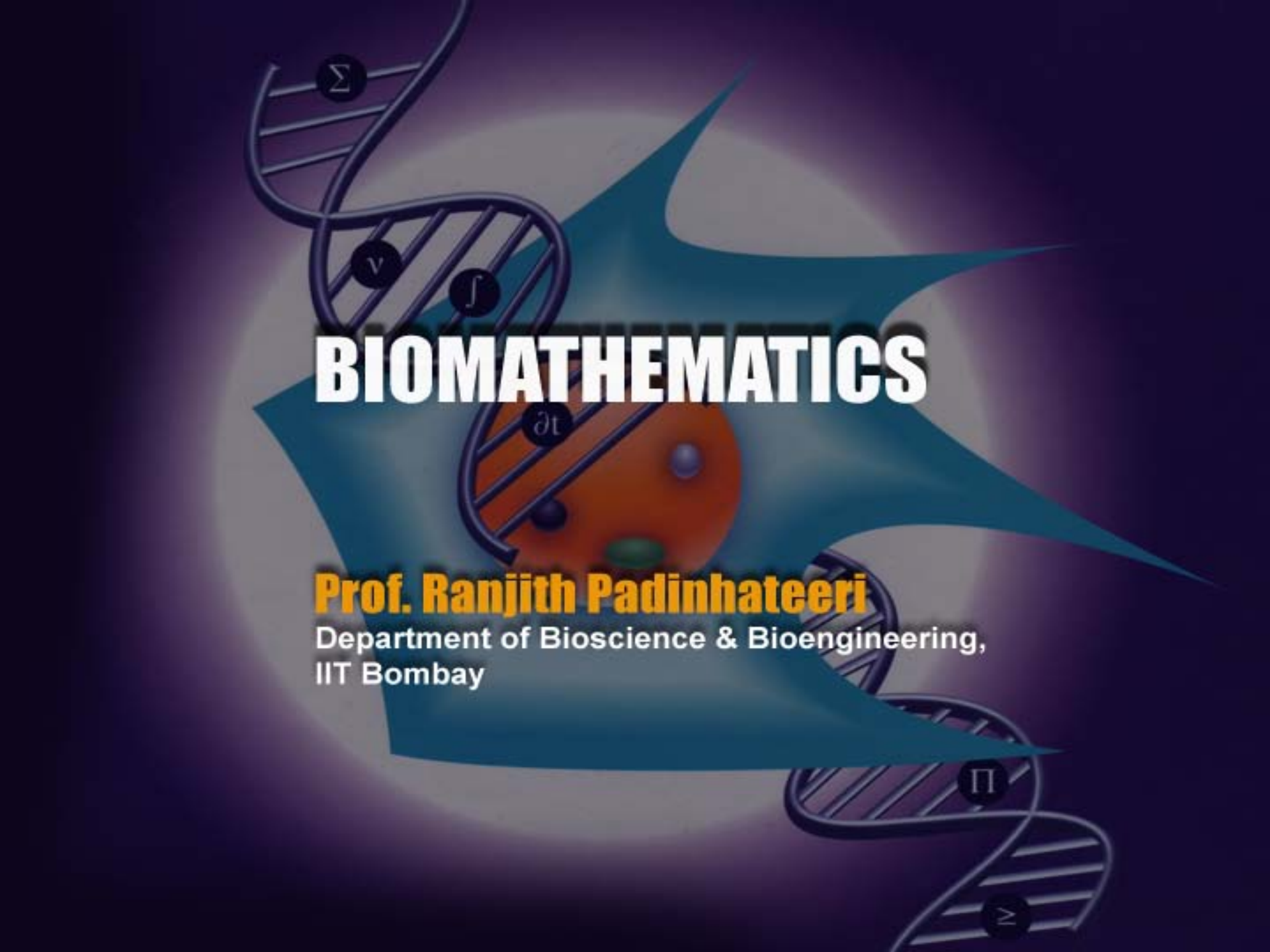

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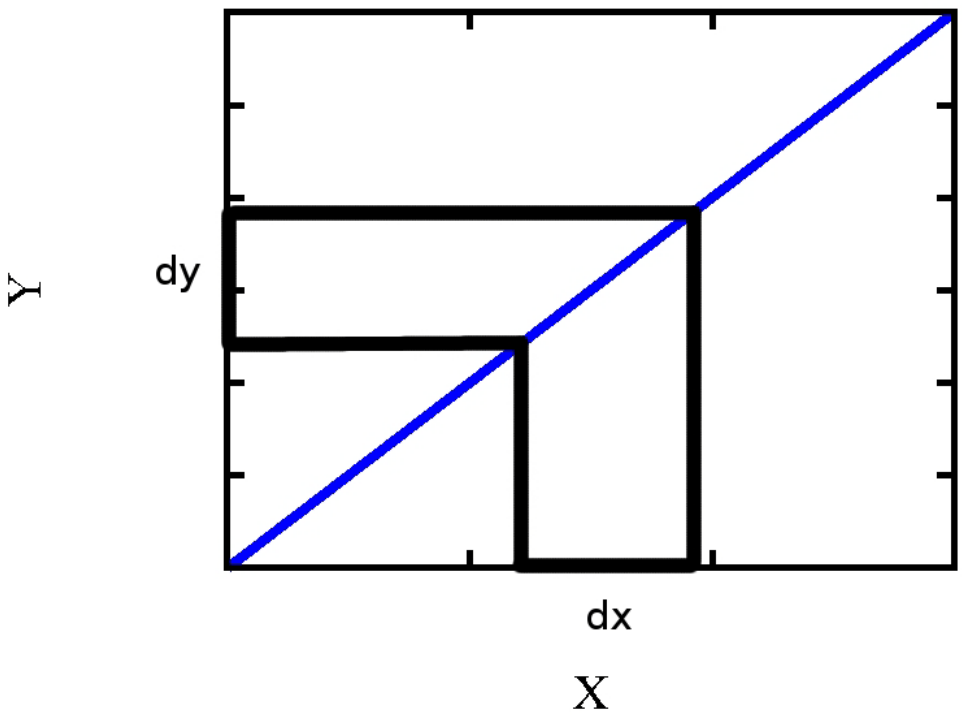
Functions and its derivatives

In this lecture, we will discuss how to calculate “derivatives” of various functions

