ANGEL'S PUBLIC SCHOOL

Strive for Perfection

SAMPLE PAPER

HALF YEARLY EXAMS SESSION 2025 – 26

CLASS – XII

TIME : 3 HRS. **SUBJECT – MATHEMATICS** **M.M:80**

General instructions

(a) **Section – A consist of 20 objective type questions each carry 1 mark.**
(b) **Section – B contains 6 very short type questions each carry 2 mark.**
(c) **Section – C contains 6 short type questions each carry 3 marks**
(d) **Section – D contains 4 Long type questions each carry 5 marks.**
(e) **Section – E contains 2 case Based problems each carry 5 marks.**

SECTION – A

1. The function f : R – R defined as $f(x) = x^3$ is ________________.

(a) One one but not onto (b) Not one one but onto

(c) Neither one one nor onto (d) One one and onto

2. If a matrix has 36 elements, the number of possible orders it can have , is :

(a) 13 (b) 3 (c) 5 (d) 9

3. The greatest integer function f : R – R , given by f(x) = [x] is :

(a) One one (b) Onto (c) Both one and onto (d) Neither one nor onto

4. Let A and B are the matrices of the order 3 × 2 and 2 × 3 respectively, then order of matrix AB is :

(a) 3×4 (b) 3×2 (c) 2×3 (d) 3×3

5. The rate of change of the area of circle with respect to its radius r at r = 6 cm is :

(a) 10π (b) 12π (c) 8π (d) 11π

6. The domain of $\cos^{-1}(2x - 1)$ is :

(a) [0 , 1] (b) (- 1 , 1) (c) [- 1 , 1] (d) [0 , π]

7. If $\cos\left(\sin^{-1}\frac{3}{5} + \cos^{-1}x\right) = 0$ then x is equals to :

(a) 1/5 (b) 3/5 (c) 0 (d) 1

8. If A and B are two matrices of the order 3 × m and 3 ×n respectively and m = n , then the order of (5 A – 2 B) is :

(a) m × 3 (b) 3 × 3 (c) m × n (d) 3 × n

9. If A is square matrix of order 3 × 3 such that |A| = 2 , then the value of | adj(adj A) | is :

(a) -16 (b) 16 (c) 0 (d) 2

10. If y = log √tanx , then the value of dy/dx at x = π/4 is :

(a) 0 (b) 1 (c) ½ (d) Infinity □□

11. f(x) = x^x has stationary point at :

(a) x = e (b) x = 1/e (c) x = 1 (d) x = √e

12. The function f(x) = [x] , where [x] is the greatest integer function, is continuous at

(a) 4 (b) -2 (c) 1 (d) 1.5

13. Range of function $\tan^{-1} x$ is ________________.

$$\begin{vmatrix} x+1 & x-1 \\ x^2+x+1 & x^2-x+1 \end{vmatrix}$$ is equal to :

(a) 2x^3 (b) 2 (c) 0 (d) 2x^3 – 2

14. If a matrix has 36 elements, the number of possible orders it can have , is :

(a) 13 (b) 3 (c) 5 (d) 9

15. The function f(x) = x^x has stationary point at :

(a) 1/e (b) √e (c) 1 (d) zero

16. If A is square matrix of order 3 × 3 such that |A| = 2 , then the value of | adj(adj A) | is :

(a) 16 (b) -16 (c) 0 (d) 2

17. The function f(x) = [x] , where [x] is the greatest integer function, is continuous at :

(a) 4 (b) -2 (c) 1.5 (d) 2

18. If A and B are two matrices of the order 3 × m and 3 ×n respectively and m = n, then the order of (5 A – 2 B) is :

(a) m × 3 (b) 3 × 3 (c) m × n (d) 3 × n

19. The rate of change of the area of circle with respect to its radius r at r = 6 cm is :

(a) 10π (b) 12π (c) 8π (d) 13π

20. If y = log √tanx , then value of dy/dx at x = π/4 is

(a) 2 (b) 3 (c) 1 (d) None of these

SECTION – B

21. Show that relation S in the set A= { x € Z : 0 ≤ x ≤ 12 }given by S = { (a ,b) : a , b € A , | a – b | is divisible by 3 } is an equivalence relation .

OR

$$f(x) = \begin{cases} \frac{(x+3)^2 - 36}{x-3}, & x \neq 3 \\ k, & x = 3 \end{cases}$$

Determine the value of 'k' for which the given function is continuous at x = 3 .

22. Differentiate :

y = $\log[\, x + \sqrt{x^2 + a^2}\,]^n$ w.r.t x .

23. Prove that log sinxis strictly increasing in (0 , π/2) and strictly decreasing in (π/2 , π) .

OR

Show that $\tan^{-1}$ (sin x + cos x) is increasing in (0 , π/4)

24.

If $\begin{bmatrix} x+y & 2 \\ 5 & xy \end{bmatrix} = \begin{bmatrix} 6 & 2 \\ 5 & 8 \end{bmatrix}$, then find the value of $\left(\frac{24}{x} + \frac{24}{y}\right)$

25. If A is a square matrix such that $A^3 = A$, then write the value of 7A – (I + A $)^3$, where I is an identity matrix .

