NCERT Solutions for Class-XII Maths

Chapter-9.2

NCERT Math Class 12

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

1. $y = e^x + 1$

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

2. It is given that $y = x^2 + 2x + C$

Now, differentiating both sides w.r.t. x, we get,

$y' = \frac{d}{dx}(x^2 + 2x + C)$

$\Rightarrow y' = 2x + 2$

Now, Substituting the values of y' in the given differential equations, we get, $y' - 2x - 2 = 2x + 2 - 2x - 2 = 0 =$ RHS.

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

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

3. $y = \cos x + C$

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

$y' = \frac{d}{dx}(\cos x + C)$

$\Rightarrow y' = -\sin x$

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.

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

4. It is given that $y = \sqrt{1 + x^2}$

Now, differentiating both sides w.r.t. x, we get,

$y' = \frac{d}{dx}(\sqrt{1 + x^2})$

$\Rightarrow y' = \frac{1}{2\sqrt{1+x^2}} \cdot \frac{d}{dx}(1 + x^2)$

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

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

$\Longrightarrow y' = \frac{x}{1+x^2} \times \sqrt{1+x^2}$

$\Longrightarrow y' = \frac{x}{1+x^2} . y$

$\Longrightarrow y' = \frac{xy}{1+x^2}$

Therefore, LHS = RHS

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

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

5. $y = Ax$

Differentiating both sides with respect to x, we get:

$y' = \frac{d}{dx}(Ax)$

$\Rightarrow y' = A$

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.

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

6. It is given that y = xsinx

Now, differentiating both sides w.r.t. x, we get,

$y' = \frac{d}{dx}(x\sin x)$

$\Longrightarrow y' = \sin x \frac{d}{dx}(x) + x . \frac{d}{dx}(\sin x)$

$\Rightarrow$ y' = sinx + xcosx

Now, Substituting the values of y' in the given differential equations, we get,

LHS = xy' = x(sinx + xcosx)

$= x\sin x + x^2\cos x$

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

$= y + x^2\sqrt{1 - \left(\frac{y}{x}\right)^2}$

$= y + x\sqrt{(y)^2 - (x)^2}$

= RHS

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

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

7. $xy = \log y + C$

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

$$\frac{d}{dx}(xy)=\frac{d}{dx}(\log y)$$

$$\Rightarrow y.\frac{d}{dx}(x)+x.\frac{dy}{dx}=\frac{1}{y}\frac{dy}{dx}$$

$$\Rightarrow y+xy'=\frac{1}{y}y'$$

$$\Rightarrow y^2+xy\,y'=y'$$

$$\Rightarrow (xy-1)y'=-y^2$$

$$\Rightarrow y'=\frac{y^2}{1-xy}$$

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

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

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

8. It is given that y – cosy = x

Now, differentiating both sides w.r.t. x, we get,

$$\frac{dy}{dx}-\frac{d}{dx}\cos y=\frac{d}{dx}(x)$$

$$\Longrightarrow y'+\sin y . y'=1$$

$$\Rightarrow y'(1+\sin y)=1$$

$$\Rightarrow y'=\frac{1}{1+\sin y}$$

Now, Substituting the values of y' in the given differential equations, we get,

LHS = (ysiny + cosy + x)y'

$$=(y\sin y+\cos y+y-\cos y)\times\frac{1}{1+\sin y}$$

$$=y(1+\sin y)\times\frac{1}{1+\sin y}$$

= y = RHS

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

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

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

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

$$\frac{d}{dx}(x+y)=\frac{d}{dx}(\tan^{-1}y)$$

$$\Rightarrow 1+y'=\left[\frac{1}{1+y^2}\right]y'$$

$$\Rightarrow y'\left[\frac{1}{1+y^2}-1\right]=1$$

$$\Rightarrow y'\left[\frac{1-(1+y^2)}{1+y^2}\right]=1$$

$$\Rightarrow y'\left[\frac{-y^2}{1+y^2}\right]=1$$

$$\Rightarrow y'=\frac{-(1+y^2)}{y^2}$$

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

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

$$=-1-y^2+y^2+1$$

$$=0$$

$$=\text{R.H.S.}$$

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

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

10. It is given that $y=\sqrt{a^2-x^2}$

Now, differentiating both sides w.r.t. x, we get,

$$\frac{dy}{dx}=\frac{d}{dx}(\sqrt{a^2-x^2})$$

$$\Longrightarrow \frac{dy}{dx}=\frac{1}{2\sqrt{a^2-x^2}}.\frac{d}{dx}(a^2-x^2)$$

$$=\frac{1}{2\sqrt{a^2-x^2}}(-2x)$$

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

Now, Substituting the values of y’ in the given differential equations, we get,

$$\text{LHS} = x+y\frac{dy}{dx}$$

$$=x+\sqrt{a^2-x^2}\times\frac{-x}{2\sqrt{a^2-x^2}}$$

$= x - x = 0 =$ RHS.

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

11. 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

11. 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.

12. 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

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