



Exercise 9.2 : Solutions of Questions on Page Number : 385

Q1 : $y = e^x + 1$: $y'' - y' = 0$

Answer :

$$y = e^x + 1$$

Differentiating both sides of this equation with respect to x , we get:

$$\begin{aligned}\frac{dy}{dx} &= \frac{d}{dx}(e^x + 1) \\ \Rightarrow y' &= e^x \quad \dots(1)\end{aligned}$$

Now, differentiating equation (1) with respect to x , we get:

$$\begin{aligned}\frac{d}{dx}(y') &= \frac{d}{dx}(e^x) \\ \Rightarrow y'' &= e^x\end{aligned}$$

Substituting the values of y' and y'' in the given differential equation, we get the L.H.S. as:

$$y'' - y' = e^x - e^x = 0 = \text{R.H.S.}$$

Thus, the given function is the solution of the corresponding differential equation.

Answer needs Correction? [Click Here](#)

Q2 : $y = x^2 + 2x + C$: $y' - 2x - 2 = 0$

Answer :

$$y = x^2 + 2x + C$$

Differentiating both sides of this equation with respect to x , we get:

$$\begin{aligned}y' &= \frac{d}{dx}(x^2 + 2x + C) \\ \Rightarrow y' &= 2x + 2\end{aligned}$$

Substituting the value of y' in the given differential equation, we get:

$$\text{L.H.S.} = y' - 2x - 2 = 2x + 2 - 2x - 2 = 0 = \text{R.H.S.}$$

Hence, the given function is the solution of the corresponding differential equation.

Answer needs Correction? [Click Here](#)

Q3 : $y = \cos x + C$: $y' + \sin x = 0$

Answer :

$$y = \cos x + C$$

Differentiating both sides of this equation with respect to x , we get:

$$\begin{aligned}y' &= \frac{d}{dx}(\cos x + C) \\ \Rightarrow y' &= -\sin x\end{aligned}$$

Substituting the value of y' in the given differential equation, we get:

$$\text{L.H.S.} = y' + \sin x = -\sin x + \sin x = 0 = \text{R.H.S.}$$

Hence, the given function is the solution of the corresponding differential equation.

Answer needs Correction? [Click Here](#)

Q4 : $y = \sqrt{1+x^2}$: $y' = \frac{xy}{1+x^2}$

Answer :

$$y = \sqrt{1+x^2}$$

Differentiating both sides of the equation with respect to x , we get:

$$\begin{aligned}y' &= \frac{d}{dx}(\sqrt{1+x^2}) \\ y' &= \frac{1}{2\sqrt{1+x^2}} \cdot \frac{d}{dx}(1+x^2) \\ y' &= \frac{2x}{2\sqrt{1+x^2}} \\ y' &= \frac{x}{\sqrt{1+x^2}}\end{aligned}$$

$$\begin{aligned} & \sqrt{1+x^2} \\ \Rightarrow y' &= \frac{x}{1+x^2} \times \sqrt{1+x^2} \\ \Rightarrow y' &= \frac{x}{1+x^2} \cdot y \\ \Rightarrow y' &= \frac{xy}{1+x^2} \end{aligned}$$

\therefore L.H.S. = R.H.S.

Hence, the given function is the solution of the corresponding differential equation.

Answer needs Correction? [Click Here](#)

Q5: $y = Ax$: $xy' = y(x \neq 0)$

Answer :

$$y = Ax$$

Differentiating both sides with respect to x , we get:

$$\begin{aligned} y' &= \frac{d}{dx}(Ax) \\ \Rightarrow y' &= A \end{aligned}$$

Substituting the value of y' in the given differential equation, we get:

$$\text{L.H.S.} = xy' = x \cdot A = Ax = y = \text{R.H.S.}$$

Hence, the given function is the solution of the corresponding differential equation.

Answer needs Correction? [Click Here](#)

Q6: $y = x \sin x$: $xy' = y + x\sqrt{x^2 - y^2}$ ($x \neq 0$ and $x > y$ or $x < -y$)

Answer :

$$y = x \sin x$$

Differentiating both sides of this equation with respect to x , we get:

$$\begin{aligned} y' &= \frac{d}{dx}(x \sin x) \\ \Rightarrow y' &= \sin x \cdot \frac{d}{dx}(x) + x \cdot \frac{d}{dx}(\sin x) \\ \Rightarrow y' &= \sin x + x \cos x \end{aligned}$$

Substituting the value of y' in the given differential equation, we get:

$$\begin{aligned} \text{L.H.S.} &= xy' = x(\sin x + x \cos x) \\ &= x \sin x + x^2 \cos x \\ &= y + x^2 \cdot \sqrt{1 - \sin^2 x} \\ &= y + x^2 \sqrt{1 - \left(\frac{y}{x}\right)^2} \\ &= y + x \sqrt{y^2 - x^2} \\ &= \text{R.H.S.} \end{aligned}$$

Hence, the given function is the solution of the corresponding differential equation.

