



Register Number:

Date:

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BENGALURU-27
B.SC MATHEMATICS - IV SEMESTER
SEMESTER EXAMINATION: APRIL, 2022
(Examination conducted in July 2022)
MTOE 4220: MATHEMATICS FOR BIOLOGISTS

Duration: 1.5 Hours

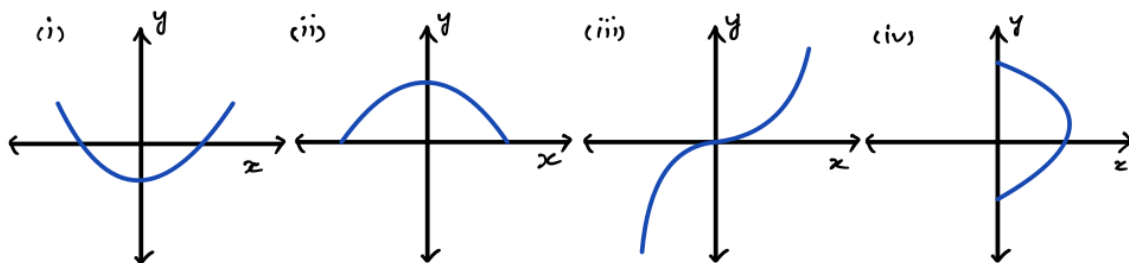
Max. Marks: 35

The paper contains **THREE** printed pages and **TWO PARTS**.

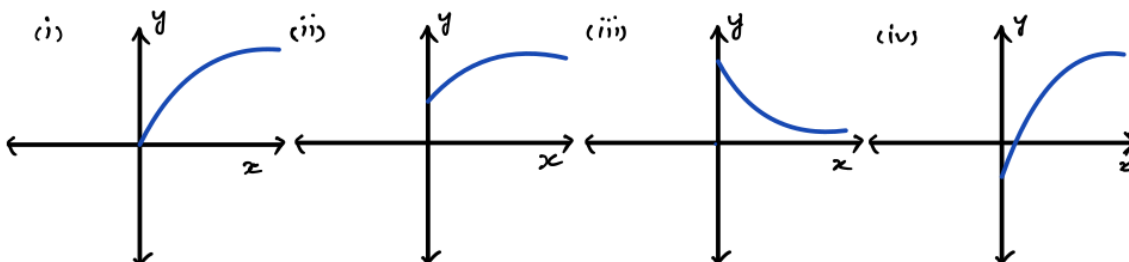
I. ANSWER ANY FIVE QUESTIONS

5 × 2 = 10

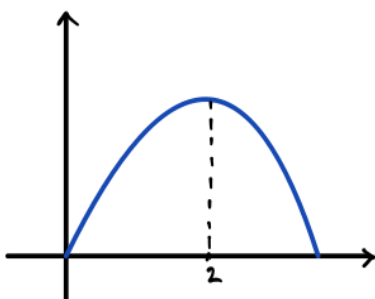
1. Which of the following diagrams is **NOT** the graph of a function of x ?



2. Which of the following graphs best represents the growth (in terms of length vs time) of a tomato plant from a seed into a plant? (You may assume there are ideal conditions of soil, nutrients, water and sunlight).

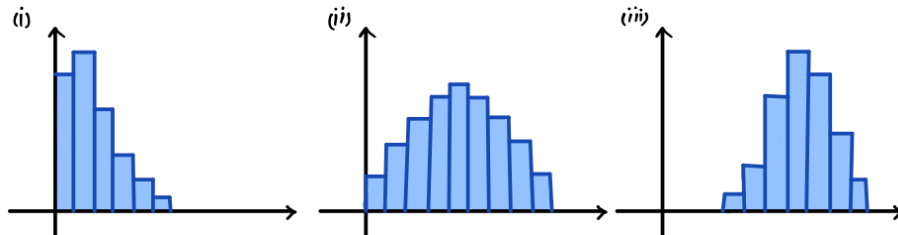


3. Which of the following statements is true about the graph of the function $f(x)$ drawn below?

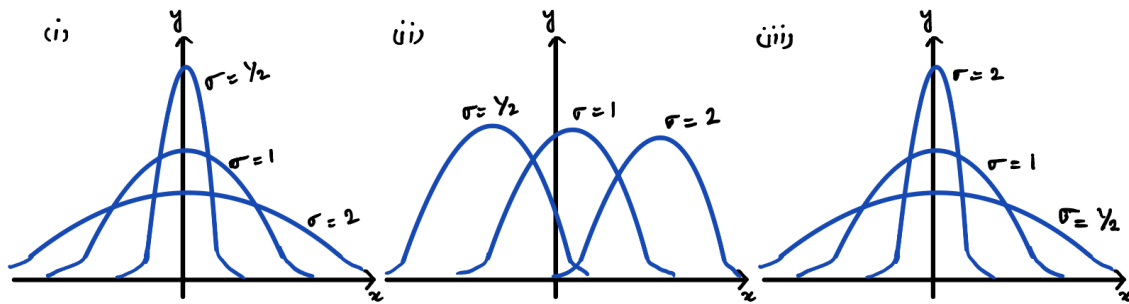


- (i) The function has a local maximum at 2 which is a global maximum.
- (ii) The function has a local maximum at 2 which is not a global maximum.
- (iii) The function has a local minimum at 2 which is a global minimum.
- (iv) The function has a local minimum at 2 which is not a global minimum.