26. A balloon , which always remain spherical , has a variable diameter 2/3 (3x + 1) , Find the rate of change of its volume w.r.t x .

<u>SECTION – C</u>

27. A function f : R – R defined as f(x) = ax + b , such that f(1) = 1 and f(2) = 3 . Find function f(x) . Hence check whether the function f(x) is one one and onto or not .

OR

A relation R on set A = { 1 , 2 , 3 , 4 , 5 } is defined as R = { | $x^2 - y^2$ | < 8 } , Check , whether relation R is reflexive, symmetric and transitive .

$$\text{Where A} = \begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix}$$

28. FindA^2 - 5A + 4 I and hence find the matrix X such that A^2 - 5A + 4 I + X = 0

29. If y = $e^{\tan^{-1} x}$, Prove that :

(1 + x^2) y_2 + (2x – 1) y_1 = 0

OR

Find $\frac{dy}{dx}$, if $y = e^{\sin^2 x}\left\{2\tan^{-1}\sqrt{\frac{1-x}{1+x}}\right\}$

30. Find the value of x , such that function y = [x (x – 2)]²is an increasing function .

31. If x = $\sqrt{a^{\sin^{-1}} t}$ and $y = \sqrt{a^{\cos^{-1}} \cdot t}$. , show that $\frac{dy}{dx} = -\frac{y}{x}$

OR

$$\text{If } y = x^{\sin x} + (\sin x)^{x} \text{ , then find } \frac{dy}{dx}.$$

32. (a) Find the principal value of $\cos^{-1}(-\frac{1}{2}) - 2\sin^{-1}\left(-\frac{1}{2}\right)$.

(b) Find the domain off(x) =$[\sin^{-1}\sqrt{x - 1}]$

SECTION – D

33. Prove that :$cos^{-1}\left(\frac{4}{5}\right) + cos^{-1}\left(\frac{12}{13}\right) = cos^{-1}\left(\frac{33}{65}\right)$

OR

Find the value of a for which the function f defined as :

$$f(x) = \begin{cases} a \sin\frac{\pi}{2}(x+1), & x \le 0 \\ \frac{\tan x - \sin x}{x^3}, & x > 0 \end{cases}$$ is continuous at $x = 0$.

$$3x - 2y + 3z = 8$$
$$2x + y - z = 1$$
$$4x - 3y + 2z = 4$$

34. Solve the system of linear equations by Matrix Method.

35. A jet of Pakistan Rangers is flying along the curve x² + 4. An Indian soldier is standing at the point (5 , 3). What is the nearest distance between the soldier and jet .

OR

Find the value of $\frac{dy}{dx}$ at $t = \frac{\pi}{4}$, if $x = a\left(\cos t + \log\tan\frac{t}{2}\right)$, $y = a\, sint$.

36. Find the intervals in which the function f (x) = sin x + cos x , 0 ≤ x ≤ 2π is strictly increasing or strictly decreasing.

SECTION – D

37. CASE STUDY 1

Sherlin and Danju are playing Ludo at home during Covid-19. While rolling the dice, Sherlin's sister Raji observed and noted the possible outcomes of the throw every time belongs to set {1,2,3,4,5,6}. Let A be the set of players while B be the set of all possible outcomes.

A = {S, D}, B = {1,2,3,4,5,6}

1. Let $R : B \to B$ be defined by R = $\{(x, y): y \text{ is divisible by } x\}$ is
a. Reflexive and transitive but not symmetric
b. Reflexive and symmetric and not transitive
c. Not reflexive but symmetric and transitive
d. Equivalence
2. Raji wants to know the number of functions from A to B. How many number of functions are possible?
a. 6^2
b. 2^6
c. 6!
d. 2^{12}
3. Let R be a relation on B defined by R = {(1,2), (2,2), (1,3), (3,4), (3,1), (4,3), (5,5)}. Then R is
a. Symmetric
b. Reflexive
c. Transitive
d. None of these three
4. Raji wants to know the number of relations possible from A to B. How many numbers of relations are possible?
   a. 6^2
   b. 2^6
   c. 6!
   d. 2^{12}
5. Let $R: B \to B$ be defined by R={(1,1),(1,2), (2,2), (3,3), (4,4), (5,5),(6,6)}, then R is
   a. Symmetric
   b. Reflexive and Transitive
   c. Transitive and symmetric
   d. Equivalence

38. CASE BAESD – 2

The reliability of a COVID PCR test is specified as follows:

Of people having COVID, 90% of the test detects the disease by 10% goes undetected. Of people free of COVID, 99% of the test is judged COVID negative but 1% are diagnosed as showing COVID positive. From a large population of which only 0.1% have COVID, one person is selected at random, given the COVID PCR test and the pathologist reports him/her as COVID positive.

Based on the above information, answer the following questions:

(*i*) What is the probability of the 'person to be tested as COVID positive' given that 'he is actually having COVID'?

(*ii*) What is the probability of the 'person to be tested as COVID positive' given that 'he is actually not having COVID'?