http://www.maharashtrastudy.com

DAY — 08 SEAT NUMBER

| 2020 | II | 28 | 1100 | J-360 | (E) |
|---|---|---|---|---|---|

# MATHEMATICS & STATISTICS (40)
## (ARTS & SCIENCE)

**Time : 3 Hrs.** **(8 Pages)** **Max. Marks : 80**

***General instructions :***

*The question paper is divided into **FOUR** sections.*

*(1)* ***Section A :*** *Q. 1 contains **Eight** multiple choice type of questions, each carrying **Two** marks.*
*Q. 2 contains **Four** sub-questions, each carrying **one** mark.*

*(2)* ***Section B :*** *Q. 3 to Q. 14 each carries **Two** marks. (Attempt any **Eight**)*

*(3)* ***Section C :*** *Q. 15 to Q. 26 each carries **Three** marks. (Attempt any **Eight**)*

*(4)* ***Section D :*** *Q. 27 to Q. 34 each carries **Four** marks. (Attempt any **Five**)*

*(5) Use of log table is allowed. Use of calculator is not allowed.*

*(6) Figures to the right indicate full marks.*

*(7) Use of graph paper is not necessary. Only rough sketch of graph is expected.*

*(8) For each MCQ, correct answer must be written along with its alphabet:*
*e.g. (a) ..... / (b) ..... / (c) ..... / (d)....., etc.*

*(9) Start answers to each section on a new page.*

http://www.maharashtrastudy.com
http://www.maharashtrastudy.com



http://www.maharashtrastudy.com

http://www.maharashtrastudy.com

## SECTION – A

**Q. 1. Select and write the most appropriate answer from the given alternatives for each question :** [16]

**(i)** In $\Delta ABC$, if $a = 2$, $b = 3$ and $\sin A = \frac{2}{3}$, then $\angle B =$ _____.

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$

(c) $\frac{\pi}{3}$ (d) $\frac{\pi}{6}$ (2)

**(ii)** If $\bar{a} = 3\hat{i} - \hat{j} + 4\hat{k}$, $\bar{b} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\bar{c} = -5\hat{i} + 2\hat{j} + 3\hat{k}$, then $\bar{a} \cdot (\bar{b} \times \bar{c})$ is _____.

(a) 100 (b) 110

(c) 109 (d) 108 (2)

**(iii)** The cartesian equation of the line passing through the points A (4, 2, 1) and B (2, –1, 3) is _____.

(a) $\frac{x+4}{2} = \frac{y-2}{3} = \frac{z-1}{-2}$

(b) $\frac{x-4}{-2} = \frac{y-2}{-3} = \frac{z-1}{-2}$

(c) $\frac{x-4}{2} = \frac{y-2}{3} = \frac{z-1}{-2}$

(d) $\frac{x-4}{-2} = \frac{y-2}{3} = \frac{z-1}{-2}$ (2)

**(iv)** If the line $\bar{r} = (\hat{i} - 2\hat{j} + 3\hat{k}) + \lambda(2\hat{i} + \hat{j} + 2\hat{k})$ is parallel to the plane $\bar{r} \cdot (3\hat{i} - 2\hat{j} + m\hat{k}) = 10$, then value of $m$ is _____.

(a) – 2 (b) 2

(c) ± 2 (d) 0 (2)



http://www.maharashtrastudy.com

http://www.maharashtrastudy.com

http://www.maharashtrastudy.com

http://www.maharashtrastudy.com

**(v)** If $f(x) = 1 - x$, for $0 < x \leq 1$

$= k$, for $x = 0$ is continuous at $x = 0$, then $k =$ _____.

(a) 0 (b) $-1$

(c) 2 (d) 1 (2)

**(vi)** The function $f(x) = x^x$ is minimum at $x =$ _____.

(a) $e$ (b) $-e$

(c) $\frac{1}{e}$ (d) $-\frac{1}{e}$ (2)

**(vii)** If $\int_0^k 4x^3 \, dx = 16$, then the value of $k$ is _____.

(a) 1 (b) 2

(c) 3 (d) 4 (2)

**(viii)** Order and degree of differential equation

$\frac{d^4y}{dx^4} = \left[1 + \left(\frac{dy}{dx}\right)^2\right]^3$ respectively are _____.

