KENDRIYA VIDYALAYA SANGATHAN, HYDERABAD REGION

MOCK TEST PAPER – 10 (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	--	--	--	6(1)	**6(1)**
Inverse Trigonometric Functions	--	--	4(1)	--	**4(1)**
Matrices	--	--	8(2)	--	**8(2)**
Determinants	1(1)	--	4(1)	--	**5(2)**
Continuity & Differentiability	--	2(1)	8(2)	--	**10(3)**
Applications of Derivatives	--	4(2)	--	6(1)	**10(3)**
Integrals	2(2)	4(2)	4(1)	--	**10(5)**
Applications of the Integrals	--	--	--	6(1)	**6(1)**
Differential Equations	--	2(1)	--	6(1)	**8(2)**
Vector Algebra	--	2(1)	4(1)	--	**6(2)**
Three-Dimensional Geometry	1(1)	--	4(1)	6(1)	**11(3)**
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. Find the angle between the lines 2x = 3y = – z and 6x = – y = – 4z.

2. Evaluate: $\int \frac{dx}{\sin^2 x \cos^2 x}$

3. Evaluate: $\int_0^{\pi/4} \tan x dx$

4. If $A = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$, then for any natural number n, find the value of Det (A^n).

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

5. A family has two children. What is the probability that both the children are boys given that at least one of them is a boy ?

6. Evaluate: $\int \sin^3 x dx$

7. Find the equation of the tangent line to the curve $y = x^2 - 2x + 7$ which is perpendicular to the line $5y - 15x = 13$.

8. Find the unit vector in the direction of the sum of the vectors, $\vec{a} = 2\hat{i} + 2\hat{j} - 5\hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} + 3\hat{k}$

9. Find the solution of the following differential equation: $x\sqrt{1+y^2}dx + y\sqrt{1+x^2}dy = 0$

10. If y = $2\sqrt{\cot x^2}$, then find $\frac{dy}{dx}$

11. Find the approximate change in the volume V of a cube of side *x* meters caused by increasing the side by 2%.

12. Find the anti derivative F of *f* defined by $f(x) = 4x^3 - 6$, where F (0) = 3

SECTION – C
Questions 13 to 23 carry 4 marks each.

13. Evaluate: $\tan\left\{2\tan^{-1}\left(\frac{1}{5}\right) + \frac{\pi}{4}\right\}$

14. There are 2 families A and B. There are 4 men, 6 women and 2 children in family A, and 2 men, 2 women and 4 children in family B. The recommended daily amount of calories is 2400 for men, 1900 for women, 1800 for children and 45 grams of proteins for men, 55 grams for women and 33 grams for children. Represent the above information using matrices. Using matrix multiplication, calculate the total requirement of calories and proteins for each of the 2 families. What awareness can you create among people about the balanced diet from this question ?

15. Using properties of determinants, prove that $\begin{vmatrix} a^3 & 2 & a \\ b^3 & 2 & b \\ c^3 & 2 & c \end{vmatrix} = 2(a-b)(b-c)(c-a)(a+b+c)$

16. Using elementary row operations (transformations), find the inverse of the following matrix :

$$\begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 0 \end{bmatrix}$$

OR

If $A = \begin{bmatrix} 0 & 6 & 7 \\ -6 & 0 & 8 \\ 7 & -8 & 0 \end{bmatrix}, B = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{bmatrix}, C = \begin{bmatrix} 2 \\ -2 \\ 3 \end{bmatrix}$, then calculate AC, BC and (A + B) C. Also verify that (A + B) C = AC + BC.

17. Discuss the continuity and differentiability of the function f(x) = | x | + | x – 1 | in the interval (–1, 2).

18. If x = a (cos 2t + 2t sin 2t) and y = a (sin 2t – 2t cos 2t), then find $\frac{d^2y}{dx^2}$.

19. Evaluate: $\int \frac{\sin x - x\cos x}{x(x+\sin x)}dx$

OR

Evaluate: $\int \frac{x^3}{(x-1)(x^2+1)}dx$

20. Let $\vec{a} = \hat{i} + 4\hat{j} + 2\hat{k}, \vec{b} = 3\hat{i} - 2\hat{j} + 7\hat{k}$ and $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$. Find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ and $\vec{c}.\vec{d} = 27$

21. Find the shortest distance between the following lines:

$\vec{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + \lambda(2\hat{i} + 3\hat{j} + 4\hat{k})$

$\vec{r} = (2\hat{i} + 4\hat{j} + 5\hat{k}) + \mu(4\hat{i} + 6\hat{j} + 8\hat{k})$

OR

Find the equation of the plane passing through the line of intersection of the planes 2x + y – z = 3 and 5x – 3y + 4z + 9 = 0 and is parallel to the line $\frac{x-1}{2} = \frac{y-3}{4} = \frac{5-z}{-5}$

22. A man takes a step forward with probability 0.4 and backward with probability 0.6. Find the probability that at the end of 5 steps, he is one step away from the starting point.

OR

Suppose a girl throws a die. If she gets a 1 or 2, she tosses a coin three times and notes the number of 'tails'. If she gets 3, 4, 5 or 6, she tosses a coin once and notes whether a 'head' or 'tail' is obtained. If she obtained exactly one 'tail', what is the probability that she threw 3, 4, 5 or 6 with the die ?

23. An urn contains 5 red and 2 black balls. Two balls are randomly drawn, without replacement. Let X represent the number of black balls drawn. Find the mean and variance of X.

SECTION – D

Questions 24 to 29 carry 6 marks each.

24. Determine whether the relation R defined on the set of all real numbers as $R = \{(a, b) : a, b \in R$ *and* $a - b + \sqrt{3} \in S,$ where S is the set of all irrational numbers$\}$, is reflexive, symmetric and transitive.

OR

Let A = R x R and * be the binary operation on A defined by (a, b) * (c, d) = (a + c, b + d). Prove that * is commutative and associative. Find the identity element for * on A. Also write the inverse element of the element (3, – 5) in A.

25. Tangent to the circle $x^2 + y^2 = 4$ at any point on it in the first quadrant makes intercepts OA and OB on x and y axes respectively, O being the centre of the circle. Find the minimum value of (OA + OB).

26. If the area bounded by the parabola $y^2 = 16ax$ and the line y = 4mx is $\frac{a^2}{12}$ sq. units, then using integration, find the value of m.

27. Show that the differential equation $(x - y)\frac{dy}{dx} = x + 2y$ is homogeneous and solve it also.

OR

Find the differential equation of the family of curves $(x - h)^2 + (y - k)^2 = r^2$, where h and k are arbitrary constants.

28. Find the equation of a plane passing through the point P(6, 5, 9) and parallel to the plane determined by the points A(3, –1, 2), B(5, 2, 4) and C(–1, –1, 6). Also find the distance of this plane from the point A.

29. Solve the following linear programming problem graphically.
Minimise z = 3x + 5y
subject to the constraints $x + 2y \geq 10$; $x + y \geq 6$; $3x + y \geq 8$; $x, y \geq 0$.