Answer needs Correction? [Click Here](#)

Q7: $xy = \log y + C$: $y' = \frac{y^2}{1-xy}$ ($xy \neq 1$)

Answer :

$$xy = \log y + C$$

Differentiating both sides of this equation with respect to x , we get:

$$\begin{aligned} \frac{d}{dx}(xy) &= \frac{d}{dx}(\log y) \\ \Rightarrow y \cdot \frac{d}{dx}(x) + x \cdot \frac{dy}{dx} &= \frac{1}{y} \frac{dy}{dx} \\ \Rightarrow y + xy' &= \frac{1}{y} y' \\ \Rightarrow y^2 + xy y' &= y' \\ \Rightarrow (xy - 1) y' &= -y^2 \\ \Rightarrow y' &= \frac{-y^2}{1-xy} \end{aligned}$$

\therefore L.H.S. = R.H.S.

Hence, the given function is the solution of the corresponding differential equation.

Answer needs Correction? [Click Here](#)

Q8: $y - \cos y = x$: $(y \sin y + \cos y + x) y' = y$

Answer :

$$y - \cos y = x \quad \dots(1)$$

Differentiating both sides of the equation with respect to x , we get:

$$\begin{aligned}\frac{dy}{dx} - \frac{d}{dx}(\cos y) &= \frac{d}{dx}(x) \\ \Rightarrow y' + \sin y \cdot y' &= 1 \\ \Rightarrow y'(1 + \sin y) &= 1 \\ \Rightarrow y' &= \frac{1}{1 + \sin y}\end{aligned}$$

Substituting the value of y' in equation (1), we get:

$$\begin{aligned}\text{L.H.S.} &= (y \sin y + \cos y + x) y' \\ &= (y \sin y + \cos y + y - \cos y) \times \frac{1}{1 + \sin y} \\ &= y(1 + \sin y) \cdot \frac{1}{1 + \sin y} \\ &= y \\ &= \text{R.H.S.}\end{aligned}$$

Hence, the given function is the solution of the corresponding differential equation.

Answer needs Correction? [Click Here](#)

Q9 : $x + y = \tan^{-1} y$: $y^2 y' + y^2 + 1 = 0$

Answer :

$$x + y = \tan^{-1} y$$

Differentiating both sides of this equation with respect to x , we get:

$$\begin{aligned}\frac{d}{dx}(x + y) &= \frac{d}{dx}(\tan^{-1} y) \\ \Rightarrow 1 + y' &= \left[\frac{1}{1 + y^2} \right] y' \\ \Rightarrow y' \left[\frac{1}{1 + y^2} - 1 \right] &= -1 \\ \Rightarrow y' \left[\frac{1 - (1 + y^2)}{1 + y^2} \right] &= -1 \\ \Rightarrow y' \left[\frac{-y^2}{1 + y^2} \right] &= -1 \\ \Rightarrow y' &= \frac{-(1 + y^2)}{y^2}\end{aligned}$$

Substituting the value of y' in the given differential equation, we get:

$$\begin{aligned}\text{L.H.S.} &= y^2 y' + y^2 + 1 = y^2 \left[\frac{-(1 + y^2)}{y^2} \right] + y^2 + 1 \\ &= -1 - y^2 + y^2 + 1 \\ &= 0 \\ &= \text{R.H.S.}\end{aligned}$$

Hence, the given function is the solution of the corresponding differential equation.

Answer needs Correction? [Click Here](#)

Q10 : $y = \sqrt{a^2 - x^2}$, $x \in (-a, a)$: $x + y \frac{dy}{dx} = 0$ ($y \neq 0$)

Answer :

$$y = \sqrt{a^2 - x^2}$$

Differentiating both sides of this equation with respect to x , we get:

$$\begin{aligned}\frac{dy}{dx} &= \frac{d}{dx}(\sqrt{a^2 - x^2}) \\ \Rightarrow \frac{dy}{dx} &= \frac{1}{2\sqrt{a^2 - x^2}} \cdot \frac{d}{dx}(a^2 - x^2) \\ &= \frac{1}{2\sqrt{a^2 - x^2}} (-2x) \\ &= \frac{-x}{\sqrt{a^2 - x^2}}\end{aligned}$$

Substituting the value of $\frac{dy}{dx}$ in the given differential equation, we get:

$$\begin{aligned}\text{L.H.S.} &= x + y \frac{dy}{dx} = x + \sqrt{a^2 - x^2} \times \frac{-x}{\sqrt{a^2 - x^2}} \\ &= x - x \\ &= 0 \\ &= \text{R.H.S.}\end{aligned}$$

Hence, the given function is the solution of the corresponding differential equation.

Answer needs Correction? [Click Here](#)

Q11 : The numbers of arbitrary constants in the general solution of a differential equation of fourth order are:

(A) 0 (B) 2 (C) 3 (D) 4

Answer :

We know that the number of constants in the general solution of a differential equation of order n

we know that the number of constants in the general solution of a differential equation of order n is equal to its order.

Therefore, the number of constants in the general equation of fourth order differential equation is four.

Hence, the correct answer is D.

Answer needs Correction? [Click Here](#)

Q12 : The numbers of arbitrary constants in the particular solution of a differential equation of third order are:

(A) 3 (B) 2 (C) 1 (D) 0

Answer :

In a particular solution of a differential equation, there are no arbitrary constants.

Hence, the correct answer is D.

Answer needs Correction? [Click Here](#)

***** END *****