THEORY

Differential equations with Variables Separable:

A first order, first deg. diff. eqn is of form.

$$\frac{dy}{dx} = F(x, y)$$

If $F(x,y)$ can be expressed as product of $g(x)\, h(y)$

Where $g(x)$ is function of x and

$h(y)$ is function of y.

Then $\frac{dy}{dx} = g(x)\, h(y)$

If $h(y) \neq 0$ the separating the variables, we get

$$\frac{1}{h(y)} dy = g(x)\, dx$$

$$\Rightarrow \int \frac{1}{h(y)} dy = \int g(x)\, dx.$$

Thus Soln. of given diff. eqn will be of form

$$H(y) = G(x) + C$$

Where $H(y) = \int \frac{1}{h(y)} dy$

$G(x) = \int g(x)\, dx.$

C: is arbitrary constant.

EXERCISE 9.4

For each of differential eqns from 1 to 10 find the general solution:

Q No. 1

$$\frac{dy}{dx} = \frac{1-\cos x}{1+\cos x}$$

Sol.

$$\frac{dy}{dx} = \frac{1-\cos x}{1+\cos x} = \frac{2\sin^2\frac{x}{2}}{2\cos^2 x/_2} = \tan^2\frac{x}{2}$$

$$\frac{dy}{dx} = \sec^2\frac{x}{2} - 1$$

$$\therefore \quad dy = \left(\sec^2\frac{x}{2} - 1\right)dx.$$

$$\therefore \quad \int dy = \int\left(\sec^2\frac{x}{2} - 1\right)dx$$

or $$y = \frac{\tan x/_2}{1/_2} - x + C$$

or $y = 2\tan x/_2 - x + C$

Q No. 2

$$\frac{dy}{dx} = \sqrt{4-y^2} \quad (-2<y<2)$$

Sol.

$$\frac{dy}{dx} = \sqrt{4-y^2}.$$

or $$\frac{1}{\sqrt{4-y^2}}\,dy = dx.$$

or $$\int \frac{1}{\sqrt{(2)^2-(y)^2}}\,dy = \int dx$$

or $\sin^{-1}\frac{y}{2} = x + C$ or $y = 2\sin(x+C)$

Q No 3

$$\frac{dy}{dx} + y = 1 \quad (y \neq 1)$$

Sol.

$\frac{dy}{dx} = 1-y.$ or $\frac{dy}{dx} = -(y-1)$

or. $$\frac{1}{y-1}\,dy = -dx.$$

or $$\int \frac{1}{y-1}\,dy = -\int dx$$

or $$\log|y-1| = -x + C$$

or $|y-1| = e^{(-x+C)} = e^{-x}\cdot e^{C} = C' e^{-x}$ where $C' = e^{C}$

$\therefore \quad y = 1 + c' e^{-x}$ where $c' = \pm e^{c}$

Q No 4 $\quad \sec^2 x \tan y + \sec^2 y \cdot \tan x = 0$

Sol. $\quad \sec^2 x \tan y \, dx + \sec^2 y \tan x \, dy = 0$

$\Rightarrow \quad \frac{\sec^2 x}{\tan x} dx + \frac{\sec^2 y}{\tan y} dy = 0 \quad [\because$ Divinding by $\tan x \tan y]$

$\Rightarrow \quad \int \frac{\sec^2 x}{\tan x} \cdot dx + \int \frac{\sec^2 y}{\tan y} \cdot dy = 0$

$\Rightarrow \quad \log|\tan x| + \log|\tan y| = C$

$\Rightarrow \quad \log|\tan x \tan y| = C$

or $\quad |\tan x \cdot \tan y| = e^{C}$ or $\tan x \cdot \tan y = \pm e^{C} = c'$ (say)

