

EXERCISE 22.1

Question. 1

Solution:

From the question it is given that,

$$\frac{d^3x}{dt^3} + \frac{d^2x}{dt^2} + \left(\frac{dx}{dt}\right)^2 = e^t$$

So, it is clear that the highest order of given differential coefficient is d^3x/dt^3 and then its power is 1.

The given differential equation is a non-linear with order 3 and degree 1.

Question. 2

Solution:

From the question it is given that,

$$\frac{d^2y}{dx^2} + 4y = 0$$

So, it is clear that the highest order of given differential coefficient is d^2y/dx^2 and then its power is 1.

The given differential equation is a linear with order 2 and degree 1.

Question. 3

Solution:

From the question it is given that,

$$\left(\frac{dy}{dx}\right)^2 + \frac{1}{\left(\frac{dy}{dx}\right)} = 2$$

By cross multiplication we get,

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

Transposing we get,

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

So, it is clear that the highest order of given differential coefficient is d^2y/dx^2 and then its power is 1.

The given differential equation is a linear with order 2 and degree 1.

Question. 4

Solution:

From the question it is given that,

$$\text{Differential equation, } \sqrt{1 + \left(\frac{dy}{dx}\right)^2} = \left(c \frac{d^2y}{dx^2}\right)^{\frac{1}{3}}$$

Now, squaring on both the side of differential equation we get,

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

Again cubing on both side of differential equation we get,

$$\left[1 + \left(\frac{dy}{dx}\right)^2\right]^3 = \left\{\left(c \frac{d^2y}{dx^2}\right)^{\frac{2}{3}}\right\}^3$$

Then,

$$1 + \left(\frac{dy}{dx}\right)^6 + 3\left(\frac{dy}{dx}\right)^2 + 3\left(\frac{dy}{dx}\right)^4 = c^2 \left(\frac{d^2y}{dx^2}\right)^2$$

By transposing we get,

$$c^2 \left(\frac{d^2y}{dx^2}\right)^2 - \left(\frac{dy}{dx}\right)^6 - 3\left(\frac{dy}{dx}\right)^4 - 3\left(\frac{dy}{dx}\right)^2 - 1 = 0$$

So, it is clear that the highest order of above differential equation is d^2y/dx^2 and then its power is 2.

The differential equation is a non-linear with order 2 and degree 2.

Question. 5

Solution:

From the question it is given that,

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

So, it is clear that the highest order of given differential coefficient is d^2y/dx^2 and then its power is 1.

The given differential equation is a non-linear with order 2 and degree 1.