KENDRIYA VIDYALAYA SANGATHAN, HYDERABAD REGION
MOCK TEST PAPER – 03 (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)	--	--	6(1)	**7(2)**
Inverse Trigonometric Functions	1(1)	2(1)	--	--	**3(2)**
Matrices	--	2(1)	4(1)	--	**6(2)**
Determinants	1(1)	--	--	6(1)	**7(2)**
Continuity & Differentiability	--	2(1)	8(2)	--	**10(3)**
Applications of Derivatives	--	2(1)	8(2)	--	**10(3)**
Integrals	--	2(1)	4(1)	6(1)	**12(3)**
Applications of the Integrals	--	--	--	6(1)	**6(1)**
Differential Equations	--	2(1)	4(1)	--	**6(2)**
Vector Algebra	1(1)	2(1)	4(1)	--	**7(3)**
Three-Dimensional Geometry	--	--	4(1)	6(1)	**10(2)**
Linear Programming	--	--	--	6(1)	**6(1)**
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 $f : \{1, 3, 4\} \rightarrow \{1, 2, 5\}$ and $g : \{1, 2, 5\} \rightarrow \{1, 3\}$ 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 $\sin^{-1}\left(\sin\frac{3\pi}{5}\right)$

3. Write the value of $\Delta = \begin{vmatrix} x+y & y+z & z+x \\ z & x & y \\ -3 & -3 & -3 \end{vmatrix}$.

4. Write a unit vector perpendicular to both the vectors $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + \hat{j}$

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

5. Simplify: $\tan^{-1}\left(\frac{a\cos x - b\sin x}{b\cos x + a\sin x}\right), if\ \frac{a}{b}\tan x > -1$

6. If $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -1 & 3 \\ -1 & 0 & 2 \end{bmatrix}$, then find 2A – B.

7. If $y = \cos^{-1}\left(2x\sqrt{1-x^2}\right)$, find $\frac{dy}{dx}$.

8. If $\frac{d}{dx} f(x) = 4x^3 - \frac{3}{x^4}$ such that $f(2) = 0$, then find $f(x)$.

9. Use differential to approximate $25^{1/3}$.

10. Find the unit vector in the direction of vector $\overrightarrow{PQ}$, where P and Q are the points (1, 2, 3) and (4, 5, 6), respectively.

11. In a school, there are 1000 students, out of which 430 are girls. It is known that out of 430, 10% of the girls study in class XII. What is the probability that a student chosen randomly studies in Class XII given that the chosen student is a girl?

12. Form a differential equation representing the given family of curves $y = a\,e^{3x} + b\,e^{-2x}$ by eliminating arbitrary constants *a* and *b*

SECTION – C

Questions 13 to 23 carry 4 marks each.

13. Evaluate: $\int (3-2x).\sqrt{2+x-x^2}\ dx$

OR

Evaluate: $\int \frac{x^2+x+1}{(x^2+1)(x+2)}\ dx$

14. Show that the function f(x) = |x – 1| + |x + 1|, for all x ∈ R, is not differentiable at the points x = – 1 and x = 1.

15. To promote the making of toilets for women, an organisation tried to generate awareness through (i) house calls (ii) letters, and (iii) announcements. The cost for each mode per attempt is given below :

(i) ` 50
(ii) ` 20
(iii) ` 40

The number of attempts made in three villages X, Y, and Z are given below :

	(i)	(ii)	(iii)
X	400	300	100
Y	300	250	75
Z	500	400	150

Find the total cost incurred by the organisation for the three villages separately, using matrices. Write one value generated by the organisation in the society.

16. Three cards are drawn successively with replacement from a well shuffled pack of 52 cards. Find the probability distribution of the number of spades. Hence find the mean of the distribution.

OR

For 6 trials of an experiment, let X be a binomial variate which satisfies the relation 9P(X = 4) = P(X = 2). Find the probability of success.

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

OR

Find the particular solution of the differential equation $(\tan^{-1}y - x)dy = (1 + y^2)dx$, given that x = 1 when y = 0.

18. In a factory which manufactures bolts, machines A, B and C manufacture respectively 30%, 50% and 20% of the bolts. Of their outputs 3, 4 and 1 percent respectively are defective bolts. A bolts is drawn at random from the product and is found to be defective. Find the probability that this is not manufactured by machine B.

19. If $y = e^{m\sin^{-1}x}$, then prove that $(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} - m^2y = 0$.

20. The side of an equilateral triangle is increasing at the rate of 2cm/s. At what rate is its area increasing, when the side of the triangle is 20cm?

21. Find the equation of a line passing through the point (1, 2, – 4) and perpendicular to two lines $\vec{r} = (8\hat{i} - 19\hat{j} + 10\hat{k}) + \lambda(3\hat{i} - 16\hat{j} + 7\hat{k})$ and $\vec{r} = (15\hat{i} + 29\hat{j} + 5\hat{k}) + \mu(3\hat{i} + 8\hat{j} - 5\hat{k})$.

22. If $\vec{a} = \hat{i} + 2\hat{j} + \hat{k}, \vec{b} = 2\hat{i} + \hat{j}$ *and* $\vec{c} = 3\hat{i} - 4\hat{j} - 5\hat{k}$, then find a unit vector perpendicular to both of the vectors $(\vec{a} - \vec{b})$ and $(\vec{c} - \vec{b})$

23. Find the value of p for when the curves $x^2 = 9p\ (9 - y)$ and $x^2 = p\ (y + 1)$ cut each other at right angles.

SECTION – D

Questions 24 to 29 carry 6 marks each.

24. Consider $f : R_+ \to [-9, \infty]$ given by $f(x) = 5x^2 + 6x - 9$. Prove that f is invertible with

$$f^{-1}(y) = \left(\frac{\sqrt{54 + 5y} - 3}{5} \right)$$

OR

A binary operation * is defined on the set x = R – { – 1 } by

$x * y = x + y + xy, \ \forall \ x, y \in X.$

Check whether * is commutative and associative. Find its identity element and also find the inverse of each element of X.

25. Using properties of determinants, prove that $\begin{vmatrix} a^2 & bc & ac + c^2 \\ a^2 + ab & b^2 & ac \\ ab & b^2 + bc & c^2 \end{vmatrix} = 4a^2b^2c^2$

26. Using integration, prove that the curves $y^2 = 4x$ and $x^2 = 4y$ divide the area of the square bounded by x = 0, x = 4, y = 4, and y = 0 into three equal parts.

OR

Using integration, find the area of the region $\left\{ (x, y) : x^2 + y^2 \le 1 \le x + \frac{y}{2}, x, y \in R \right\}$

27. Evaluate: $\int_0^1 x(\tan^{-1} x)^2 dx$.

OR

Evaluate $\int_1^3 (e^{2-3x} + x^2 + 1) dx$ as a limit of a sum.

28. Find the distance of the point P(3, 4, 4) from the point, where the line joining the points A(3, – 4, – 5) and B(2, – 3, 1) intersects the plane 2x + y + z = 7.

29. A company manufactures three kinds of calculators : A, B and C in its two factories I and II. The company has got an order for manufacturing at least 6400 calculators of kind A, 4000 of kind B and 4800 of kind C. The daily output of factory I is of 50 calculators of kind A, 50 calculators of kind B, and 30 calculators of kind C. The daily output of factory II is of 40 calculators of kind A, 20 of kind B and 40 of kind C. The cost per day to run factory I is ` 12,000 and of factory II is ` 15,000. How many days do the two factories have to be in operation to produce the order with the minimum cost ? Formulate this problem as an LPP and solve it graphically.