4. How many DNA molecules of length 10 can we get such that the same base does not occur consecutively? (The bases that comprise a DNA molecule are Adenine, Guanine, Cytosine and Thymine)
5. Suppose in a hospital there are 10 babies born everyday. What is the probability that all babies born will be girls? (Assume that sex ratio is 1:1).
6. A new drug has a 30% probability of curing a disease. Which of the following diagrams is the most accurate representation of the probability histogram of the number of people cured by the drug?



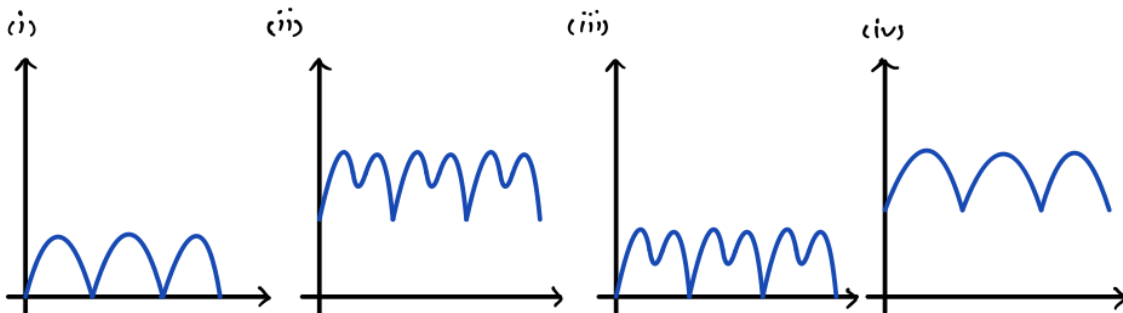
7. Which of the following pictures accurately depicts how a normal distribution curve changes with standard deviation σ ?



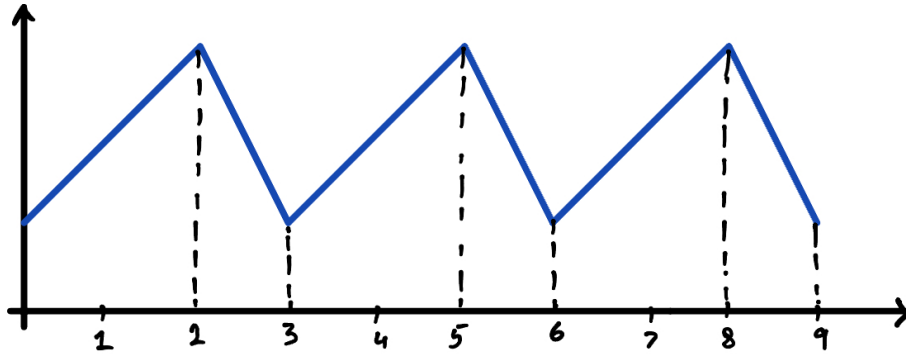
II. ANSWER ANY FIVE QUESTIONS

5 × 5 = 25

8. Compute the slope of the function $f(x) = \cos(x)$ at the point x_1 . You may assume $\lim_{t \rightarrow 0} \frac{\sin(t)}{t} = 1$ and $\cos(A) - \cos(B) = -2 \sin\left(\frac{A+B}{2}\right) \cdot \sin\left(\frac{A-B}{2}\right)$.
9. a) Compute the value of $\frac{d}{dx}[x \log_e(x) + \sin(\cos(x))]$.
 b) Which of the following graphs is the most accurate one that determines the change of temperature versus time over a period of three years in Bangalore. (You may assume there is no climate change and that the hottest months are May and October.) [3+2]



10. Compute the critical points of the function $f(x) = x^3 - 3x$ and determine whether they are maxima, minima or saddle points respectively.
11. a) The growth and shrinkage of a microtubule is depicted in the graph below. Draw the graph of its slope.



- b) Out of 7 consonants and 4 vowels, how many words of 3 consonants and 2 vowels can be formed? [2+3]
12. The following were the scores (out of 10) obtained by a class of 30 students in a botany test:

3	5	3	4	8	7	6	5	8	4
8	5	5	6	4	3	5	4	5	5
6	5	8	6	8	3	5	6	7	5

Draw the frequency table for this data and represent it as a histogram. Also compute the mean and standard deviation of this data.

13. A certain type of missile hits its target 30% of the times it is fired. Find the minimum number of missiles that need to be fired so that there is at least a 90% probability of hitting a target.
14. a) In a certain company there are 4 employees who earn Rs. 20000, 4 who earn Rs. 25000, 3 who earn Rs. 30000 and 5 who earn Rs. 35000. What is the median of the employee's salaries?
- b) Suppose 95% of students are between 1.1m and 1.7m tall. Assuming the heights of students are distributed normally, compute the mean and standard deviation of the data. [2+3]