Q No 5 $\quad (e^x + e^{-x}) dy - (e^x - e^{-x}) dx = 0$

Sol. $\quad (e^x + e^{-x}) dy - (e^x - e^{-x}) dx = 0$

or $\quad (e^x + e^{-x}) dy = (e^x - e^{-x}) dx$

or $\quad dy = \frac{e^x - e^{-x}}{e^x + e^{-x}} dx$

or $\quad \int dy = \int \frac{\frac{d}{dx}(e^x + e^{-x})}{e^x + e^{-x}} dx$

or $\quad y = \log|e^x + e^{-x}| + c = \log(e^x + e^{-x}) + c$

$[\because e^x + e^{-x} \geq 2 \ \forall x \in R]$

Q No. 6 $\quad \frac{dy}{dx} = (1+x^2)(1+y^2)$

Sol. $\quad \frac{dy}{dx} = (1+x^2)(1+y^2)$

or $\quad \frac{1}{1+y^2} dy = (1+x^2) dx.$

or $\quad \int \frac{1}{1+y^2} dy = \int x^2 dx + \int dx.$

$\Rightarrow \quad \tan^{-1} y = \frac{x^3}{3} + x + c$

Q.No. 7 $\quad y \log y \, dx - x \, dy = 0$

Sol. $\quad y \log y \, dx = x \, dy$

or $\quad \frac{dx}{x} = \frac{1}{y \log y} dy = \frac{1/y}{\log y} dy$

or $\quad \int \frac{1}{x} dx = \int \frac{1/y}{\log y} dy$

or $\quad \log|x| = \log|\log y| + c$

or $\quad \log|x| - \log|\log y| = c$

or $\quad \log\left|\frac{x}{\log y}\right| = c \quad$ or $\left|\frac{x}{\log y}\right| = e^c$

or $\quad \frac{x}{\log y} = \pm e^c = c'$ (say)

$\Rightarrow \quad x = c' \log y$.

or $\quad \log y = \frac{1}{c'} x = c'' x \quad$; where $c'' = 1/c'$

or $\quad y = e^{c'' x}$ where $c'' \neq 0$ is arbitrary const.

Q.No. 8. $\quad x^5 \frac{dy}{dx} = -y^5$

Soln. Given diff. eqn is $x^5 \frac{dy}{dx} = -y^{5}$

or $\quad \int y^{-5} dy = -\int x^{-5} dx$

or $\quad \frac{y^{-4}}{-4} = -\frac{x^{-5+1}}{-5+1} + c$

or $\quad x^{-4} + y^{-4} = -4c = c'$ (say)

or $\quad x^{-4} + y^{-4} = c'$

Which is required general soln of given diff. eqn.

QNo 9 $\frac{dy}{dx} = \sin^{-1}x$.

Soln : Given diff. eqn is $\frac{dy}{dx} = \sin^{-1}x$.

or $dy = \sin^{-1}x\, dx$

or $\int dy = \int \sin^{-1}x\, dx$.

or $y = \sin^{-1}x \cdot x - \int \frac{1}{\sqrt{1-x^2}} x\, dx + C$ [Integrating by parts taking $\sin^{-1}x$ as first function]

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

$= x\cdot \sin^{-1}x + \frac{1}{2}\frac{(1-x^2)^{-1/2+1}}{-1/2+1} + C = x\sin^{-1}x + \sqrt{1-x^2} + C$

QNo 10 $e^x \tan y\, dx + (1-e^x)\sec^2 y\, dy = 0$

Sol. given differential eqn is $e^x \tan y\, dy + (1-e^x)\sec^2 y\, dy = 0$

or $\frac{e^x}{1-e^x} dx + \frac{\sec^2 y}{\tan y} dy = 0$ [Dividing throughout by $(1-e^x)\tan y$]

$\Rightarrow \int \frac{e^x}{1-e^{+x}} dx + \int \frac{\sec^2 y}{\tan y} dy = C$.

or $-\int \frac{-e^x}{1-e^{+x}} dx + \int \frac{\frac{d}{dy}(\tan y)}{\tan y} dy = C$

or $-\log|1-e^x| + \log|\tan y| = C$

or $\log\left|\frac{\tan y}{1-e^x}\right| = C$ or $\left|\frac{\tan y}{1-e^x}\right| = e^C$

or $\frac{\tan y}{1-e^x} = \pm e^C = C'$ (say)

or $\tan y = C'(1-e^x)$

Find particular solution of differential eqns from 11 to 14.

QNo 11 $(x^3+x^2+x+1)\frac{dy}{dx} = 2x^2+x$; $y = 1$ when $x = 0$.

