Roll No.

MATHEMATICS
SET - B

Time allowed : 3 hr ***Maximum Marks : 100***

General Instructions:

(i) All Questions are compulsory.
*(ii) The question paper consists of 29 questions divided into three sections A, B, and C. Section A comprises of 10 questions of **one mark** each. Section B comprises of 12 questions of **four marks** each and Section C comprises of **7** questions of **six marks** each.*
(iii) All questions in Section A are to be answered in one word, one sentence or as per the exact requirement of the question..
(iv) There is no overall choice. However, internal choice has been provided in 4 questions of four marks each and 2 questions of six marks each. You have to attempt only one of the alternatives in all such questions.

Section A

1 If f(x) is an invertible function, find the inverse of $f(x)=\frac{3x-2}{5}$.

2 Find the principal value of $\tan^{-1}\left(\tan\frac{7\pi}{6}\right)+\cot^{-1}\left(\cot\frac{7\pi}{6}\right)$.

3 If A is non-singular square matrix such that |A| = 10, find $|A^{-1}|$.

4 If $\text{adj } A=\begin{bmatrix}3 & 5\\ 7 & -2\end{bmatrix}$ $\text{adj } B=\begin{bmatrix}2 & -3\\ -5 & 2\end{bmatrix}$, find adj AB.

5 Find the values of x and y if: $2\begin{bmatrix}3 & 4\\ 5 & x\end{bmatrix}+\begin{bmatrix}1 & y\\ 0 & 1\end{bmatrix}=\begin{bmatrix}7 & 0\\ 10 & 5\end{bmatrix}$

6 Find the value of $\int_0^1 x(1-x)^2dx$

7 Write the value of $\int_0^2 x[x]dx$

8 Find a vector in the direction of $\vec{a}=4\hat{i}-\hat{j}+3\hat{k}$, whose magnitude is 3.

9 If $|\vec{a}|=1, |\vec{b}|=1, \vec{a}.\vec{b}=\cos\theta$, find $|\vec{a}-\vec{b}|$

10 Find k for which the lines $\frac{x-1}{-3}=\frac{y-2}{2k}=\frac{z-3}{2}$ and $\frac{x-1}{3k}=\frac{y-1}{1}=\frac{6-z}{5}$ are $\perp$ to each other

Section B

11 Let f: W $\to$ W be defined as f(n) = n -1, if n is odd and f(a) = n +1, if n is even. Show that f is invertible. Find the inverse of f. Here, W is the set of all whose numbers. **OR**

Let A = R –{3} and B = R-{1}. Consider the function f: A $\to$ B defined by $f(x)=\frac{x-2}{x-3}$. Is f is one-one and onto? Justify your answer.

12 Show that $\sin^{-1}\frac{12}{13}+\cos^{-1}\frac{4}{5}+\tan^{-1}\frac{63}{16}=\pi$

13 If $A=\begin{bmatrix}3 & -5\\ -4 & 2\end{bmatrix}$, show that $A^2-5A-14I=0$. Hence, find A^{-1}

14 Show that f(x) = |x -2|, x $\in$ R is continuous but not differentiable at x = 2. **OR**

If $x^m y^n = (x+y)^{m+n}$, prove that $\frac{dy}{dx}=\frac{y}{x}$

15 Find the interval in which the function $f(x)=x^3+\frac{1}{x^3}, x\neq 0$ is (i) increasing (ii) decreasing

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16 The two equal sides of an isosceles triangle with fixed base b are decreasing at the rate of 3 cm per second. How fast is the area decreasing when the two equal sides are equal to the base?

Or

Using differential, find the approximate value of $(0.009)^{1/3}$.

17 By using the properties of definite integrals, evaluate: $\int_0^{\pi/4} \log(1+\tan x)\,dx$

18 Solve: $\left(x\cos\frac{y}{x} + y\sin\frac{y}{x}\right)y\,dx = \left(y\sin\frac{y}{x} - x\cos\frac{y}{x}\right)x\,dy$

19 Solve the following differential equation: $(1+y+x^2y)dx + (x+x^3)dy = 0$, where y = 0 when x=1

20 If $\vec{a}, \vec{b}, \vec{c}$ are respectively the position vectors of the vertices A, B, C of ΔABC, prove that area of the triangle ABC is given by $\Delta = \frac{1}{2}|\vec{a}\times\vec{b} + \vec{b}\times\vec{c} + \vec{c}\times\vec{a}|$

21 Find the equation of the plane which contains of the line of intersection of the plane $\vec{r}.(\hat{i}+2\hat{j}+3\hat{k}) - 4 = \vec{r}.(2\hat{i}+\hat{j}-\hat{k}) + 5 = 0$ and which is ⊥ to the plane $\vec{r}.(5\hat{i}+3\hat{j}-6\hat{k}) + 8 = 0$

22 A can hit a target 3 times in 6 shots, B:2 times in 6 shots and C: 4 times in 4 shots. They fix a volley. What is the probability that at least 2 shots hit ?

