KENDRIYA VIDYALAYA SANGATHAN, HYDERABAD REGION
MOCK TEST PAPER – 07 (2017-18)

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)	2(1)	4(1)	--	**7(3)**
Determinants	--	--	--	6(1)	**6(1)**
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. Let $f : \{1, 3, 4\} \to \{1, 2, 5\}$ and $g : \{1, 2, 5\} \to \{1, 3\}$ be given by $f = \{(1, 2), (3, 5), (4, 1)\}$ and $g = \{(1, 3), (2, 3), (5, 1)\}$. Write down gof.

2. Find the value of $\tan^{-1}\tan\left(\frac{7\pi}{4}\right)$.

3. If $A=\begin{bmatrix}2 & 3\\ 5 & -2\end{bmatrix}$, then write A^{-1}.

4. If $\vec{a}=\hat{i}+2\hat{j}-\hat{k}, \vec{b}=2\hat{i}+\hat{j}+\hat{k}, \vec{c}=5\hat{i}-4\hat{j}+3\hat{k}$, then find the value of $(\vec{a}+\vec{b}).\vec{c}$

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

5. Show that $f : N \to N$, given by $f(x)=\begin{cases}x+1, \text{if is odd,}\\ x-1, \text{if is even}\end{cases}$ is both one-one and onto.

6. Find x, if $\begin{bmatrix}x & -5 & -1\end{bmatrix}\begin{bmatrix}1 & 0 & 2\\ 0 & 2 & 1\\ 2 & 0 & 3\end{bmatrix}\begin{bmatrix}x\\ 4\\ 1\end{bmatrix}=0$

7. Find the differential equation representing the curve $y = cx + c^2$.

8. Find $\frac{dy}{dx}$, if $x = a\cos\theta$, $y = a\sin\theta$.

9. The volume of a cube is increasing at a rate of 9 cubic centimetres per second. How fast is the surface area increasing when the length of an edge is 10 centimetres ?

10. Assume that each born child is equally likely to be a boy or a girl. If a family has two children, what is the conditional probability that both are girls given that the youngest is a girl?

11. Find the angle between the pair of lines $\frac{x+3}{3}=\frac{y-1}{5}=\frac{z+3}{4}$ and $\frac{x+1}{1}=\frac{y-4}{1}=\frac{z-5}{2}$.

12. Solve the following linear programming problem graphically:
Minimise $Z = 200x + 500y$;
subject to the constraints: $x + 2y \geq 10$; $3x + 4y \leq 24$; $x \geq 0, y \geq 0$

SECTION – C

Questions 13 to 23 carry 4 marks each.

13. Evaluate: $\int\left(\sqrt{\cot x}+\sqrt{\tan x}\right)\,dx$

14. If $A=\begin{bmatrix}2 & 0 & 1\\ 2 & 1 & 3\\ 1 & -1 & 0\end{bmatrix}$, find $A^2 - 5A + 16I$.

15. If x = α sin 2t (1 + cos 2t) and y = β cos 2t (1 – cos 2t), then $\frac{d^2y}{dx^2}$

16. Find points on the curve $\frac{x^2}{4}+\frac{y^2}{25}=1$ at which the tangents are (i) parallel to *x*-axis (ii) parallel to *y*-axis.

OR

Show that the function *f* given by $f(x) = \tan^{-1}(\sin x + \cos x)$, $x > 0$ is always an strictly increasing function in $\left(0, \frac{\pi}{4}\right)$

17. Evaluate: $\int_0^{\pi/2}\frac{2^{\sin x}}{2^{\sin x}+2^{\cos x}}\,dx$

OR

Evaluate: $\int_0^{3/2}|x.\cos(\pi x)|\,dx$

18. Find the differential equation for all the straight lines, which are at a unit distance from the origin.

OR

Show that the differential equation $2xy\frac{dy}{dx}=x^2+3y^2$ is homogeneous and solve it.

19. The postmaster of a local post office wishes to hire extra helpers during the Deepawali season, because of a large increase in the volume of mail handling and delivery. Because of the limited office space and the budgetary conditions, the number of temporary helpers must not exceed 10. According to past experience, a man can handle 300 letters and 80 packages per day, on the average, and a woman can handle 400 letters and 50 packets per day. The postmaster believes that the daily volume of extra mail and packages will be no less than 3400 and 680 respectively. A man receives ` 225 a day and a woman receives ` 200 a day. How many men and women helpers should be hired to keep the pay-roll at a minimum? Formulate an LPP and solve it graphically.

20. 40% students of a college reside in hostel and the remaining reside outside. At the end of the year, 50% of the hostelers got A grade while from outside students, only 30% got A grade in the examination. At the end of the year, a student of the college was chosen at random and was found to have gotten A grade. What is the probability that the selected student was a hosteler ?

21. A and B throw a die alternatively till one of them gets a number greater than four and wins the game. If A starts the game, what is the probability of B winning?

22. Find the acute angle between the plane 5x – 4y + 7z – 13 = 0 and the y-axis.

23. Show that four points A, B, C and D whose position vectors are $4\hat{i}+5\hat{j}+\hat{k}, -\hat{j}-\hat{k}$, $3\hat{i}+9\hat{j}+4\hat{k}$ and $4(-\hat{i}+\hat{j}+\hat{k})$ respectively are coplanar.

SECTION – D

Questions 24 to 29 carry 6 marks each.

24. Find the direction ratios of the normal to the plane, which passes through the points (1, 0, 0) and (0, 1, 0) and makes angle $\frac{\pi}{4}$ with the plane x + y = 3. Also find the equation of the plane.

25. Let A = Q × Q, where Q is the set of all rational numbers, and * be a binary operation defined on A by (a, b) * (c, d) = (ac, b + ad), for all (a, b) (c, d) $\in$ A.
Find (i) the identity element in A. (ii) the invertible element of A.

OR

Prove that : $2\tan^{-1}\left(\sqrt{\frac{a-b}{a+b}}\tan\frac{x}{2}\right)=\cos^{-1}\left(\frac{a\cos x+b}{a+b\cos x}\right)$

26. Using the properties of determinants, prove the following :

$$\begin{vmatrix} 1 & x & x+1 \\ 2x & x(x-1) & x(x+1) \\ 3x(1-x) & x(x-1)(x-2) & x(x+1)(x-1) \end{vmatrix} = 6x^2(1-x^2)$$

27. Find the derivative of the following function f(x) w.r.t. x, at x = 1 : $\cos^{-1}\left[\sin\sqrt{\frac{1+x}{2}}\right]+x^x$

28. Using integration, find the area of the region bounded by the lines y = 2 + x, y = 2 – x and x = 2.

OR

Evaluate: $\int_0^{\pi/2} 2\sin x\cos x\tan^{-1}(\sin x)dx$

29. If the function f(x) = $2x^3 - 9mx^2 + 12m^2x + 1$, where m > 0 attains its maximum and minimum at p and q respectively such that $p^2 = q$, then find the value of m.

OR

Show that of all the rectangles inscribed in a given fixed circle, the square has the maximum area.