D.E.

Que: $(x^3 + x^2 + x + 1)\frac{dy}{dx} = 2x^2 + x$; $\boxed{y = 1}$ when $\boxed{x = 0}$

$\Rightarrow \int dy = \int \frac{dx\,(2x^2 + x)}{x^3 + x^2 + x + 1}$

$\Rightarrow y = \int \frac{2x^2 + x}{(x^2+1)(x+1)} \cdot dx = I$

$I = \int \frac{2x^2 + x}{(x^2+1)(x+1)} dx = \frac{A}{(x+1)} + \frac{Bx + C}{(x^2+1)}$

$2x^2 + x = A(x^2+1) + (Bx + C)(x+1)$

$2x^2 + x = Ax^2 + A + Bx^2 + Bx + Cx + C$

Compair

$\Rightarrow \boxed{2 = A + B}$ & $\boxed{1 = B + C}$ & $\boxed{0 = A + C}$

$\boxed{2 = -C + B}$

$\qquad 2 \quad B - C$

$3 = 2B$

$B = 3/2$

$A = -C$

$A = \frac{1}{2}$

$C = B - 2 = \frac{3}{2} - 2 = \frac{-1}{2}$

so $I = \int \frac{1/2}{x+1} \cdot dx + \int \frac{3/2\,x - 1/2 \cdot dx}{(x^2+1)}$

$I = \frac{1}{2} \log(x+1) + \frac{1}{2}\left[\int \frac{3x}{x^2+1} \cdot dx - \int \frac{1 \cdot dx}{x^2+1}\right]$

$I = \frac{1}{2} \log(x+1) + \frac{1}{2}\left[\frac{3}{2} \log(x^2+1) - \tan^{-1} x\right] + C = y$

$\Rightarrow \frac{1}{2} \log(1) + \frac{1}{2}\left[\frac{3}{2} \log(1) - \tan^{-1}(0)\right] + C = 1$

$0 + 0 + C = 1 \Rightarrow \boxed{C = 1}$

$\Rightarrow y = \frac{1}{2} \log(x+1) + \frac{1}{2}\left[\frac{3}{2} \log(x^2+1) - \tan^{-1} x\right] + 1$ Ans

D.E.

Ans. $\cos\left(\frac{dy}{dx}\right) = a$; $[y = 1, \text{ when } x = 0]$

$\Rightarrow \frac{dy}{dx} = \cos^{-1} a$

$\Rightarrow \int dy = \int \cos^{-1} a \cdot dx$

$\Rightarrow y = \cos^{-1} a \cdot x + c$

$\Rightarrow y = 1 \rightarrow x = 0 \Rightarrow 1 = 0 + c \Rightarrow c = 1$

$y = \cos^{-1} a \cdot x + (1)$ Ans

$y - 1 = \cos^{-1} a \cdot x$

$\frac{y-1}{x} = \cos^{-1} a \Rightarrow a = \cos\left(\frac{y-1}{x}\right)$ Ans

D.E.

Ans. Find the eq. of curve passing through $\overset{x\ \ y}{(0,0)}$ & whose D.E. is $[y' = e^x \cdot \sin x]$.

Sol^n:-

$\frac{dy}{dx} = e^x \cdot \sin x$

$\int dy = \boxed{\int \underset{(2)}{e^x} \underset{(1)}{\sin x} \cdot dx = y}$

$\Rightarrow y = \sin x\, e^x - \int \underset{(I)}{\cos x} \cdot \underset{(II)}{e^x} \cdot dx$

$y = e^x \cdot \sin x - \left[\cos x \cdot e^x + \int \sin x\, e^x \cdot dx\right] + c$

$y = e^x \cdot \sin x - e^x \cos x - \int e^x \sin x \cdot dx + c$

$y = e^x[\sin x - \cos x] - y + c$

$2y = e^x[\sin x - \cos x] + c$

$y = \frac{e^x}{2}(\sin x - \cos x) + c \Rightarrow y = \frac{e^x}{2}(\sin x - \cos x) + 1$ Ans

So curve passing through $(0,0)$

$\Rightarrow 0 = \frac{e^0}{2}[\sin 0 - \cos 0] + c$

$\Rightarrow 0 = 1[0 - 1] + c \Rightarrow \boxed{c = 1}$

D.E.