OR

How many times must a man toss a fair coin, so that the probability of having at least one head is more than 80% ?

SECTION C

23 Show that: $\Delta = \begin{vmatrix} (y+z)^2 & xy & zx \\ xy & (x+z)^2 & yz \\ xz & yz & (x+y)^2 \end{vmatrix} = 2xyz(x+y+z)^3$

24 Show that the right circular cone of least curved surface and given volume has an altitude equal to $\sqrt{2}$ times the radius of the base.

OR

Find the point on the curve $y^2 = 2x$ which is at a minimum distance from the point (1,4),

25 Evaluate: $\int \sqrt{\frac{1-\sqrt{x}}{1+\sqrt{x}}}\,dx$ **OR** Show that : $\int_0^{\pi/2} (\sqrt{\tan x} + \sqrt{\cot x})dx = \sqrt{2}\pi$

26 Using integration, find the area of the region $\left\{ (x,y) ; |x-1| \le y \le \sqrt{5-x^2} \right\}$

27 Find the equation of the plane which contains the two parallel line $\frac{x-3}{3} = \frac{y+4}{2} = \frac{z-1}{1}$ and $\frac{x+1}{3} = \frac{y-2}{2} = \frac{z}{1}$

28 An urn contains 25 balls of which 10 balls bear a mark 'X' and the remaining 15 bear mark 'Y'. A ball is drawn at random from the urn, its mark is noted down and it is replaced. If 6 balls are drawn in this way, find the probability that

(i) all will bear 'X' mark. (ii) not more than 2 will bear 'Y' mark

(iii) at least one ball will bear 'Y' mark

(iv) the number of balls with 'X' mark and 'Y' mark will be equal

29 A dietician wishes to mix together two kind of food X and Y in such a way that the mixture contains at least 10 units of vitamin A, 12 units of vitamin B and 8 units of vitamin C. The vitamin contents of 1 kg food is given below

Food	Vitamin A	Vitamin B	Vitamin C
X	1	2	3
Y	2	2	1

One kg of food X costs Rs. 16 and one kg of food Y costs Rs. 20. Find the least cost of the mixture which will produce the required diet?

Best of Luck

Answers (MOCK TEST -2)

Section A

1 $f^{-1}(y)=\frac{5y+2}{3}$ 2 $\frac{\pi}{3}$ 3 $\frac{1}{10}$ (4) $\begin{bmatrix}-15 & 16\\ -1 & -29\end{bmatrix}$ 5 x =2 and y = -8

(6) $\frac{1}{12}$ 7 $\frac{3}{2}$ (8) $\frac{3}{\sqrt{26}}(4\hat{i}-\hat{j}+3\hat{k})$ 9 $2\sin\frac{\theta}{2}$ (10) $-\frac{10}{7}$

Section B

13 $\frac{1}{14}\begin{bmatrix}-2 & -5\\ -4 & -3\end{bmatrix}$ 15 Increasing in (-∞, -1) and (1, ∞) and decreasing in the interval (-1,1)

16 decreasing at the rate $\sqrt{3}\,b\ cm^2/s$ or 0.2083 17 $\frac{\pi}{8}\log 2$ 18 $xy\cos\frac{y}{x}=C$

19 $\Rightarrow yx+\tan^{-1}x=\frac{\pi}{4}$ 21 $\vec{r}.(33\hat{i}+45\hat{j}+50\hat{k})-41=0$ 22 $\frac{2}{3}$ or 3 times

Section C

24 the point (2, 2) on the curve $y^2 = 2x$ is at a minimum distance from the point (1, 4)

25 $-2\sqrt{1-x}+\cos^{-1}\sqrt{x}+\sqrt{x}\sqrt{1-x}+C$ 26 $\frac{5}{2}\left[\sin^{-1}\left(\frac{2}{\sqrt{5}}\right)+\sin^{-1}\left(\frac{1}{\sqrt{5}}\right)\right]-\frac{1}{2}$

27 $8x + y - 26z + 6 = 0$ 28 (i) $\left(\frac{2}{5}\right)^6$ (ii) $7\left(\frac{2}{5}\right)^4$ (iii) $1-\left(\frac{2}{5}\right)^6$ (iv) $20\left(\frac{2}{5}\right)^3\left(\frac{3}{5}\right)^3$

29 if 2 kg of food X and 4 kg of food Y are used. The minimum cost C will be Rs 112