# KENDRIYA VIDYALAYA SANGATHAN, HYDERABAD REGION
## MOCK TEST PAPER – 04 (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** | 2(2) | -- | -- | 6(1) | **8(3)** |
| **Inverse Trigonometric Functions** | -- | 2(1) | -- | -- | **2(1)** |
| **Matrices** | -- | 2(1) | -- | -- | **2(1)** |
| **Determinants** | 1(1) | -- | 4(1) | 6(1) | **11(3)** |
| **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.** Find the number of all one-one functions from set A = {1, 2, 3} to itself.

**2.** If $f : \mathbf{R} \to \mathbf{R}$ is defined by $f(x) = x^2 - 3x + 2$, find $f(f(x))$.

**3.** Find values of $x$ for which $\begin{vmatrix} 3 & x \\ x & 1 \end{vmatrix} = \begin{vmatrix} 3 & 2 \\ 4 & 1 \end{vmatrix}$

**4.** The vectors $\vec{a} = 3\hat{i} + x\hat{j}$ *and* $\vec{b} = 2\hat{i} + \hat{j} + y\hat{k}$ are mutually perpendicular. If $|\vec{a}| = |\vec{b}|$, then find the value of y.

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

**5.** Prove that $2\tan^{-1}\frac{1}{x} = \sin^{-1}\left(\frac{2x}{x^2+1}\right)$

**6.** Find the value of (x + y) from the following matrix equation: $2\begin{bmatrix} x & 5 \\ 7 & y-3 \end{bmatrix} + \begin{bmatrix} 3 & -4 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 7 & 6 \\ 15 & 14 \end{bmatrix}$

**7.** If cos(x + y) = ysinx, find $\frac{dy}{dx}$.

**8.** Find the integrating factor of the following differential equation: $x\log x\frac{dy}{dx} + y = 2\log x$

**9.** Evaluate: $\int \tan^{-1}\left(\sqrt{\frac{1+\cos 2x}{1-\cos 2x}}\right) dx$.

**10.** Using differentials find the approximate value of the square root of 26.

**11.** If $\vec{a} = 5\hat{i} - \hat{j} - 3\hat{k}$ *and* $\vec{b} = \hat{i} + 3\hat{j} - 5\hat{k}$, the show that $(\vec{a} + \vec{b})$ and $(\vec{a} - \vec{b})$ are perpendicular to each other.

**12.** A die is thrown. If E is the event 'the number appearing is a multiple of 3' and F be the event 'the number appearing is even' then find whether E and F are independent ?

## SECTION – C

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

**13.** A trust caring for handicapped children gets ` 30,000 every month from its donors. The trust spends half of the funds received for medical and educational care of the children and for that it charges 2% of the spent amount from them, and deposits the balance amount in a private bank to get the money multiplied so that in future the trust goes on functioning regularly. What percent of interest should the trust get from the bank to get a total of ` 1,800 every month ? Use matrix method, to find the rate of interest. Do you think people should donate to such trusts ?

**14.** Let f(x) = x – | x – $x^2$ |, x ∈ [– 1, 1]. Find the point of discontinuity, (if any), of this function on [– 1, 1].

**15.** Evaluate: $\int \left[ \log\log x + \frac{1}{(\log x)^2} \right] dx$

**OR**

Evaluate: $\int_0^{\pi/2} \left( \frac{5\sin x + 3\cos x}{\sin x + \cos x} \right) dx$

**16.** If $y = \log\left( \frac{x}{a+bx} \right)^x$, then prove that $x^3 \frac{d^2y}{dx^2} = \left( x\frac{dy}{dx} - y \right)^2$

**17.** Find a unit vector perpendicular to the plane of triangle ABC, where the coordinates of its vertices are A(3, – 1, 2), B(1, – 1, – 3) and C(4, – 3, 1).

**18.** Find the shortest distance between the lines x + 1 = 2y = – 12z and x = y + 2 = 6z – 6.

**OR**

From the point P(a, b, c), perpendiculars PL and PM are drawn to YZ and ZX planes respectively. Find the equation of the plane OLM.

**19.** An urn contains 3 red and 5 black balls. A ball is drawn at random, its colour is noted and returned to the urn. Moreover, 2 additional balls of the colour noted down, are put in the urn and then two balls are drawn at random (without replacement) from the urn. Find the probability that both the balls drawn are of red colour.

**20.** A man is known to speak truth 3 out of 5 times. He throws a die and reports that it is 4. Find the probability that it is actually a 4.

**21.** ($x^2$ + $y^2$) dy = xy dx. If y (1) = 1 and y ($x_0$) = e, then find the value of $x_0$.

**OR**

Find the particular solution of the differential equation $\frac{dy}{dx} + y\tan x = 3x^2 + x^3 \tan x, x \neq \frac{\pi}{2}$ given that y = 0 when $x = \frac{\pi}{3}$

**22.** Show that the semi-vertical angle of the cone of the maximum volume and of given slant height is $\cos^{-1}\frac{1}{\sqrt{3}}$.

**23.** Find the intervals in which the function $f(x) = 3x^4 - 4x^3 - 12x^2 + 5$ is (*a*) strictly increasing (*b*) strictly decreasing

## SECTION – D

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

**24.** On the set {0, 1, 2, 3, 4, 5, 6}, a binary operation * is defined as: $a*b=\begin{cases} a+b, & if\ a+b<7 \\ a+b-7, & if\ a+b\geq 7 \end{cases}$

Write the operation table of the operation * and prove that zero is the identity for this operation and each element a ≠ 0 of the set is invertible with 7 – a being the inverse of a.

**25.** Using properties of determinants, prove that $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = (bc+ca+ab+abc)$

**26.** Evaluate: $\int_{\pi/6}^{\pi/3} \frac{dx}{1+\sqrt{\cot x}}$.

**OR**

Find $\int_0^2 (x^2-x)dx$ as the limit of a sum.

**27.** Find the area of the region {(x, y) : $x^2 + y^2 \leq 4$, $x + y \geq 2$}, using the method of integration.

**OR**

Find the area of the region in the first quadrant enclosed by the *x*-axis, the line $y = x$ and the circle $x^2 + y^2 = 32$.

**28.** Find the coordinates of the point where the line through the points A(3, 4, 1) and B(5, 1, 6) crosses the plane determined by the points P(2, 1, 2), Q(3, 1, 0) and R(4, – 2, 1).

**29.** A dealer in a rural area wishes to purchase some sewing machines. He has only ` 57,600 to invest and has space for at most 20 items. An electronic machine costs him ` 3,600 and a manually operated machine costs ` 2,400. He can sell an electronic machine at a profit of ` 220 and a manually operated machine at a profit of ` 180. Assuming that he can sell all the machines that he buys, how should he invest his money in order to maximize his profit ? Make it as a LPP and solve it graphically.