(a) Order : 1, Degree : 4

(b) Order : 4, Degree : 1

(c) Order : 6, Degree : 1

(d) Order : 1, Degree : 6 (2)

**Q. 2. Answer the following questions :** **[4]**

(i) Write the dual of $p \wedge \sim p \equiv F$ (1)

(ii) Find the general solution of $\tan 2x = 0$ (1)

(iii) Differentiate $\sin(x^2 + x)$ w. r. t. $x$ (1)

**(iv)** If $X \sim B(n, p)$ and $n = 10$, $E(X) = 5$, then find the value of $p$. (1)



http://www.maharashtrastudy.com

http://www.maharashtrastudy.com

http://www.maharashtrastudy.com

http://www.maharashtrastudy.com

## SECTION – B

**Attempt any EIGHT of the following questions :** **[16]**

**Q. 3.** Using truth table verify that $\sim(p \vee q) \equiv \sim p \wedge \sim q$ (2)

**Q. 4.** Find the matrix of co-factors for the matrix $\begin{bmatrix} 1 & 3 \\ 4 & -1 \end{bmatrix}$ (2)

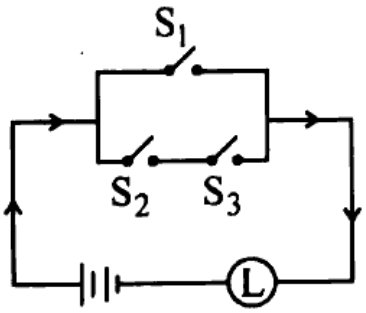
**Q. 5.** Find the angle between the lines represented by

$3x^2 + 4xy - 3y^2 = 0$ http://www.maharashtrastudy.com (2)

**Q. 6.** $\bar{a}$ and $\bar{b}$ are non-collinear vectors. If $\bar{c} = (x-2)\bar{a} + \bar{b}$ and $\bar{d} = (2x+1)\bar{a} - \bar{b}$ are collinear, then find the value of $x$. (2)

**Q. 7.** If a line makes angles 90°, 135°, 45° with X, Y and Z axes respectively, then find its direction cosines. (2)

**Q. 8.** Express the following circuit in symbolic form : (2)




**Q. 9.** Differentiate log (sec $x$ + tan $x$) w. r. t. $x$. (2)

**Q. 10.** Evaluate : $\int \frac{dx}{x^2 + 4x + 8}$ (2)

**Q. 11.** Evaluate : $\int_0^{\frac{\pi}{2}} \cos^2 x \, dx$ (2)



http://www.maharashtrastudy.com

http://www.maharashtrastudy.com

http://www.maharashtrastudy.com

http://www.maharashtrastudy.com

**Q. 12.** Solve the differential equation $\frac{dy}{dx} = x^2y + y$ (2)

**Q. 13.** Find expected value of the random variable X whose probability mass function is :

| $X = x$ | 1 | 2 | 3 |
|---|---|---|---|
| $P(X = x)$ | $\frac{1}{5}$ | $\frac{2}{5}$ | $\frac{2}{5}$ |

(2)

**Q. 14.** If $y = x \log x$, then find $\frac{d^2y}{dx^2}$. (2)

## SECTION – C

**Attempt any EIGHT of the following questions :** [24]

**Q. 15.** State the converse, inverse and contrapositive of the conditional statement : 'If a sequence is bounded, then it is convergent'. (3)

**Q. 16.** Show that : $\sin^{-1}\left(\frac{8}{17}\right) + \sin^{-1}\left(\frac{3}{5}\right) = \sin^{-1}\left(\frac{77}{85}\right)$. (3)

**Q. 17.** Show that the points A(2, 1, –1), B(0, –1, 0), C(4, 0, 4) and D(2, 0, 1) are coplanar. (3)

**Q. 18.** If $\Delta ABC$ is right angled at B, where A(5, 6, 4), B(4, 4, 1) and C(8, 2, $x$), then find the value of $x$. (3)

