Exercise 9.1

Question 1:

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

Answer

$\frac{d^4y}{dx^4}+\sin\left(y'''\right)=0$

$\Rightarrow y''''+\sin\left(y'''\right)=0$

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

Answer

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

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

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

Question 4:

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

Answer

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

The highest order derivative present in the given differential equation is $\frac{d^2y}{dx^2}$. 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 $\frac{d^2y}{dx^2}=\cos 3x+\sin 3x$

Answer

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

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

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

It is a polynomial equation in $\frac{d^2y}{dx^2}$ and the power raised to $\frac{d^2y}{dx^2}$ is 1.
Hence, its degree is one.

Question 6:

Determine order and degree(if defined) of differential equation

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

Answer

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

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 $y''', y'' \text{ and } y'$. 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

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