KENDRIYA VIDYALAYA SANGATHAN, HYDERABAD REGION
MOCK TEST PAPER – 09 (2016-17)

SUBJECT: MATHEMATICS(041)

BLUE PRINT : CLASS XII

Chapter	VSA (1 mark)	Short answer (2 marks)	Long answer - I (4 marks)	Long answer - II (6 marks)	Total
Relations and Functions	1(1)	2(1)	--	--	**3(3)**
Inverse Trigonometric Functions	1(1)	--	--	6(1)	**7(2)**
Matrices	1(1)	--	4(1)	--	**5(2)**
Determinants	--	2(1)	--	6(1)	**8(2)**
Continuity & Differentiability	--	2(1)	--	6(1)	**8(2)**
Applications of Derivatives	--	2(1)	8(2)	6(1)	**16(4)**
Integrals	--	--	4(1)	6(1)	**10(2)**
Applications of the Integrals	--	--	4(1)	--	**4(1)**
Differential Equations	--	2(1)	4(1)	--	**6(2)**
Vector Algebra	1(1)	--	4(1)	--	**5(2)**
Three-Dimensional Geometry	--	2(1)	4(1)	6(1)	**12(3)**
Linear Programming	--	2(1)	4(1)	--	**6(2)**
Probability	--	2(1)	8(2)	--	**10(3)**
Total	**4(4)**	**16(8)**	**44(11)**	**36(6)**	**100(29)**

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SUBJECT: MATHEMATICS | **MAX. MARKS : 100**
CLASS : XII | **DURATION : 3 HRS**

General Instruction:
(i) **All** questions are compulsory.
(ii) This question paper contains **29** questions.
(iii) Question **1- 4** in **Section A** are very short-answer type questions carrying **1** mark each.
(iv) Question **5-12** in **Section B** are short-answer type questions carrying **2** marks each.
(v) Question **13-23** in **Section C** are long-answer-I type questions carrying **4** marks each.
(vi) Question **24-29** in **Section D** are long-answer-II type questions carrying **6** marks each.

SECTION – A
Questions 1 to 4 carry 1 mark each.

1. Consider $f : N \to N$, $g : N \to N$ and $h : N \to R$ defined as $f(x) = 2x$, $g(y) = 3y + 4$ and $h(z) = \sin z$, $\forall\, x, y$ and z in N. Find $ho(gof)$

2. Find the value of $\cos^{-1}\left[\cos\left(\frac{13\pi}{6}\right)\right]$.

3. In the interval $\pi/2 < x < \pi$, find the value of x for which the matrix $\begin{bmatrix} 2\sin x & 3 \\ 1 & 2\sin x \end{bmatrix}$ is singular.

4. Find the projection of the vector $\vec{a} = 2\hat{i} + 3\hat{j} + 2\hat{k}$ on the vector $\vec{b} = 2\hat{i} + 2\hat{j} + \hat{k}$.

SECTION – B
Questions 5 to 12 carry 2 marks each.

5. Show that the relation R in R defined as R = $\{(a, b) : a \le b\}$, is reflexive and transitive but not symmetric.

6. Using the properties of determinant, find the value of $\begin{vmatrix} x+y & y+z & z+x \\ z & x & y \\ 1 & 1 & 1 \end{vmatrix}$.

7. Find the solution of the differential equation $\frac{dy}{dx} = x^3 e^{-2y}$

8. If $y = e^x.\log(\sin 2x)$, then find $\frac{dy}{dx}$.

9. The length x of a rectangle is decreasing at the rate of 5 cm/minute and the width y is increasing at the rate of 4 cm/minute. When x = 8cm and y = 6cm, find the rates of change of (a) the perimeter, and (b) the area of the rectangle.

10. Two balls are drawn at random with replacement from a box containing 10 black and 8 red balls. Find the probability that (i) both balls are red. (ii) first ball is black and second is red.

11. Find the vector and cartesian equations of the planes that passes through the point (1, 0, – 2) and the normal to the plane is $\hat{i} + \hat{j} - \hat{k}$

12. Solve the following linear programming problem graphically:
Minimise Z = $x + 2y$
subject to $2x + y \ge 3$, $x + 2y \ge 6$, $x, y \ge 0$.

SECTION – C

Questions 13 to 23 carry 4 marks each.

13. Evaluate $\int_0^1 (3x^2 + 2x + 1)dx$ as limit of sums.

14. If $A = \begin{bmatrix} 2 & 3 \\ 1 & -4 \end{bmatrix}, B = \begin{bmatrix} 1 & -2 \\ -1 & 3 \end{bmatrix}$, verify that $(AB)^{-1} = B^{-1}A^{-1}$.

