# KENDRIYA VIDYALAYA SANGATHAN, HYDERABAD REGION
## MOCK TEST PAPER – 01 (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) | -- | -- | **3(2)** |
| **Determinants** | -- | -- | 4(1) | 6(1) | **10(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.** Let f : R → R be defined by f(x) = $3x^2 - 5$ and g : R → R be defined by g(x) = $\frac{x}{x^2+1}$. Find gof

**2.** What is the principal value of $\cos^{-1}\left(\cos\frac{2\pi}{3}\right)$?

**3.** A and B are square matrices of order 3 each, | A | = 2 and | B | = 3. Find | 3AB |

**4.** If $|\vec{a}| = a$, then find the value of $|\vec{a}\times\hat{i}|^2 + |\vec{a}\times\hat{j}|^2 + |\vec{a}\times\hat{k}|^2$.

## SECTION – B

**Questions 5 to 12 carry 2 marks each.**

**5.** Show that if *f* : A → B and *g* : B → C are one-one, then *gof* : A → C is also one-one.

**6.** If $A = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$, the verify that A'A = I.

**7.** Form the differential equation of the family of circles having centre on x-axis and radius 3 units.

**8.** Differentiate sinx with respect to $e^{\cos x}$.

**9.** A stone is dropped into a quiet lake and waves move in circles at a speed of 5cm/s. At the instant, when the radius of the circular wave is 15 cm, how fast is the enclosed area increasing?

**10.** Find the Cartesian and Vector equations of the line which passes through the point ( 2 4 5) and parallel to the line given by $\frac{x+3}{3} = \frac{y-4}{5} = \frac{8-z}{-6}$.

**11.** A black and a red dice are rolled. Find the conditional probability of obtaining a sum greater than 9, given that the black die resulted in a 5.

**12.** Solve the following Linear Programming Problem graphically:
Maximize Z = 3x + 4y; subject to $x + y \le 4, x \ge 0$ *and* $y \ge 0$

## SECTION – C

**Questions 13 to 23 carry 4 marks each.**

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

**14.** Using properties of determinant, prove that $\begin{vmatrix} \cos A\cos B & \cos A\sin B & -\sin A \\ -\sin B & \cos B & 0 \\ \sin A\cos B & \sin A\sin B & \cos A \end{vmatrix} = 1$

**OR**

Using properties of determinant, prove that $\begin{vmatrix} a^2+1 & ab & ac \\ ab & b^2+1 & bc \\ ca & cb & c^2+1 \end{vmatrix} = 1 + a^2 + b^2 + c^2$

**15.** It is given that for the function f(x) = $x^3 - 6x^2 + ax + b$ Rolle's theorem holds in [1, 3] with $c = 2 + \frac{1}{\sqrt{3}}$. Find the values of 'a' and 'b'.

**16.** Determine for what values of x, the function f(x) = $x^3 + \frac{1}{x^3}$ ( $x \neq 0$) is strictly increasing or strictly decreasing

**OR**

Find the points on the curve $y = x^3$ at which the slope of the tangent is equal to the *y*-coordinate of the point.

**17.** Find the area of the region bounded by the y-axis, y = cos x and y = sinx, $0 \le x \le \frac{\pi}{2}$

**18.** Show the following differential equation is homogeneous: $x^2\frac{dy}{dx} - xy = 1 + \cos\left(\frac{y}{x}\right), x \neq 0$

Find the general solution of the differential equation using substitution y = vx.

**OR**

Find the general solution of the differential equation $x\log x.\frac{dy}{dx} + y = \frac{2}{x}\log x$

**19.** If a 20 year old girl drives her car at 25 km/h, she has to spend Rs 4/km on petrol. If she drives her car at 40 km/h, the petrol cost increases to Rs 5/km. She has Rs 200 to spend on petrol and wishes to find the maximum distance she can travel within one hour. Express the above problem as a Linear Programming Problem. Write any one value reflected in the problem.

**20.** An experiment succeeds twice as often as it fails. Find the probability that in the next six trails there will be at least 4 successes.

**21.** 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?

**22.** If the vectors $\vec{p} = a\hat{i} + \hat{j} + \hat{k}, \vec{q} = \hat{i} + b\hat{j} + \hat{k}$ *and* $\vec{p} = \hat{i} + \hat{j} + c\hat{k}$ are coplanar, then for a, b, c $\neq 1$ show that $\frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c} = 1$

**23.** A plane meets the coordinate axes in A, B and C such that the centroid of Δ ABC is the point (α, β, γ). Show that the equation of the plane is $\frac{x}{\alpha} + \frac{y}{\beta} + \frac{z}{\gamma} = 3$

## SECTION – D

**Questions 24 to 29 carry 6 marks each.**

**24.** Define skew lines. Using only vector approach, find the shortest distance between the following two skew lines: $\vec{r} = (8+3\lambda)\hat{i} - (9+16\lambda)\hat{j} + (10+7\lambda)\hat{k}$ and $\vec{r} = 15\hat{i} + 29\hat{j} + 5\hat{k} + \mu(3\hat{i} + 8\hat{j} - 5\hat{k})$.

**25.** Solve the trigonometric equation: $\tan^{-1}\left(\frac{x+1}{x-1}\right) + \tan^{-1}\left(\frac{x-1}{x}\right) = -\tan^{-1} 7$

**OR**

Determine whether the operation define below on Q is binary operation or not.

a * b = ab+1

If yes, check the commutative and the associative properties. Also check the existence of identity element and the inverse of all elements in Q

**26.** Find the value of x, y and z, if $A = \begin{bmatrix} 0 & 2y & z \\ x & y & -z \\ x & -y & z \end{bmatrix}$ satisfies A' = $A^{-1}$

**OR**

Verify: A(adj A) = (adj A)A = | A | I for matrix $A = \begin{bmatrix} 1 & -1 & 2 \\ 3 & 0 & -2 \\ 1 & 0 & 3 \end{bmatrix}$

**27.** Using properties of integral, evaluate $\int_0^{\pi/2} (2\log \sin x - \log \sin 2x)dx$.

**OR**

Find: $\int \frac{\sin x}{\sin^3 x + \cos^3 x} dx$

**28.** Find $\frac{dy}{dx}$, if $y = (\sin x)^{\tan x} + (\cos x)^{\sec x}$.

**29.** Show that the right circular cylinder, open at the top, and of given surface area and maximum volume is such that its height is equal to the radius of the base.