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Class XII : Maths
Chapter 9 : Differential Equations

Questions and Solutions | Exercise 9.1 - NCERT Books

Question 1:

Determine order and degree(if defined) of differential equation $\dfrac{d^4y}{dx^4} + \sin(y''') = 0$

Answer

$$\dfrac{d^4y}{dx^4} + \sin(y''') = 0$$
$$\Rightarrow y'''' + \sin(y''') = 0$$

The highest order derivative present in the differential equation is y''''. Therefore, its order is four.

The given differential equation is not a polynomial equation in its derivatives. Hence, its degree is not defined.

Question 2:

Determine order and degree(if defined) of differential equation $y' + 5y = 0$

Answer

The given differential equation is:

$$y' + 5y = 0$$

The highest order derivative present in the differential equation is y'. Therefore, its order is one.

It is a polynomial equation in y'. The highest power raised to y' is 1. Hence, its degree is one.

Question 3:

Determine order and degree(if defined) of differential equation $\left(\dfrac{ds}{dt}\right)^4 + 3s\dfrac{d^2s}{dt^2} = 0$

Answer

$$\left(\dfrac{ds}{dt}\right)^4 + 3s\dfrac{d^2s}{dt^2} = 0$$

The highest order derivative present in the given differential equation is $\dfrac{d^2 s}{dt^2}$. Therefore, its order is two.

It is a polynomial equation in $\dfrac{d^2 s}{dt^2}$ and $\dfrac{ds}{dt}$. The power raised to $\dfrac{d^2 s}{dt^2}$ is 1. Hence, its degree is one.

Question 4:

Determine order and degree(if defined) of differential equation $\left(\dfrac{d^2 y}{dx^2}\right)^2 + \cos\left(\dfrac{dy}{dx}\right) = 0$

Answer

$$\left(\dfrac{d^2 y}{dx^2}\right)^2 + \cos\left(\dfrac{dy}{dx}\right) = 0$$

The highest order derivative present in the given differential equation is $\dfrac{d^2 y}{dx^2}$. Therefore, its order is 2.

The given differential equation is not a polynomial equation in its derivatives. Hence, its degree is not defined.

Question 5:

Determine order and degree(if defined) of differential equation $\dfrac{d^2 y}{dx^2} = \cos 3x + \sin 3x$

Answer

$$\dfrac{d^2 y}{dx^2} = \cos 3x + \sin 3x$$

$$\Rightarrow \dfrac{d^2 y}{dx^2} - \cos 3x - \sin 3x = 0$$

The highest order derivative present in the differential equation is $\dfrac{d^2 y}{dx^2}$. Therefore, its order is two.

It is a polynomial equation in $\dfrac{d^2y}{dx^2}$ and the power raised to $\dfrac{d^2y}{dx^2}$ is 1.

Hence, its degree is one.

Question 6:

Determine order and degree(if defined) of differential equation

$$\left(y'''\right)^2+\left(y''\right)^3+\left(y'\right)^4+y^5=0$$

Answer

$$\left(y'''\right)^2+\left(y''\right)^3+\left(y'\right)+y^5=0$$

The highest order derivative present in the differential equation is y'''. Therefore, its order is three.

The given differential equation is a polynomial equation in $y''',y'',\text{and } y'$.

The highest power raised to y''' is 2. Hence, its degree is 2.

Question 7:

Determine order and degree(if defined) of differential equation $y'''+2y''+y'=0$

Answer

$$y'''+2y''+y'=0$$

The highest order derivative present in the differential equation is y'''. Therefore, its order is three.

It is a polynomial equation in y''',y'' and y'. The highest power raised to y''' is 1. Hence, its degree is 1.

Question 8:

Determine order and degree(if defined) of differential equation $y'+y=e^x$

Answer

$$y'+y=e^x$$
$$\Rightarrow y'+y-e^x=0$$

The highest order derivative present in the differential equation is y'. Therefore, its order is one.

The given differential equation is a polynomial equation in y' and the highest power raised to y' is one. Hence, its degree is one.

Question 9:

Determine order and degree(if defined) of differential equation $y'' + (y')^2 + 2y = 0$

Answer

$$y'' + (y')^2 + 2y = 0$$

The highest order derivative present in the differential equation is y''. Therefore, its order is two.

The given differential equation is a polynomial equation in y'' and y' and the highest power raised to y'' is one.
Hence, its degree is one.

Question 10:

Determine order and degree(if defined) of differential equation $y'' + 2y' + \sin y = 0$

Answer

$$y'' + 2y' + \sin y = 0$$

The highest order derivative present in the differential equation is y''. Therefore, its order is two.

This is a polynomial equation in y'' and y' and the highest power raised to y'' is one.
Hence, its degree is one.

Question 11:
The degree of the differential equation

$$\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + \sin\left(\frac{dy}{dx}\right) + 1 = 0 \text{ is}$$

(A) 3 **(B)** 2 **(C)** 1 **(D)** not defined

Answer

$$\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + \sin\left(\frac{dy}{dx}\right) + 1 = 0$$

The given differential equation is not a polynomial equation in its derivatives. Therefore,
its degree is not defined.

Hence, the correct answer is D.

Question 12:

The order of the differential equation

$$2x^2\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + y = 0$$ is

(A) 2 **(B)** 1 **(C)** 0 **(D)** not defined

Answer

$$2x^2\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + y = 0$$

The highest order derivative present in the given differential equation is $\frac{d^2y}{dx^2}$. Therefore,
its order is two.

Hence, the correct answer is A.