

# Take one Domain and draw the graph (Normal distribution) (Empirical rule).

## 1. Introduction

- In the education domain, student exam marks often follow a Normal Distribution.
- A Normal Distribution is a continuous probability distribution that forms a bell-shaped curve.
- Most students score around the average marks.
- Very few students score extremely low or extremely high.
- This pattern can be explained using the Empirical Rule (68% – 95% – 99.7%).

In this example:

- Mean (Average marks) = 70
- Standard Deviation = 10

## 2. Understanding Normal Distribution

### 2.1 Definition

- A Normal Distribution is a symmetric distribution around the mean.
- The mean, median, and mode are equal.
- The curve is bell-shaped.
- Total area under the curve equals 1.

### 2.2 Properties

- Symmetrical around the mean.
- Maximum height at the mean.
- Tails approach the horizontal axis but never touch it.
- Spread is determined by standard deviation.

### 3. Components in Education Example

#### 3.1 Mean ( $\mu$ )

- Represents average marks of students.
- In our case:  $\mu = 70$
- Most students score close to 70.

#### 3.2 Standard Deviation ( $\sigma$ )

- Measures how much marks vary from the average.
- In our case:  $\sigma = 10$
- Smaller  $\sigma \rightarrow$  marks tightly clustered.
- Larger  $\sigma \rightarrow$  marks widely spread.

### 4. Empirical Rule (68% – 95% – 99.7%)

The Empirical Rule explains how data is distributed in a normal distribution.

#### 4.1 68 Percent Rule

- 68% of students score within 1 standard deviation of the mean.
- Range:  
 $70 - 10 = 60$   
 $70 + 10 = 80$
- Therefore, about 68% of students score between 60 and 80 marks.

#### 4.2 95 Percent Rule

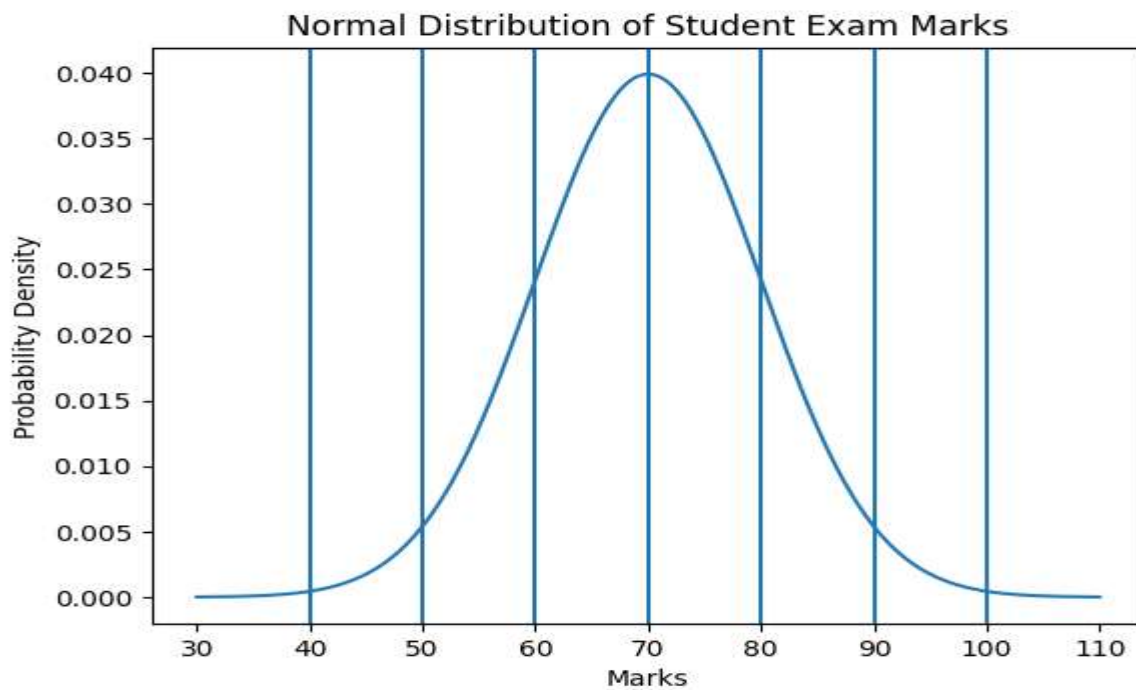
- 95% of students score within 2 standard deviations.
- Range:  
 $70 - 20 = 50$   
 $70 + 20 = 90$
- About 95% of students score between 50 and 90 marks.

#### 4.3 99.7 Percent Rule

- 99.7% of students score within 3 standard deviations.
- Range:  
 $70 - 30 = 40$   
 $70 + 30 = 100$
- Nearly all students score between 40 and 100 marks.

## 5. Interpretation of the Graph

- The peak of the curve is at 70 marks.
- Vertical lines represent:
  - Mean
  - $\pm 1$  standard deviation
  - $\pm 2$  standard deviations
  - $\pm 3$  standard deviations
- The curve shows decreasing probability as we move away from the mean.
- Very few students score below 40 or above 100.



## **6. Educational Significance**

### **6.1 Performance Analysis**

- Teachers can identify average performers.
- Helps classify students into:
  - Below average
  - Average
  - Above average

### **6.2 Grading System**

- Grades can be assigned using standard deviation ranges.
- Example:
  - 60–80 → Average grade
  - 80–90 → Above average
  - Above 90 → Excellent

### **6.3 Identifying Outliers**

- Students scoring far from mean may need special attention.
- Extremely low scores may indicate learning difficulty.
- Extremely high scores may indicate gifted students.

## **7. Advantages of Using Normal Distribution in Education**

- Helps in fair evaluation.
- Simplifies performance prediction.
- Supports data-driven decision making.
- Used in competitive exams and standardized testing.

## **8. Real-Life Example**

If a school has 1000 students:

- Around 680 students score between 60 and 80.
- Around 950 students score between 50 and 90.
- Around 997 students score between 40 and 100.

Only about 3 students score outside 40–100 range.

## **9. Summary of Empirical Rule in Education Domain**

Mean = 70

Standard Deviation = 10

Within  $1\sigma$  (60–80) → 68% students

Within  $2\sigma$  (50–90) → 95% students

Within  $3\sigma$  (40–100) → 99.7% students

This confirms that student marks approximately follow a bell-shaped distribution.

## **10. Conclusion**

- Student exam marks in large populations tend to follow Normal Distribution.
- The curve is symmetric and centered at the average score.
- The Empirical Rule helps in understanding score distribution.
- Most students perform near the average.
- Very few students perform extremely poorly or extremely well.
- Normal distribution helps educators in grading, evaluation, and performance analysis.