15. For what value of l the function defined by $f(x) = \begin{cases} \lambda(x^2 + 2), if\ x \le 0 \\ 4x + 6, \quad if\ x > 0 \end{cases}$ is continuous at $x = 0$?

Hence check the differentiability of f(x) at $x = 0$.

16. Find the equations of the tangent and normal to the curve $x^{2/3} + y^{2/3} = 2$ at (1, 1).

OR

Find the intervals in which the function f given by $f(x) = 2x^3 - 3x^2 - 36x + 7$ is (a) strictly increasing (b) strictly decreasing

17. Evaluate: $\int_0^{\pi/4} \log(1 + \tan x)dx$

OR

Evaluate: $\int_0^{1/\sqrt{2}} \frac{\sin^{-1} x}{(1 - x^2)^{3/2}} dx$

18. Solve the differential equation $\left(x\sin^2\left(\frac{y}{x}\right) - y \right)dx + xdy = 0$ given $y = \frac{\pi}{4}$ when x = 1.

OR

Solve the differential equation $\frac{dy}{dx} - 3y\cot x = \sin 2x$ given y = 2 when $x = \frac{\pi}{2}$

19. A manufacturer produces nuts and bolts. It takes 2 hours work on machine A and 3 hours on machine B to produce a package of nuts. It takes 3 hours on machine A and 2 hours on machine B to produce a package of bolts. He earns a profit of ` 24 per package on nuts and ` 18 per package on bolts. How many packages of each should be produced each day so as to maximize his profit, if he operates his machines for at the most 10 hours a day. Make an L.P.P. from above and solve it graphically?

20. In answering a question on a multiple choice test, a student either knows the answer or guesses. Let $\frac{3}{5}$ be the probability that he knows the answer and $\frac{2}{5}$ be the probability that he guesses. Assuming that a student who guesses at the answer will be correct with probability $\frac{1}{3}$, what is the probability that the student knows the answer given that he answered it correctly?

21. A pair of dice is thrown 4 times. If getting a doublet is considered a success, find the probability distribution of number of successes. Hence find the mean of the distribution.

22. Find the shortest distance between the following lines : $\vec{r} = (2\hat{i} - 5\hat{j} + \hat{k}) + \lambda(3\hat{i} + 2\hat{j} + 6\hat{k})$ and $\vec{r} = (7\hat{i} - 6\hat{k}) + \mu(\hat{i} + 2\hat{j} + 2\hat{k})$

23. Prove that $\left[\vec{a}, \vec{b} + \vec{c}, \vec{d}\right] = \left[\vec{a}, \vec{b}, \vec{d}\right] + \left[\vec{a}, \vec{c}, \vec{d}\right]$

SECTION – D

Questions 24 to 29 carry 6 marks each.

24. Find the vector and cartesian equations of the plane passing through the line of intersection of the planes $\vec{r}.(2\hat{i}+2\hat{j}-3\hat{k})=7,\ \vec{r}.(2\hat{i}+5\hat{j}+3\hat{k})=9$ such that the intercepts made by the plane on x-axis and z-axis are equal.

25. Show that the relation R in the set A = {1, 2, 3, 4, 5} given by R = {(a, b) : |a – b| is divisible by 2} is an equivalence relation. Write all the equivalence classes of R.

OR

Prove that : $\sin^{-1}\frac{12}{13}+\cos^{-1}\frac{4}{5}+\tan^{-1}\frac{63}{16}=\pi$

26. Using the properties of determinants, Solve for x: $\begin{vmatrix} a+x & a-x & a-x \\ a-x & a+x & a-x \\ a-x & a-x & a+x \end{vmatrix}=0$

OR

Express the matrix A = $\begin{bmatrix} 2 & 4 & -6 \\ 7 & 3 & 5 \\ 1 & -2 & 4 \end{bmatrix}$ as the sum of a symmetric and skew symmetric matrix.

27. Find the derivative of the following function f(x) w.r.t. x, : $x^{\tan x}+\sqrt{\frac{x^2+1}{x}}$

28. Find the area of the region $\{(x,y): y^2 \le 4x, 4x^2+4y^2 \le 9\}$, using integration.

OR

Using integration, find the area enclosed by the parabola 4y = $3x^2$ and the line 2y = 3x + 12.

29. The sum of surface areas of a sphere and a cuboid with sides $\frac{x}{3}$, x and 2x, is constant. Show that the sum of their volumes is minimum if x is equal to three times the radius of sphere.