## Model Quesiton - 9

## Subject : Mathematics XII (Mat. 402/008)

Time : 3 hrs
F.M. 75

Attempt all the questions:

## Group "A"

Rewrite the correct option in your answer sheet:
11X1=11

1) Five digit numbers are formed with $0,1,2,3,4$ without repetitions, they can be formed in
a. 120 ways
b. 96 ways
c. 24 ways
d. 720 ways
2) The condition that one root of the quadratic equation $a x^{2}+b x+c=0$ is zero is
a. $a=0$
b. $b=0$
c. $\mathrm{c}=0$
d. $b=c$
3) If $\sin ^{-1} x=\frac{\pi}{5}$ then $\cos ^{-1} x=$
a. $\frac{\pi}{10}$
b. $\frac{3 \pi}{4}$
c. $\frac{3 \pi}{10}$
d. $\frac{7 \pi}{5}$
4) If a line makes an angle of $\alpha, \beta, \gamma, \delta$ with the four diagonals of a cube then
a. $\sin ^{2} \alpha+\sin ^{2} \beta+\sin ^{2} \gamma+\sin ^{2} \delta=\frac{8}{3}$
b. $\cos ^{2} \alpha+\cos ^{2} \beta+\cos ^{2} \gamma+\cos ^{2} \delta=\frac{4}{3}$
c. Both a and b
d. None of the above
5) The vector product of two non-zero vectors $\vec{a}$ and $\vec{b}$ is zero if and only if
a. $a=0$
b. $b=0$
c. $\vec{a}$ and $\vec{b}$ are parallel d .
6) $\quad \int_{0}^{a} \frac{d x}{a^{2}+x^{2}}$ is equal to
a. $\frac{\pi}{a}$
b. $\frac{\pi}{2 a}$
c. $\frac{\pi}{3 a}$
d. $\frac{\pi}{4 a}$
7) The value of $\lim _{x \rightarrow \frac{\pi}{2}} \frac{\tan 5 x}{\tan x}$ is
a. $\frac{1}{5}$
b. $\frac{2}{5}$
c. $\frac{5}{2}$
d. 5
8) Distance between the parallel planes $2 x-2 y+z+1=0$ and $4 x-4 y+2 z+3=0$ is
a. 3
b. $\frac{1}{3}$
c. 6
d. $\frac{1}{6}$
9) The correlation coefficient between the two variables is
a. 1
b. -1
c. $\geq 1$
d. $\leq 1$
10) The system of equations:

$$
x_{1}-x_{2}+x_{3}=1 ; 3 x_{1}+x_{2}+5 x_{3}=11 ; \quad 4 x_{1}+2 x_{2}+7 x_{3}=16
$$

a. consistent
b. Inconsistent
c. consistent and finite solutions
d. consistent and infinite solutions
11) If the pull of the earth on a mass of 5 kg is 49 N , then the acceleration due to gravity is
a. $10 \mathrm{~m} / \mathrm{s}$
b. $9.8 \mathrm{~m} / \mathrm{s}$
c. $9.6 \mathrm{~m} / \mathrm{s}$
d. $9.4 \mathrm{~m} / \mathrm{s}$

## Group "B"

Short answer questions:
$8 \times 5=40$
12) If $(1+x)^{n}=C_{0}+C_{1} x+C_{2} x^{2}+\ldots \ldots .+C_{n} x^{n}$, prove that:
$C_{0} C_{n}+C_{1} C_{n-1}+\ldots \ldots \ldots \ldots \ldots . . C_{n} C_{0}=\frac{(2 n)!}{n!n!}$
13) State De Moivre's theorem and applying De Moivre's theorem find the cube root of -1 .
14) Find the equation of the plane through the point ( $-1,1,1$ ) and ( $1,-1,1$ ) and perpendicular to the plane $x+2 y+2 z=5$
15)
a) The regression co-efficient of $x$ and $y$ and $y$ on $x$ are 1.5 and 0.65 respectively. If the arithmetic means $\bar{X}$ and $\bar{Y}$ are 36 and 52 respectivel. Find the two regression equations. Also, find the value of $y$ when $x=60$.
b) Suppose 3 cards are drawn from a well shuffled deck of 52 cards. What is the probability of getting all black cards?
16) Find from first principle, the derivative of $\log \left(\operatorname{secx}^{2}\right)$.
17) Integrate: $\int \frac{x^{3} d x}{\left(x^{2}-a^{2}\right)\left(x^{2}+b^{2}\right)}$
18) Maximize: $g=15 x+12 y$ such that
$2 x+3 y \leq 21$
$3 x+2 y \leq 24$
$x, y \geq 0$
19) $P, Q$ are like parallel forces. If $P$ is moved parallel to itself through a discatnce $x$, show that the resultant of P and Q moves a distance $\frac{P X}{P+Q}$

## Group "C"

## Long answer questions:

 $3 \times 8=24$20) 

a) From 10 persons, in how many ways can a committee of 4 is to be formed when one particular person is always included.
b) Show that the multiplication is a binary operation on the set $S=\{-1,0,1\} \quad 2$
c) Find the value of $k$ so that the equation $4 x^{2}-17 x+k=0$ has the reciprocal roots. 2
d) Sum to $n$ terms of the following series: $1+(1+2)+(1+2+3)+$
a) Verify Rolle's theorem for the function $f(x)=\sqrt{1-x^{2}}$ in the interval $-1 \leq x \leq 1$.
b) Solve: $\left(x^{2}-y^{2}\right) \frac{d y}{d x}=x y$
22)
a) Find the equation of the plane through the points $(2,2,1)$ and $(9,3,-6)$ and normal to the plane $2 x+6 y+6 z=9$.
b) Find the angle between the lines whose direction cosines are given by $\mathrm{I}+\mathrm{m}+\mathrm{n}=0$ and $2 \mathrm{~lm}-\mathrm{mn}+2 \mathrm{nl}=0$.

## Answers:

## Group A

| 1) | b |  |  | 3) | c | 4) | c |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 5) | c |  | d | 7) | a | 8) | d |
| 9) | d | 10) |  | 11) | b |  |  |

## Group B

$$
\text { 13) }-1, \frac{1}{2}(1+i \sqrt{3}), \frac{1}{2}(1-i \sqrt{3})
$$

14) $2 x+2 y-3 z+3=0$
15) (a) $y=0.65 x+28.6$
(b) $\frac{2}{17}$
16) $2 x \tan x^{2}$
17) $\frac{1}{2\left(a^{2}-b^{2}\right)}\left\{a^{2} \log \left(x^{2}+a^{2}\right)-b^{2} \log \left(x^{2}+b^{2}\right)+c\right.$
18) Max. $g=126, x=6, y=3$

## Group C

20) (a) 84
(c) $k=4$
(d) $\frac{1}{6} n(n+1)(n+2)$
21) 

(b) $x^{2}+2 y^{2} \log C y=0$
22) a) $3 x+4 y-6 z=9$
b) $\frac{1}{\sqrt{6}}, \frac{1 .}{\sqrt{6}}, \frac{-2}{\sqrt{6}}, \frac{1}{\sqrt{6}}, \frac{2}{\sqrt{6}}, \frac{-1}{\sqrt{6}}$

$$
\theta=60^{\circ}
$$