Sol. Given diff. eqn is $(x^3+x^2+x+1)\frac{dy}{dx} = 2x^2+x$

$\Rightarrow dy = \frac{2x^2+x}{x^3+x^2+x+1} dx$.

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

Now. $\dfrac{2x^2+x}{(x^2+1)(x+1)} = \dfrac{Ax+B}{(x^2+1)} + \dfrac{C}{x+1}$.

$$\Rightarrow \quad 2x^2+x = (Ax+B)(x+1) + C(x^2+1)$$

$$\Rightarrow \quad 2x^2+x = (A+C)x^2 + (A+B)x + (B+C)$$

$$\Rightarrow \quad A+C=2 \;;\; A+B=1 \;;\; B+C=0$$

Solving for A, B, C we get

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

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

$$\Rightarrow \quad y = \int \frac{\frac{3}{2}x - \frac{1}{2}}{x^2+1}\, dx + \int \frac{1/2}{x+1}\, dx + C$$

$$= \frac{3}{2}\cdot\frac{1}{2}\int \frac{2x}{x^2+1}\, dx - \frac{1}{2}\int \frac{1}{x^2+1}\, dx + \frac{1}{2}\int \frac{1}{x+1}\, dx + C$$

$$y = \frac{3}{4}\log|x^2+1| - \frac{1}{2}\tan^{-1}x + \frac{1}{2}\log|x+1| + C \quad \text{---- (1)}$$

When $x=0$ $y=1$.

$$\therefore \quad 1 = \frac{3}{4}\log|1| - \frac{1}{2}\tan^{-1}(0) + \frac{1}{2}\log|1| + C$$

$$\Rightarrow \quad 1 = 0 + C \quad \text{or} \quad C = 1. \quad \text{---- (ii)}$$

From (i) and (ii)

$$y = \frac{3}{4}\log(x^2+1) - \frac{1}{2}\tan^{-1}x + \frac{1}{2}\log|x+1| + 1$$

Which is required particular Soln. of given diff. eqn.

Q No 12 $\quad x(x^2-1)\dfrac{dy}{dx} = 1 \;;\; y=0$ when $x=2$.

Sol The given diff. eqn is

$$x(x^2-1)\frac{dy}{dx} = 1 \quad \text{or} \quad dy = \frac{1}{x(x^2-1)}\, dx.$$

Now Let $\frac{1}{x(x^2-1)} = \frac{1}{x(x-1)(x+1)} = \frac{A}{x} + \frac{B}{x-1} + \frac{C}{x+1}$

$\therefore$ By resolving into Partial fractions using short cut method.

$$\frac{1}{x(x-1)(x+1)} = \frac{1}{x(-1)(+1)} + \frac{1}{(x-1)(1)(1+1)} + \frac{1}{(x+1)(-1)(-1-1)}$$

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

$\therefore \int dy = \int \frac{1}{x(x^2-1)}\,dx$

$\Rightarrow y = -\int \frac{1}{x}\,dx + \frac{1}{2}\int \frac{1}{x-1}\,dx + \frac{1}{2}\int \frac{1}{x+1}\,dx + C$

$$= -\log|x| + \frac{1}{2}\log|x-1| + \frac{1}{2}\log|x+1| + C$$

$$y = \frac{1}{2}\log\left[\frac{|(x-1)(x+1)|}{|x|^2}\right] + C \quad \text{---(1)}$$

When $x = 2$ $y = 0$

$\therefore 0 = \frac{1}{2}\log\left|\frac{(2-1)(2+1)}{(2)^2}\right| + C$

$0 = \frac{1}{2}\log\left(\frac{3}{4}\right) + C \quad \text{----(2)}$

$\therefore$ from (1) and (2)

$$y = \frac{1}{2}\log\left|\frac{x^2-1}{x^2}\right| - \frac{1}{2}\log\left(\frac{3}{4}\right)$$

Which is required particular solution.

