KENDRIYA VIDYALAYA SANGATHAN, HYDERABAD REGION
MOCK TEST PAPER – 08 (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. Find *gof*, if $f : R \to R$ and $g : R \to R$ are given by $f(x) = \cos x$ and $g(x) = 3x^2$.

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

3. If $A = \begin{bmatrix} 3 & 5 \\ 7 & 9 \end{bmatrix}$ is written as A = P + Q, where P is a symmetric matrix and Q is skew symmetric matrix, then write the matrix P.

4. If $|\vec{a}\times\vec{b}|^2 + |\vec{a}.\vec{b}|^2 = 400$ and $|\vec{a}| = 5$, then write the value of $|\vec{b}|$.

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

5. Show that the relation R defined in the set A of all triangles as R = {(T_1, T_2) : T_1 is similar to T_2}, is equivalence relation.

6. If $\begin{vmatrix} x & \sin\theta & \cos\theta \\ -\sin\theta & -x & 1 \\ \cos\theta & 1 & x \end{vmatrix} = 8$, then find the value of x.

7. Find the general solutions of the differential equation $\frac{dy}{dx} = y\tan x$

8. If $e^x + e^y = e^{x+y}$, prove that $\frac{dy}{dx} = -e^{y-x}$.

9. 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.

10. Given that the two numbers appearing on throwing two dice are different. Find the probability of the event 'the sum of numbers on the dice is 4'.

11. Find the distance of a point (2, 5, – 3) from the plane $\vec{r}.(6\hat{i} - 3\hat{j} + 2\hat{k}) = 4$.

12. Solve the following linear programming problem graphically:
Maximise Z = 3x + 4y
subject to the constraints : $x + y \le 4$, $x \ge 0$, $y \ge 0$.

SECTION – C

Questions 13 to 23 carry 4 marks each.

13. Evaluate $\int_0^1 e^{2-3x} dx$ as a limit of a sum.

14. Find the values of *x*, *y*, *z* if the matrix $A = \begin{bmatrix} 0 & 2y & z \\ x & y & -z \\ x & -y & z \end{bmatrix}$ satisfy the equation A′A = I.

15. Find the values of a and b, if the function f defined by $f(x) = \begin{cases} x^2 + 3x + a, & x \le 1 \\ bx + 2, & x > 1 \end{cases}$ is differentiable at $x = 1$.

16. Find the angle of intersection of the curves $y^2 = 4ax$ and $x^2 = 4by$.

OR

Find the intervals in which the function *f* given by $f(x) = \dfrac{4\sin x - 2x - x\cos x}{2 + \cos x}$ is (i) increasing (ii) decreasing.

17. Evaluate: $\int \dfrac{(x^2+1)(x^2+4)}{(x^2+3)(x^2-5)} dx$

OR

Evaluate: $\int (2x+5)\sqrt{10-4x-3x^2}\, dx$

18. Solve the following differential equation : $y^2 dx + (x^2 - xy + y^2) dy = 0$

OR

Solve the following differential equation : $(\cot^{-1} y + x)\, dy = (1 + y^2)\, dx$

19. A dietician has to develop a special diet using two foods P and Q. Each packet (containing 30 g) of food P contains 12 units of calcium, 4 units of iron, 6 units of cholesterol and 6 units of vitamin A. Each packet of the same quantity of food Q contains 3 units of calcium, 20 units of iron, 4 units of cholesterol and 3 units of vitamin A. The diet requires atleast 240 units of calcium, atleast 460 units of iron and at most 300 units of cholesterol. How many packets of each food should be used to minimise the amount of vitamin A in the diet? What is the minimum amount of vitamin A?

20. A box has 20 pens of which 2 are defective. Calculate the probability that out of 5 pens drawn one by one with replacement, at most 2 are defective.

OR

Let, X denote the number of colleges where you will apply after your results and P (X = *x*) denotes your probability of getting admission in *x* number of colleges. It is given that

$$P(X = x) = \begin{cases} kx, & \text{if x = 0 or 1} \\ 2kx, & \text{if x = 2} \\ k(5-x), & \text{if x = 3 or 4} \\ 0, & \text{if x > 4} \end{cases}$$

where k is a positive constant. Find the value of k. Also find the probability that you will get admission in (i) exactly one college (ii) at most 2 colleges (iii) at least 2 colleges.

21. If $\vec{a} \times \vec{b} = \vec{c} \times \vec{d}$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{d}$, show that $\vec{a} - \vec{d}$ is parallel to $\vec{b} - \vec{c}$, where $\vec{a} \ne \vec{d}$ and $\vec{b} \ne \vec{c}$.

22. Bag A contains 3 red and 5 black balls, while bag B contains 4 red and 4 black balls. Two balls are transferred at random from bag A to bag B and then a ball is drawn from bag B at random. If the ball drawn from bag B is found to be red, find the probability that two red balls were transferred from A to B.

23. Prove that the line through A(0, –1, –1) and B(4, 5, 1) intersects the line through C(3, 9, 4) and D(–4, 4, 4).

SECTION – D

Questions 24 to 29 carry 6 marks each.

24. Find the equation of the plane which contains the line of intersection of the planes $x + 2y + 3z - 4 = 0$ and $2x + y - z + 5 = 0$ and whose x-intercept is twice its z-intercept. Hence write the vector equation of a plane passing through the point (2, 3, –1) and parallel to the plane obtained above.

25. If $f, g : R \to R$ be two functions defined as $f(x) = |x| + x$ and $g(x) = |x| - x, \ \forall x \in R$. Then find fog and gof. Hence find fog(–3), fog(5) and gof (–2).

OR

Solve for x : $\tan^{-1}\left(\frac{x-2}{x-1}\right) + \tan^{-1}\left(\frac{x+2}{x+1}\right) = \frac{\pi}{4}$

26. If a, b and c are all non-zero and $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = 0$, then prove that $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} + 1 = 0$

27. Find the derivative of the following function f(x) w.r.t. x, : $x^{x^x} + x^x$

28. Using integration find the area of the region bounded by the curves $y = \sqrt{4 - x^2}$, $x^2 + y^2 - 4x = 0$ and the x-axis.

OR

Evaluate: $\int_0^{\pi} \frac{x}{1 + \sin\alpha \sin x} dx$

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

OR

Find the equation of tangents to the curve $y = \cos(x + y)$, $-2\pi \le x \le 2\pi$ that are parallel to the line $x + 2y = 0$.