Ans:- For D.E. $x \cdot \boxed{y \cdot \frac{dy}{dx}} = (x+2)(y+2) \rightarrow$ eq. of curves $\rightarrow$ passing $(1, -1)$

$$\int \frac{y}{y+2}\,dy = \int \frac{x+2}{x}\,dx$$

$$\int 1 \cdot dx + \int \frac{2}{x} \cdot dx$$

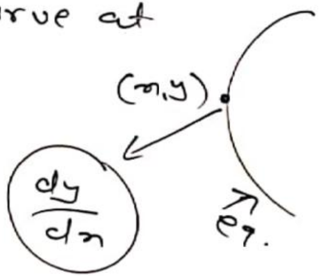
$$\int \left(\frac{y+2}{y+2} - 2\right) \cdot dy$$

$$\underline{\int 1 \cdot dy} - \int \frac{2}{y+2} \cdot dy$$

$y = 4.$ # D.E. # ($\rightarrow$ find

Ques:- Find $\boxed{\text{eq. of curve}}$ passing thro. point $\boxed{\left(\overset{x}{0}, \overset{y}{-2}\right)}$ given that at any point (x, y) on the curve, the product of slope of its tangent & y-coordinate of the point is $\boxed{\text{equal}}$ to the x-coordinate of the point.

Sol^n:- Let the x-coordinate & y-coordinate of the curve at point (x, y) is x & y.



$\therefore$ according to question:-

$$\frac{dy}{dx} \times y = x$$

$$\Rightarrow \int y \cdot dy = \int x \cdot dx$$

$$\frac{y^2}{2} = \frac{x^2}{2} + C$$

at $(0, -2) \Rightarrow \frac{4}{2} = 0 + C \Rightarrow C = 2$

$$\Rightarrow \frac{y^2}{2} = \frac{x^2}{2} + 2$$

$$y^2 - x^2 = 4$$

ABLES® KOTA

D.E.

$\frac{216}{3} = 72^{2\times4}$ $= 288$ 36 252

Que. The volume of spherical balloon being inflated changes at a constant rate. If initially its radius is 3 unit & after 3 sec. it is 6 unit. Find the radius of balloon after t. sec.?

$$\boxed{R = (63t + 27)^{1/3}}$$

Solⁿ:- ATC:- $\left[\frac{dV}{dt} = K\right] \to$ Constant

$\because$ ① $R = 3$ unit $\to$ when $t = 0$

& ② $R = 6$ unit $\to$ when $t = 3$

find $\boxed{R = ?}$ $\to$ when time $= t$

$\because$ Vol. of sphere $\Rightarrow V = \frac{4}{3}\pi R^3$

$\therefore \Rightarrow \frac{d}{dt}\left[\frac{4}{3}\pi R^3\right] = K$

$\Rightarrow \frac{4}{\cancel{3}}\pi \times \cancel{3}R^2 \times \frac{dR}{dt} = K$

$\Rightarrow R^2 \times dR = \frac{K}{4\pi} \cdot dt$

Integ. on both $\Rightarrow \int R^2 \cdot dR = \int \frac{k}{4\pi} \cdot dt$

① $\left[4\pi \cdot \frac{R^3}{3} = Kt + C\right] \Leftarrow \left[\frac{R^3}{3} = \frac{K}{4\pi} t + C\right]$

put :- $t = 0 \Rightarrow R = 3 \Rightarrow 4\pi \cdot \frac{(3)^{3}}{3} = K(0) + C \Rightarrow \boxed{C = 36\pi}$

② So:- $\left[4\pi \cdot \frac{R^3}{3} = Kt + 36\pi\right]$

$\Rightarrow R = 6$; $t = 3 \Rightarrow 4\pi \cdot \frac{(6)^3}{3} = K(3) + 36\pi$

③ $\Rightarrow 288\pi - 36\pi = 3K \Rightarrow 252\pi = 3K \Rightarrow K = \frac{252}{3}\pi$ (84)

$K = 84\pi$

So:- $4\pi \cdot \frac{R^3}{3} = 84\pi \cdot t + 36\pi \Rightarrow \frac{R^3}{3} = 21t + 9 \Rightarrow R^3 = 63t + 27$ ④