Q.No. 13 $\cos\left(\frac{dy}{dx}\right) = a \ (a \in R)$; $y = 2$ when $x = 0$

Soln: The given diff. eqn is $\cos\frac{dy}{dx} = a$

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

or $dy = \cos^{-1}a\,dx$

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

$\Rightarrow y = \cos^{-1}a \cdot x + C \quad \text{---(1)}$

Now When $x=0$ $y=2$

$\Rightarrow$ $2 = c$ ...(2)

$\therefore$ From (1) and (2) $y = x\cos^{-1}a + 2$

or $\cos\left(\frac{y-2}{x}\right) = a.$

Q No 14 $\frac{dy}{dx} = y\tan x$; $y=1$ when $x=0$

Sol. Given diff eqn is $\frac{dy}{dx} = y\tan x.$

$\Rightarrow \frac{dy}{y} = \tan x\, dx.$

$\Rightarrow \int \frac{1}{y}\, dy = \int \tan x \cdot dx.$

$\Rightarrow \log|y| = -\log|\cos x| + C \Rightarrow \log|y\cos x| = C \Rightarrow y\cos x = \pm e^{C} = C'$ (say)

Now When $x=0$, $y=1$

$1 \cdot \cos 0 = C' \Rightarrow C' = 1$

$\therefore$ $y\cos x = 1$ which is required particular soln.

Q No. 15 find the equation of curve passing through the point $(0,0)$ and whose diff eqn $y' = e^x \sin x$.

Sol. Given differentl. eqn. is $\frac{dy}{dx} = e^x \sin x$

$\Rightarrow dy = e^x \sin x\, dx$

$\Rightarrow \int dy = \int e^x \sin x \cdot dx \Rightarrow y = \int e^x \sin x\, dx$ ...(1)

$\Rightarrow y = e^x[-\cos x] - \int\left(\frac{d}{dx}(e^x)(-\cos x)\right)dx$. [Integrating by Parts taking e^x as first fn]

$= -e^x\cos x + \left[e^x \sin x - \int e^x \sin x\, dx\right]$ [again "]

$y = e^x[\sin x - \cos x] - y + c'$ [from (1)]

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

$\Rightarrow y = \frac{1}{2}e^x[\sin x - \cos x] + C$ [where $C = c'/2$]

As $(0,0)$ lies on curve

$\therefore$ $0 = \frac{1}{2}e^0[\sin 0 - \cos 0] \Rightarrow C = \frac{1}{2}.$

$\therefore\ y = \frac{1}{2}e^x[\sin x - \cos x] + \frac{1}{2}$ which is required soln.

Q No. 16. For the differential eqn. $xy\frac{dy}{dx} = (x+2)(y+2)$, find the soln. curve passing through point $(1,-1)$

Sol. Given diff. eqn is $xy\frac{dy}{dx} = (x+2)(y+2)$ .... (1)

$$\Rightarrow \frac{y}{y+2}dy = \frac{x+2}{x}dx.$$

$$\Rightarrow \frac{y+2-2}{y+2}dy = \left(1+\frac{2}{x}\right)\cdot dx$$

$$\Rightarrow \left(1-\frac{2}{y+2}\right)dy = \left(1+2\cdot\frac{1}{x}\right)dx$$

$$\Rightarrow \int 1\cdot dy - 2\int\frac{1}{y+2}dy = \int 1\,dx + 2\int\frac{1}{x}dx$$

$$\Rightarrow y - 2\log|y+2| = x + 2\log|x| + c \quad \text{.... (2)}$$

But $(1,-1)$ lies on this curve.

$$\therefore\ -1 - 2\log|-1+2| = 1 + 2\log|1| + c$$

$$\Rightarrow c = -2 \quad [\because \log 1 = 0]$$

$\therefore$ from (2)

$$y - 2\log|y+2| = x + 2\log|x| - 2$$

or $$y - x = 2\log|(x)(y+2)| - 2.$$

Q No 17. Find the eqn of a curve passing through the point $(0,-2)$ given that at any point (x,y) on the curve the product of slope of its tangent and y-coordinate of the point is equal to the x-coordinate of point.