Slope=How Y changes with X

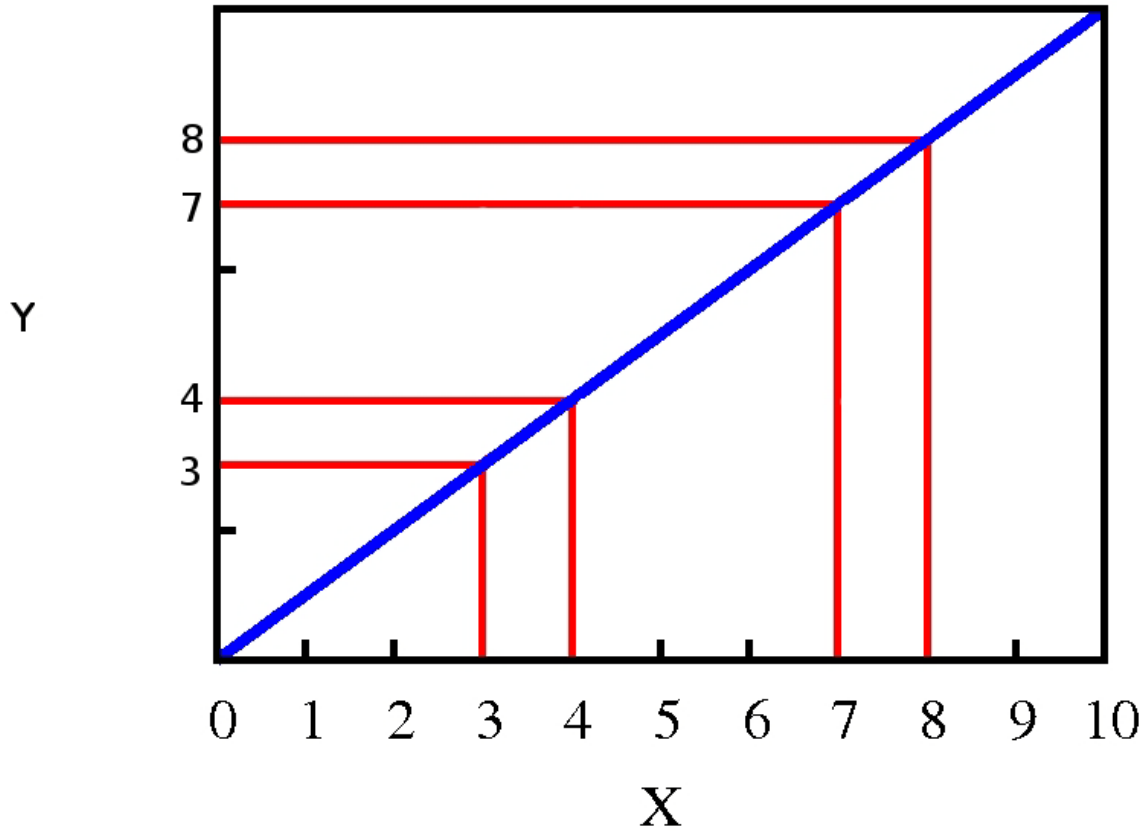


Slope = dy/dx

= derivative of y

Finding derivative of a function is nothing but calculating the slope of the function

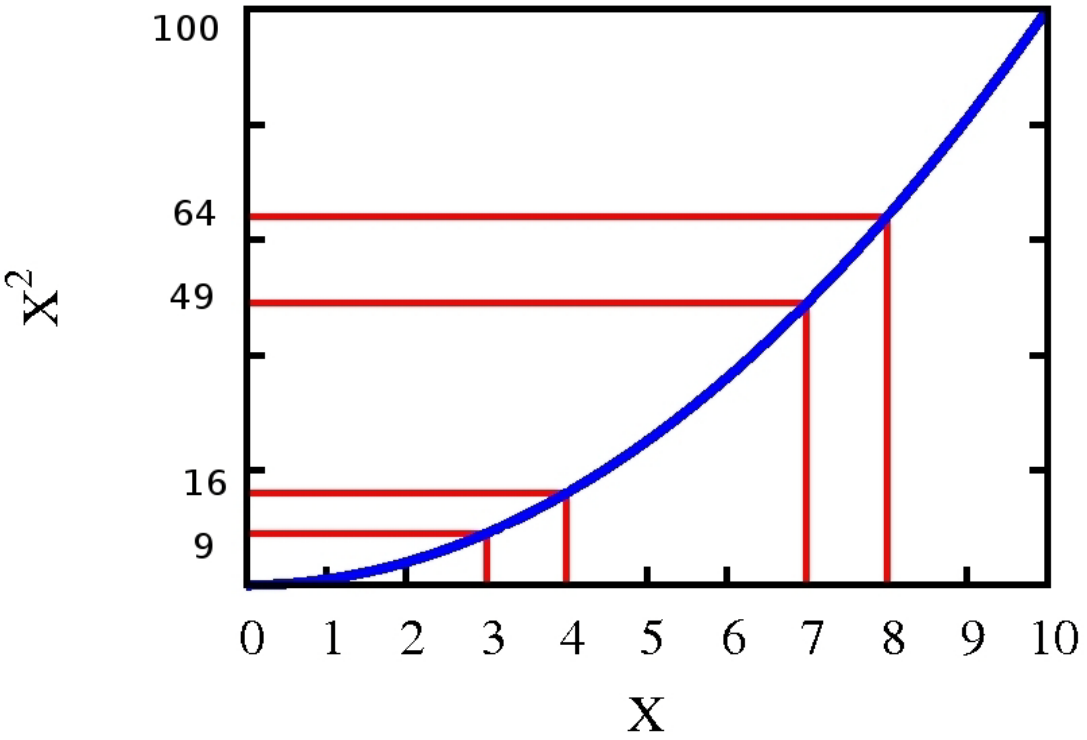
Slope of Y=X curve



Slope = dy/dx = 1.

