dx} = \frac{8x + 2y^3}{2x3y^2 - 10y}$

$\frac{dy}{dx}$ when $x = 1$ and $y = 2$

$\frac{dy}{dx} = \frac{8(1) + 2(2)^3}{2(1)3(2)^2 - 10(2)} = \frac{24}{4} = 6$