Roll No. ____

DAV BR PUBLIC SCHOOL, BINA
HALF YEARLY SAMPLE PAPER SESSION 2024-25
Class: XII **Subject: Mathematics**

Time Allowed: 3 Hrs **MM: 80**

Section A

1 The smallest integer function f(x) = [x] is **1**

(a) One-one (b) Many-one

(c) Both (a) & (b) (d) None of these

2 The function f: R → R defined by f(x) = 3 – 4x is **1**

(a) Onto (b) Not onto

(c) None one-one (d) none of these

3 Principle value of $\sin^{-1}(-\frac{1}{2})$ **1**

(a) π/3 (b) - π/3

(c) π/6 (d) -π/6

4 Principle value of $\tan^{-1}(\sqrt{3})$ **1**

(a) π/3 (b) 2π/3

(c) π/6 (d) 5π/6

5 If A and B are symmetric matrices of the same order, then **1**

(a) AB is a symmetric matrix

(b) A – B is askew-symmetric matrix

(c) AB + BA is a symmetric matrix

(d) AB – BA is a symmetric matrix

6 . If $A = \begin{bmatrix} 3 & x-1 \\ 2x+3 & x+2 \end{bmatrix}$ is a symmetric matrix, then x = **1**

(a) 4 (b) 3

(c) -4 (d) -3

7 If A is a square matrix, then A – A' is a **1**

(a) diagonal matrix (b) skew-symmetric matrix

(c) symmetric matrix (d) none of these

8 If A is any square matrix, then which of the following is skew-symmetric? **1**

(a) $A + A^T$ (b) $A – A^T$

(c) AA^T (d) A^TA

9 If $A = \begin{bmatrix} a & b \\ b & a \end{bmatrix}$ and $A^2 = \begin{bmatrix} \alpha & \beta \\ \beta & \alpha \end{bmatrix}$, then **1**

(a) $\alpha = a^2 + b^2, \beta = ab$

(b) $\alpha = a^2 + b^2, \beta = 2ab$

(c) $\alpha = a^2 + b^2, \beta = a^2 - b^2$

(d) $\alpha = 2ab, \beta = a^2 + b^2$

10 If $A = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$ and f(x) = (1+x)(1-x), then f(a) is **1**

(a) $-4\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$ (b) $-8\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$

(c) $4\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$ (d) None of these

11 The derivative of f(tan x) w.r.t. g(sec x) at x = π/4, where f'(1) = 2 and g'(√2) = 4, is **1**

(a) $1/\sqrt{2}$ (b) $\sqrt{2}$

(c) 1 (d) 0

12 The value of k so that the function f is continuous at x = π, is **1**

$$f(x) = \begin{cases} kx + 1 & if\ x \leq \pi \\ cosx & if\ x > \pi \end{cases}$$

(a) $-2/\pi$ (b) $-1/\pi$

(c) $2/\pi$ (d) $1/\pi$

13 The function $f(x) = e^{|x|}$ is **1**

(a)Continuous everywhere but not differentiable at x=0

(b)Continuous and differentiable every where

(c) Not continuous at x=0

(d)None of the above

14 Find all the points of local maxima and local minima of the function f(x) = $(x - 1)^3 (x + 1)^2$ **1**

(a) 1, -1, -1/5 (b) 1, -1

(c) 1, -1/5 (d) -1, -1/5

15 $2x^3 - 6x + 5$ is an increasing function, if **1**

(a) 0 < x < 1 (b) -1 < x < 1

(c) x < -1 or x > 1 (d) -1 < x < −1/2

16 If $\int e^x secx(1 + tanx)\, dx$ **1**

(a) e^x cos x + C (b) e^x sec x + C

(c) e^x sin x + C (d) e^x tan x + C

17 If $f(x) = \int_0^x tsint\, dt$ then f '(x) is **1**

(a) cosx + x sin x (b) x sinx

(c) x cosx (d) sinx + x cosx

18 The area enclosed by the circle $x2 + y2 = 2$ is equal to **1**

(A) 4π sq units (B) $2\sqrt{2}\pi$ sq units

(C) $4\pi^2$ sq units (D) 2π sq units

19 In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as. **1**

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true but R is not the correct explanation of A

(c) A is true but R is false

(d) A is False and R is True.

Assertion (A) The relation R in R defined as R= {(a, b):a≤b^2} is not equivalence relation.

Reason (R) Since R is not reflexive but it is symmetric and transitive

20 In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as. **1**

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true but R is not the correct explanation of A

(c) A is true but R is false

(d) A is False and R is True.