Independent of X

Slope of $Y=X^2$ curve



Slope is not Independent of X.

Slope of X^2 is 2X.

We learned

Finding derivative of a function is nothing but calculating the how Y changes with X

Slope of a function = dy/dx

In most physical situations, slope of a function represents a physical quantity (eg. Velocity)

Derivative of x^n

$$y = x^n$$

$$\frac{dy}{dx} = ?$$

$$\frac{d}{dx}\left(x^n\right) = nx^{n-1}$$

Derivative of a sum

$$\frac{d}{dx}\left(f(x)+g(x)\right)=\frac{df(x)}{dx}+\frac{dg(x)}{dx}$$

Rules

$$\frac{d}{dx}\left(f(x)+g(x)\right)=\frac{df(x)}{dx}+\frac{dg(x)}{dx}$$

Derivative of Exponential function

$$e^x = 1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \frac{x^4}{24} + \frac{x^5}{120} + \ldots$$

$$\frac{d}{dx}\left(e^x\right) = e^x$$

Derivative of Exponential function

$$e^{-x} = 1 - x + \frac{x^2}{2} - \frac{x^3}{6} + \frac{x^4}{24} - \frac{x^5}{120} + \ldots$$

$$\frac{d}{dx}\left(e^{-x}\right) = -e^{-x}$$

Derivatives of Sin(x), Cos(x)

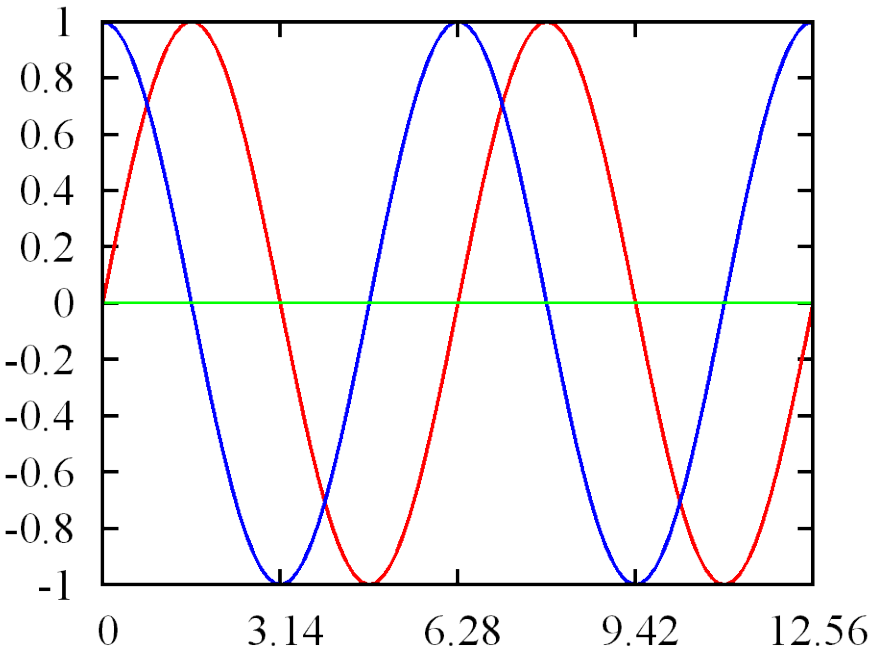
$$\sin(x) = x - \frac{x^3}{6} + \frac{x^5}{120} - \frac{x^7}{5040} + \ldots$$

$$\cos(x) = 1 - \frac{x^2}{2} + \frac{x^4}{24} - \frac{x^6}{720} \ldots$$

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

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

Derivatives of Sin(x), Cos(x)



Sin(x)

Cos(x)

$$\frac{d}{dx}\left(\sin(x)\right) = \cos(x)$$

$$\frac{d}{dx}\left(\cos(x)\right) = -\sin(x)$$