

Question

Classify the following differential equations, i.e., state their order and degree. If one is first order, first degree, identify their type. Do NOT attempt to solve them.

(i) $\frac{dx}{dt} = kx$

(ii) $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = 10 \sin x$

(iii) $\left(\frac{dy}{dx}\right)^2 = x + y$

(iv) $\frac{d^3y}{dt^3} + \left(\frac{dy}{dt}\right)^2 = e^x$

(v) $\cos x \left(\frac{dy}{dx}\right)^6 + \sin x \left(\frac{d^2y}{dx^2}\right)^3 = 0$

(vi) $\left(\frac{d^5x}{dt^5}\right)^2 = x$

Answer

(i)

$$\begin{aligned} \frac{dx}{dt} \text{ is the highest derivative} &\Rightarrow \text{order} = 1 \\ \text{power of } \frac{dx}{dt} \text{ is } 1 &\Rightarrow \text{degree} = 1 \end{aligned}$$

$$\frac{dx}{dt} = kx \text{ is unvariable separable .}$$

(ii)

$$\begin{aligned} \frac{d^2y}{dx^2} \text{ is the highest derivative} &\Rightarrow \text{order} = 2 \\ \text{power of } \frac{d^2y}{dx^2} \text{ is } 1 &\Rightarrow \text{degree} = 1 \end{aligned}$$

(iii)

$$\begin{aligned} \frac{dy}{dx} \text{ is the highest derivative} &\Rightarrow \text{order} = 1 \\ \text{power of } \frac{dy}{dx} \text{ is } 2 &\Rightarrow \text{degree} = 2 \end{aligned}$$

(iv)

$$\begin{aligned} \frac{d^3y}{dt^3} \text{ is the highest derivative} &\Rightarrow \text{order} = 3 \\ \text{power of } \frac{d^3y}{dt^3} \text{ is } 1 &\Rightarrow \text{degree} = 1 \end{aligned}$$

(v)

$$\begin{aligned} \frac{d^2y}{dx^2} \text{ is the highest derivative} &\Rightarrow \text{order} = 2 \\ \text{power of } \frac{d^2y}{dx^2} \text{ is } 3 &\Rightarrow \text{degree} = 3 \end{aligned}$$

(vi)

$$\begin{aligned} \frac{d^5x}{dt^5} \text{ is the highest derivative} &\Rightarrow \text{order} = 5 \\ \text{power of } \frac{d^5x}{dt^5} \text{ is } 2 &\Rightarrow \text{degree} = 2 \end{aligned}$$