Soln. We are given $y\frac{dy}{dx} = x$. $\left[\because \text{slope of tangent at } (x,y) = \frac{dy}{dx}\right]$

$$\Rightarrow y\,dy = x\,dx.$$

$$\Rightarrow \int y\,dy = \int x\,dx + c$$

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

Since $(0,-2)$ lies on curve.

$$\therefore \frac{(-2)^2}{2} = 0 + C \Rightarrow C = \frac{4}{2} = 2.$$

$$\therefore \frac{y^2}{2} = \frac{x^2}{2} + 2 \quad \text{or} \quad x^2 - y^2 + 4 = 0$$

Q.No. 18 At any point (x,y) of a curve, the slope of tangent is twice the slope of line segment joining the point of contact to the point $(-4,-3)$. find the eqn of curve given that it passes through $(-2,1)$

Sol. Slope of segment of line joining (x,y) and $(-4,-3)$

$$= \frac{y-(-3)}{x-(-4)} = \frac{y+3}{x+4}.$$

ATQ $$\frac{dy}{dx} = 2\left(\frac{y+3}{x+4}\right) \quad \text{.....(1)}$$

$$\Rightarrow \frac{dy}{y+3} = \frac{2}{x+4}\,dx.$$

$$\Rightarrow \int \frac{1}{y+3}\,dy = 2\int \frac{1}{x+4}\,dx$$

$$\Rightarrow \log|y+3| = 2\log|x+4| + c.$$

$$\Rightarrow \log\left|\frac{y+3}{(x+4)^2}\right| = c \Rightarrow \left|\frac{y+3}{(x+4)^2}\right| = e^c$$

$$\Rightarrow \frac{y+3}{(x+4)^2} = \pm e^c = c' \ (\text{say}) \ \text{....}$$

$$\Rightarrow y+3 = c'(x+4)^2 \quad \text{.....(2)}$$

As $(-2,1)$ lies on the curve.

$$\therefore 1+3 = c'(-2+4)^2$$

$$\Rightarrow 4 = 4c' \Rightarrow c' = 1$$

$$\therefore \text{From (2)} \quad y+3 = (x+4)^2.$$

Q.No. 19 The volume of spherical balloon being inflated changes at a constant rate. If initially its radius is 3 units and after 3 seconds it is 6 units. Find radius of balloon after 't' seconds.

Sol. Let radius of the balloon at time 't' seconds be 'r'.

then $$\frac{d}{dt}(\text{Volume}) = \text{Costant.}$$

$\Rightarrow \frac{d}{dt}\left(\frac{4}{3}\pi r^3\right) = k \text{ (say)}$

$\Rightarrow \frac{4}{3}\pi \cdot 3r^2 \frac{dr}{dt} = k$

$\Rightarrow 4\pi r^2 dr = k\,dt \quad \text{------ (1)}$

$\Rightarrow 4\pi \int r^2 dr = k\int dt + c$

$\Rightarrow 4\pi \frac{r^3}{3} = kt + c \quad \text{......... (2)}$

When $t=0$, $r=3$

$\therefore$ from (2), $4\pi \frac{3^3}{3} = k(0) + c$

$\therefore$ from (2) and (3)

$\frac{4\pi}{3}(r^3) = kt + 36\pi \quad \cdots (3)$

Also when $t=3$, $r=6$

$\therefore \frac{4\pi}{3}(6)^3 = 3k + 36\pi \quad$ (from (3))

$\Rightarrow 3k = 288\pi - 36\pi$

$\Rightarrow k = \frac{252\pi}{3} = 84\pi$

$\therefore$ From (3) we get

$\frac{4\pi}{3} r^3 = 84\pi t + 36\pi$

or $r^3 = \frac{3}{4\pi}(84\pi t + 36\pi) = 63t + 27$

$\therefore r = (63t+27)^{1/3}$ or $[9(7t+3)]^{1/3}$

Q No 20 In a bank, Principal increases continuously at the rate of r% per year. Find the value of 'r' if Rs 100 double itself in 10 years ($\log_e 2 = 0.6931$)

Sol: Given that principal increases at rate of r% per annum.
Let P be the principal at the end of t years.