Assertion(A): Function f(x)==$\mathbf{x^3 - 3x^2 + 3x + 2}$ is always increasing.

Reason(R): Derivative f'(x) is always negative.

Section B

21 Find the value of $\sin^{-1}(\frac{1}{2}) + \tan^{-1}(1) + \cos^{-1}(-\frac{1}{2})$ **2**

22 Find all the points of local maxima and local minima of the function f(x) = $(x-1)^3(x+1)^2$ **2**

23 Find the interval in which function is given by f(x) = sin x + cos x, $0 \le x \le 2\pi$, is strictly increasing or decreasing. **2**

24 A balloon, which always remains spherical has a variable radius. Find the rate at which its volume is increasing with the radius when the later is 10 cm. **2**

OR

A ladder 5m long is leaning against a wall. The bottom of the ladder is pulled along the ground away from the wall at the rate of 2cm/s. How fast its height on the wall decreasing when the foot of the ladder is 4m away from the wall?

25 Find $\int cos6x\sqrt{1+sin6x}\,dx$ **2**

Section C

26 Find $\int_0^{\pi} \frac{x}{a^2cos^2x+b^2sin^2x}dx$ **3**

27 Find $\int \frac{x^4}{(x-1)(x^2+1)}\,dx$ **3**

28 Find the area of the region bounded by $x^2 = 4y$, y = 2, y = 4 and the y-axis in the first quadrant. **3**

29 Discuss the continuity of the function f(x) = sin x cos x. **3**

30 Find $\frac{dy}{dx}$ if $y = sinx^{logx} + logx^{sinx}$ **3**

31 Check for the relation R in the set **R** of real numbers, defined as R = {(a,b) : b=a+1} is equivalence relation **3**

Section D

32 Let f: **N** → **N** be defined by $f(n) = \begin{cases} \frac{n+1}{2} \; if\; n\; is\; odd \\ \frac{n}{2} \; if\; n\; is\; even \end{cases}$ for all n ϵ N. state whether the function f is bijective. Justify your answer. **5**

OR

Check whether the relation R in the set **R** of real numbers, defined by R = {(a,b) : $a \le b^3$} is reflexive symmetric or transitive.

33 Find A^{-1} , if $A = \begin{bmatrix} 1 & 2 & 5 \\ 1 & -1 & -1 \\ 2 & 3 & -1 \end{bmatrix}$. Hence solve the following system of linear equation: **5**

x+2y+5z=10, x-y-z = -2, 2x+3y-z=-11.

34 Show that the right circular cylinder, open at the top , and of given surface area and maximum volume is such that its height is equal to the radius of the base **5**

35 Find the area of the region in the first quadrant enclosed by x-axis, line x = 3 y and the circle $x^2 + y^2 = 4$. **5**

Section E

36 On her birth day, Seema decided to donate some money to children of an orphanage home. If there were 8 children less, everyone would have got Rs.10 more. However, if there were 16 children more, everyone would have got Rs. 10 less. Let the number of children be x and the amount distributed by Seema for one child be y (in Rs.). **4**

Based on the information given above, answer the following questions:

1. Find the equations in terms x and y
2. Represent the information given above in the matrix form?

OR

3. Find the number of children who were given some money by Seema

37 $P(x) = -5x^2 + 125x + 37500$ is the total profit function of a company, where x is the production of the company **4**

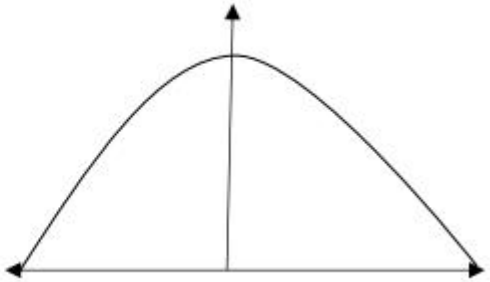
Based on the information given above, answer the following questions:

1. What will be the production when the profit is maximum?
2. What will be the maximum profit?

OR

3. Check in which interval the profit is strictly increasing .

38 The bridge connects two hills 100 feet apart. The arch on the bridge is in a parabolic form. The highest point on the bridge is 10 feet above the road at the middle of the bridge as seen in the figure. Based on the information given above, answer the following questions **4**



1. Find the equation of the parabola designed on the bridge
2. Find the value of the integral $\int_{-50}^{50} \frac{x^2}{250} dx$

OR

3. Find the area formed by the curve $x^2 = 250y$, x-axis , y = 0 and y = 10