**Q. 19.** Find the equation of the line passing through the point (3, 1, 2) and perpendicular to the lines $\frac{x-1}{1} = \frac{y-2}{2} = \frac{z-3}{3}$ and $\frac{x}{-3} = \frac{y}{2} = \frac{z}{5}$. (3)



http://www.maharashtrastudy.com

http://www.maharashtrastudy.com

http://www.maharashtrastudy.com

http://www.maharashtrastudy.com

**Q. 20.** Find the distance of the point $\hat{i}+2\hat{j}-\hat{k}$ from the plane $\vec{r}\cdot(\hat{i}-2\hat{j}+4\hat{k})=10$ (3)

**Q. 21.** If $e^x+e^y=e^{x+y}$, show that $\frac{dy}{dx}=-e^{y-x}$ (3)

**Q. 22.** The surface area of a spherical balloon is increasing at the rate of 2 $cm^2$/sec. At what rate the volume of the balloon is increasing when the radius of the balloon is 6 cm? (3)

**Q. 23.** Find the approximate value of $e^{1\cdot005}$; given $e=2\cdot7183$. (3)

**Q. 24.** Evaluate :

$$\int \frac{x^2\cdot\tan^{-1}(x^3)}{1+x^6}\,dx$$ (3)

**Q. 25.** Solve the differential equation $\frac{dy}{dx}+y=e^{-x}$ (3)

**Q. 26.** If $f(x)=kx,\ 0<x<2$

$=0$ , otherwise,

is a probability density function of a random variable X, then find :

(i) Value of $k$,

(ii) $P(1<X<2)$. (3)

## SECTION – D

**Attempt any FIVE of the following questions :** **[20]**

**Q. 27.** Prove that a homogeneous equation of degree two in $x$ and $y$ i.e. $ax^2+2hxy+by^2=0$ represents a pair of lines passing through the origin, if $h^2-ab\geq 0$. (4)



http://www.maharashtrastudy.com

http://www.maharashtrastudy.com

http://www.maharashtrastudy.com

http://www.maharashtrastudy.com

**Q. 28.** Solve the following linear programming problem :

Maximise : $z = 150x + 250y$

Subject to ; $4x + y \leq 40$

$3x + 2y \leq 60$

$x \geq 0$

$y \geq 0$ (4)

**Q. 29.** Solve the following equations by the method of reduction :

$x + 3y + 3z = 12$

$x + 4y + 4z = 15$

$x + 3y + 4z = 13$ (4)

**Q. 30.** In $\Delta$ ABC, if $a + b + c = 2s$, then prove that

$\sin\left(\frac{A}{2}\right) = \sqrt{\frac{(s-b)(s-c)}{bc}}$, with usual notations. (4)

**Q. 31.** Function $f(x)$ is continuous on its domain [–2, 2], where

$f(x) = \frac{\sin ax}{x} + 2$, for $-2 \leq x < 0$

$= 3x + 5$, for $0 \leq x \leq 1$

$= \sqrt{x^2 + 8} - b$, for $1 < x \leq 2$

Find the value of $a + b + 2$. (4)

**Q. 32.** Prove that :

$$\int \sqrt{x^2 + a^2} \cdot dx = \frac{x}{2}\sqrt{x^2 + a^2} + \frac{a^2}{2} \log\left|x + \sqrt{x^2 + a^2}\right| + c \quad (4)$$



http://www.maharashtrastudy.com

http://www.maharashtrastudy.com

http://www.maharashtrastudy.com

http://www.maharashtrastudy.com

**Q. 33.** A fair coin is tossed 8 times. Find the probability that :

(i) it shows no head

(ii) it shows head at least once. (4)

**Q. 34.** Prove that :

$$\int_0^{2a} f(x)\,dx = \int_0^{a} f(x)\,dx + \int_0^{a} f(2a-x)\,dx \qquad (4)$$

◆◆◆

http://www.maharashtrastudy.com

http://www.maharashtrastudy.com

http://www.maharashtrastudy.com
Whatsapp @ 9300930012
Send your old paper & get 10/-
अपने पुराने पेपर्स भेजे और 10 रुपये पायें,
Paytm or Google Pay से



http://www.maharashtrastudy.com