Then $\frac{dP}{dt} = r\%$ of $P = \frac{rP}{100}$

$\Rightarrow \frac{dP}{P} = \frac{r}{100}\,dt$

$$\Rightarrow \log P = \frac{r}{100} t + c.$$

$$\Rightarrow \log P = \frac{rt}{100} + c \quad \cdots\cdots (1)$$

When $t = 0$, Let $P = P_0$ then

$$\log P_0 = 0 + c \Rightarrow c = \log P_0$$

$$\therefore \quad \log P = \frac{r}{100} t + \log P_0$$

$$\Rightarrow \log P - \log P_0 = \frac{r}{100} t \quad \Rightarrow \log \frac{P}{P_0} = \frac{r}{100} t \quad \cdots\cdots (2)$$

When $t = 10$, $P = 2P_0$

$$\Rightarrow \log 2 = \frac{r(10)}{100}$$

$$\Rightarrow r = 10 \log 2 = 10 \times 0.6931 \Rightarrow r = 6.931$$

Q.No. 21 In a bank, principal increases continuously at rate of 5% per year. An amount of Rs 1000 is deposited with the bank, How much will it worth after 10 years. ($e^{0.5} = 1.648$)

Sol. ATQ (According to question) $\frac{dP}{dt} = \frac{5}{100} P$

where P is amount at end of t years.

$$\Rightarrow \frac{dP}{P} = \frac{1}{20} dt \Rightarrow \int \frac{dP}{P} = \int \frac{1}{20} dt + c$$

$$\Rightarrow \log P = \frac{1}{20} t + c \quad \cdots\cdots (1)$$

When $t = 0$, $P = 1000$

$$\Rightarrow \log 1000 = \frac{1}{20} \times 0 + c \quad \Rightarrow c = \log 1000$$

$\therefore$ (1) becomes $\log P = \frac{1}{20} t + \log 1000$

$$\Rightarrow \log \frac{P}{1000} = \frac{1}{20} t.$$

When $t = 10$ then.

$$\log \frac{P}{1000} = \frac{1}{20} \times 10 = \frac{1}{2}.$$

$$\Rightarrow \frac{P}{1000} = e^{1/2} \Rightarrow P = 1000 \times e^{1/2} = 1000 \times 1.648$$

$$\Rightarrow P = 1648$$

QNo 22. In a culture, the bacteria count is 100000. The number is increased by 10% in 2 hours. In how many hours will the count reach 2,00,000, if the rate of growth of bacteria is proportional to the number present.?

Sol. Let P be the count of the bacteria at the end of t hours.

Then $\frac{dP}{dt} \propto P \Rightarrow \frac{dP}{dt} = kP$

Where k is constant of proportionality.

$\Rightarrow \frac{dP}{P} = k\,dt$

$\Rightarrow \int \frac{dP}{P} = k\int dt + C$

$\Rightarrow \log P = kt + C$ ....(1)

When $t = 0$, $P = 100000$

and When $t = 2$

$P = 100000 + \frac{10}{100}(100000) = 110000$

$\therefore \log 100000 = C$ ....(2)

and $\log 110000 = 2k + C$ ...(3)

Subtracting (2) from (3), We get

$\log \frac{110000}{100000} = 2k \Rightarrow k = \frac{1}{2}\log(1.1)$

$\therefore$ from (1)

$\log P = \frac{1}{2}\log(1.1)\,t + \log 100000$

When $P = 200000$

$\log 200000 = \frac{1}{2}\log(1.1)t + \log 100000$

$\Rightarrow 2\log\left(\frac{200000}{100000}\right) = \log(1.1)\,t$

$\Rightarrow t = \frac{2\log 2}{\log 1.1} = 2\cdot\log_{1.1} 2 = \frac{2\log_{10} 2}{2\log_{10}(1.1)}$

$\Rightarrow t = \frac{2 \times 0.3010}{0.0414} \approx 14.545$

Q.No. 23 The general Soln. of differential equation $\frac{dy}{dx} = e^{x+y}$ is

(A) $e^{x} + e^{-y} = c$ (B) $e^{x} + e^{y} = c$ (C) $e^{-x} + e^{y} = c$ (D) $e^{-x} + e^{-y} = c$

Sol : Given $\frac{dy}{dx} = e^{x+y} = e^{x} \cdot e^{y}$

$\Rightarrow \quad \frac{dy}{e^{y}} = e^{x}\,dx.$

$\Rightarrow \quad \int e^{-y}\,dy = \int e^{x}\,dx.$

$\Rightarrow \quad \frac{e^{-y}}{-1} = e^{x} + c'$

$\Rightarrow \quad e^{x} + e^{-y} = -c' = c \text{ (say)}$

$\therefore$ option (A) is correct option.

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Prepared by :
Rupinder Kaur.
Lect. Maths.
GSSS BHARI (FGS)