Solution of differential equation $(x^2-2x+2y^2)\,dx+2xy\,dy=0$ is

(a) $y^2 = 2x - \frac{1}{4}x^2 + \frac{c}{x^2}$

(b) $y^2 = \frac{2}{3}x - x^2 + \frac{c}{x^2}$

(c) $y^2 = \frac{2}{3}x - \frac{x^2}{4} + \frac{c}{x^2}$

(d) None of these

$\frac{dy}{dx} + Py = Q$ I.F.

$\frac{dy}{dx} = -\frac{[x^2 - 2x + 2y^2]}{2xy}$ Homogen.

Divide by dx

$\Rightarrow x^2 - 2x + 2y^2 + 2xy\frac{dy}{dx} = 0$

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

$\Rightarrow$ Let $y^2 = t \rightarrow \boxed{2y\cdot\frac{dy}{dx} = \frac{dt}{dx}}$

$\rightarrow x\cdot\frac{dt}{dx} + 2t = 2x - x^2$

$\boxed{\frac{dt}{dx} + \left(\frac{2}{x}\right)t = 2 - x}$ linear D eq.

$\rightarrow P = 2/x,\ Q = 2 - x$

$I.F. = e^{\int \frac{2}{x}\cdot dx} = e^{2\log x}$

$I.F. = e^{\log x^2} = x^2$

$I.F = x^2$ $\quad y^2 = t$

$Q = 2-x$ $\quad$ ~~yeah~~

Now sol^n :-

$\Rightarrow t \times I.F = \int (2-x) \cdot x^2 \cdot dx + C$

$\Rightarrow t \cdot x^2 = \int 2x^2 \cdot dx - \int x^3 \cdot dx + C$

$\Rightarrow \underline{t} \cdot x^2 = \frac{2x^3}{3} - \frac{x^4}{4} + C$

$\Rightarrow \underline{y^2} x^2 = \frac{2x^3}{3} - \frac{x^4}{4} + C$

$\Rightarrow y^2 = \frac{2}{3}x - \frac{x^2}{4} + \frac{C}{x^2}$ Ans

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The particular solution of $\log \frac{dy}{dx} = 3x + 4y$, $\boxed{y(0) = 0}$ is

$\Rightarrow -\frac{1}{4}e^{-4y} = \frac{e^{3x}}{3} - \frac{7}{12}$

$\Rightarrow -3e^{-4y} = 4e^{3x} - 7$

(a) $e^{3x} + 3e^{-4y} = 4$ (b) $4e^{3x} - 3^{-4y} = 3$

(c) $3e^{3x} + 4e^{4y} = 7$ (d) $4e^{3x} + 3e^{-4y} = 7$

Sol^n:- $\frac{dy}{dx} = e^{3x+4y} = e^{3x}e^{4y}$

$\frac{dy}{e^{4y}} = e^{3x}.dx \Rightarrow \int e^{-4y}.dy = \int e^{3x}.dx$

$\Rightarrow \frac{e^{-4y}}{-4} = \frac{e^{3x}}{3} + C \Rightarrow \frac{-1}{4} = \frac{1}{3} + C \Rightarrow C = \frac{-3-4}{12} = \frac{-7}{12}$

The solution of the equation

$$\frac{dy}{dx} = \frac{3x - 4y - 2}{3x - 4y - 3} \text{ is}$$

Homogenous :- ?

Let $3x - 4y = t$

$3 - 4\frac{dy}{dx} = \frac{dt}{dx}$

$\frac{dy}{dx} = \frac{1}{4}\left(3 - \frac{dt}{dx}\right)$

(a) $(x - y^2) + c = \log(3x - 4y + 1)$

(b) $x - y + c = \log(3x - 4y + 4)$

(c) $(x - y + c) = \log(3x - 4y - 3)$

(d) $x - y + c = \log(3x - 4y + 1)$

$\frac{1}{4}\left[3 - \frac{dt}{dx}\right] = \frac{t-2}{t-3} \Rightarrow \frac{3}{4} - \frac{1}{4}\frac{dt}{dx} = \frac{t-2}{t-3}$

$\frac{3}{4} - \frac{t-2}{t-3} = \frac{1}{4}\cdot\frac{dt}{dx} \Rightarrow \frac{3t-9-4t+8}{4(t-3)} = \frac{1}{4}\cdot\frac{dt}{dx}$

$\frac{-t-1}{t-3} = \frac{dt}{dx}$

$\int \frac{t-3}{t+1} = \int -dx$

$\int \frac{t+1}{t+1}dt - \int \frac{4}{t+1}dt = -x + c$

$t - 4\log|t+1| = -x + c$

$\Rightarrow 3x - 4y - 4\log(3x - 4y + 1) = -x + c$

$-4\log(3x - 4y + 1) = -4x + 4y + c$

$x - y + c$

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The order and degree of the differential equation

$$y = x\frac{dy}{dx} + \sqrt{a^2\left(\frac{dy}{dx}\right)^2 + b^2}$$ is

$\frac{dy}{dx}$

$y^2 = x^2 \cdot \left(\frac{dy}{dx}\right)^2 + a^2 \cdot \left(\frac{dy}{dx}\right)^2 + b^2$

(a) order = 1, degree = 2

(c) order = 2, degree = 2

(b) order = 2, degree = 1

(d) None of these

The equation of a curve whose tangent at any point on it different from origin has slope $y + \dfrac{y}{x}$, is

(a) $y = e^x$

(b) $y = kx.\ e^x$

(c) $y = kx$

(d) $y = k.\ e^{x^2}$

$$\frac{dy}{dx} = y + y/x = y\left(1 + \frac{1}{x}\right) \quad \int \frac{dy}{y} = \int dx\left(1 + \frac{1}{x}\right)$$

$$\rightarrow \log y = x + \log x + \log C \rightarrow y = e^{(x + \log x + \log C)}$$

$$\rightarrow y = e^x * e^{\log x} * e^{\log C} \Rightarrow y = e^x \cdot x \cdot K$$

Which of the following is/are first order linear differential equation?

