Assignment 2

AI1110: Probability and Random Variables

Indian Institute of Technology Hyderabad

Donal Loitam
AI21BTECH11009

12 April 2022

ICSE 2019 Grade 12

Question 1(vi) Prove that the function $f(x) = x^3 - 6x^2 + 12x + 5$ is increasing on $\mathbb{R}$

Solution. Given function is:

$$f(x) = x^3 - 6x^2 + 12x + 5 \tag{1}$$

Taking the first derivative of $f(x)$:

$$f'(x) = 3x^2 - 12x + 12 \tag{2}$$
$$\implies f'(x) = 3(x^2 - 4x + 4) \tag{3}$$
$$\implies f'(x) = 3(x-2)^2 \tag{4}$$
$$\therefore \quad f'(x) \geq 0 \ , \ \forall \ x \in \mathbb{R} \tag{5}$$

Since the slope of $f(x)$ i.e $f'(x) \geq 0, \ \forall \ x \in \mathbb{R}$
$\therefore \ f(x) = x^3 - 6x^2 + 12x + 5$ is always increasing on $\mathbb{R}$

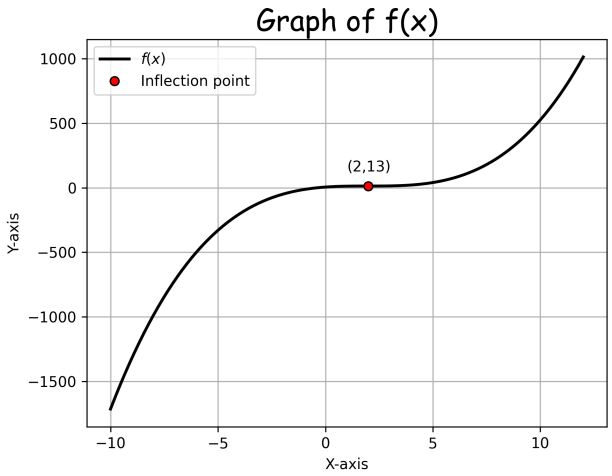

Fig. 1. Graph of $f(x) = x^3 - 6x^2 + 12x + 5$