(a) $\frac{dy}{dx} + y = \sin x$

(b) $\frac{dy}{dx} + \left(\frac{1}{x}\right) y = e^x$

(c) $\frac{dy}{dx} + \left(\frac{y}{x \log x}\right) = \frac{1}{x}$

(d) All the above

Q. $\frac{dy}{dx} + Py = Q$

$\frac{dx}{dy} + Px = Q$

In order to solve the differential equation

$$x \cos x \frac{dy}{dx} + y(x \sin x + \cos x) = 1$$

the integrating factor is:

(a) $x \cos x$ ~~(b)~~ $x \sec x$

(c) $x \sin x$ (d) $x \operatorname{cosec} x$

$\frac{dy}{dx} + Py = Q$, $e^{\int P\,dx}$

$\frac{dy}{dx} + \boxed{\left(\tan x + \frac{1}{x}\right)} y = \boxed{\frac{1}{x \cos x}}$

$e^{\int\left(\tan x + \frac{1}{x}\right).dx} = e^{\log \sec x + \log x} = e^{\log(\sec x \, x)}$

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If $x\dfrac{dy}{dx} = y(\log y - \log x + 1)$, then the solution of the equation is

(a) $y\log\left(\dfrac{x}{y}\right) = cx$ (b) $x\log\left(\dfrac{y}{x}\right) = cy$

(c) $\log\left(\dfrac{y}{x}\right) = cx$ (d) $\log\left(\dfrac{x}{y}\right) = cy$

$\dfrac{y}{x}\left[\log\left(\dfrac{y}{x}\right) + 1\right] \to$ Homog.

$\to v \cdot [\log v + 1] = v + x \cdot \dfrac{dv}{dx}$

$\to v\log v + \cancel{v} = \cancel{v} + x \cdot \dfrac{dv}{dx}$

$\to \displaystyle\int \dfrac{dv}{v\log v} = \int \dfrac{dx}{x}$

$\to \log v = t \to \dfrac{1}{v} \cdot dv = dt$

$\to \displaystyle\int \dfrac{1}{t} \cdot dt = \int \dfrac{dx}{x}$

$\log t = \log x + \log c$

$t = cx = \log v$

$cx = \log\left(y/x\right)$

$\left[\dfrac{dy}{dx} = \dfrac{y}{x}(\log y - \log x + 1)\right] \to \boxed{y = vx} \to v = y/x$

$\dfrac{dy}{dx} = v + x \cdot \dfrac{dv}{dx}$

If $y = e^x(\sin x + \cos x)$, then the value of $\dfrac{d^2y}{dx^2} - 2\dfrac{dy}{dx} + 2y$, is

(a) 0

(b) 1

(c) 2

(d) 3

$$\frac{dy}{dx} = e^x(\cos x - \sin x) + (\sin x + \cos x)\cdot e^x$$

$$\frac{dy}{dx} = e^x(\cos x - \sin x) + y$$

$$\frac{d^2y}{dx^2} = e^x(-\sin x - \cos x) + \frac{dy}{dx} + (\cos x - \sin x)e^x$$

$$\frac{d^2y}{dx^2} = -e^x(\sin x + \cos x) + \frac{dy}{dx} + \frac{dy}{dx} - y$$

$$\frac{d^2y}{dx^2} = -y + 2\frac{dy}{dx} - y$$

For the function $y = Bx^2$ to be the solution of differential equation

$$\left(\frac{dy}{dx}\right)^3 - 15x^2\frac{dy}{dx} - 2xy = 0,$$

the value of B is ______________, given that $B \neq 0$.

(a) 2 (b) 4

(c) 6 (d) 8

$\frac{dy}{dx} = B2x$

$(2Bx)^3 - 15x^2(2Bx) - 2xBx^2 = 0$

$8B^3x^3 - 30Bx^3 - 2Bx^3 = 0$

$8B^{\cancel{3}2}\cancel{x^3} = 32\cancel{B}\cancel{x^3}$

$8B^2 = 32 \rightarrow 4$

$B = \pm 2$

Q. Find vector in Direction of $5\hat{i} - \hat{j} + 2\hat{k}$ which has mag 8 unit

$\vec{a}$

#1 unit vector $\rightarrow$ $\hat{a} = \dfrac{\vec{a}}{|\vec{a}|} = \dfrac{5\hat{i} - \hat{j} + 2\hat{k}}{\sqrt{25+1+4}}$

$\hat{a} = \dfrac{5\hat{i} - \hat{j} + 2\hat{k}}{\sqrt{30}}$

So mag 8 unit $\Rightarrow$ $8 \times \hat{a} = \dfrac{40\hat{i} - 8\hat{j} + 16\hat{k}}{\sqrt{30}}$

1	2	3	4	5	6	7	8	9	10
C	D	D	A	B	D	B	C	A	A