

### **Model Question – 6**

**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) If the equation  $x^2 + 2(k+2)x + 9k = 0$  has equal roots then the value of k will be  
a. 1                      b. 4                      c. 1 or 4                      d. none
- 2) If  $C(18, r) = C(18, r+2)$  then the value of r will be

- a. 6                      b. 7                      c. 8                      d. 9
- 3) If  $\cos^{-1} x - \sin^{-1} x = 0$  then the value of x
- a.  $\frac{1}{\sqrt{2}}$                       b.  $-\frac{1}{\sqrt{2}}$                       c.  $\frac{\sqrt{3}}{2}$                       d. none
- 4) Find the eccentricity of the ellipse  $\frac{x^2}{16} + \frac{y^2}{4} = 1$  is
- a.  $\frac{1}{2}$                       b.  $\frac{\sqrt{3}}{2}$                       c.  $\frac{3}{2}$                       d.  $\frac{2}{3}$
- 5) The length of perpendicular from the point (2, 3, 4) on the plane  $3x - 2y + 6z + 4 = 0$  is
- a. 4                      b. -4                      c. 3                      d. none
- 6) If  $\vec{a} \cdot \vec{b} = 48$ ,  $|\vec{a}| = 15$ ,  $|\vec{b}| = 4$  then the value of  $|\vec{a} \times \vec{b}|$  is
- a. 36                      b. 32                      c. 25                      d. none
- 7) In a binomial distribution of  $n = 40$  and  $q = 0.5$  then mean and s.d. are
- a. 20 and 3.16                      b. 20 and 4.16  
c. 25 and 3.16                      d. 25 and 4.16
- 8) The derivative of  $e^{\sqrt{x}}$  is
- a.  $e^{\sqrt{x}}$                       b.  $2e^{\sqrt{x}}$                       c.  $\frac{e^{\sqrt{x}}}{\sqrt{x}}$                       d.  $\frac{e^{\sqrt{x}}}{2\sqrt{x}}$
- 9) The limit of  $\lim_{x \rightarrow 0} \frac{e^x - x - 1}{x^2}$  is
- a. 2                      b.  $\frac{1}{2}$                       c. 3                      d.  $\frac{1}{3}$
- 10) The pull of the earth on a body is 49 N. if the acceleration due to gravity is  $g = 9.8 \text{ m/sec}^2$  then the mass of body is
- a. 5 kg                      b. 6 kg                      c. 5 N                      d. 6 N
- 11) The maximum horizontal range of a particle thrown with a certain velocity is 10 m then the velocity of projection is
- a.  $9\text{ms}^{-1}$                       b.  $10\text{ms}^{-1}$                       c.  $11\text{ms}^{-1}$                       d. none

### Group "B"

Short answer questions:

8X5=40

12)

- a) Show that the set of all positive rational numbers forms an abelian group under the composition defined by  $a \circ b = \frac{ab}{4}$                       2
- b) For what value of P will the equation  $5x^2 - px + 45 = 0$  have equal roots?                      5

13) Solve De-Moivre's theorem and using De-Moivre's theorem find square roots of

$$4 + 4\sqrt{3}i \qquad 1+4=5$$

14) If  $\sin^{-1} x + \sin^{-1} y + \sin^{-1} z = \pi$ , prove that  $x\sqrt{1-x^2} + y\sqrt{1-y^2} + z\sqrt{1-z^2} = 2xyz$  5

15)

a) Calculate the coefficient of rank correlation between price and supply for the following data:

Price	8	10	12	6	9	14	18	16
Supply	15	25	18	20	16	21	10	12

b) If 3 dices are thrown simultaneously, what is the probability of getting

(i) no six (ii) two sixes (iii) 3 sixes 3

16)

a) Using L = Hospital's rule evaluate  $\lim_{x \rightarrow 0} \frac{x - \sin x \cdot \cos x}{x^3}$  2

b) Evaluate:  $\int \frac{dx}{3 - \cos x}$  3

17)

a) Solve:  $\frac{dy}{dx} = \frac{y}{x} - \sin^2 \frac{y}{x}$  3

b) Find the points on the circle  $x^2 + y^2 = 16$  at which the tangents are parallel to x – axis. 2

18) Using Simplex method, solve the LP problem

$$\text{Max } f = 5x_1 + 3x_2$$

$$\text{S.t. } 2x_1 + x_2 \leq 40$$

$$x_1 + 2x_2 \leq 50 \quad x_1, x_2 \geq 0 \qquad 5$$

19)

a) If R be the horizontal range of a projection and h its greatest height, prove that:

$$\sqrt{2g \left( h + \frac{R^2}{16h} \right)} \qquad 3$$

b) A bullet of mass 15 g is fired from a rifle of mass 3 kg with a velocity of 100 km h<sup>-1</sup>. Find the velocity of re coil of the rifle. 2

### Group "C"

Long answer questions:

8×3=24

20)

a) Show that:  $\sum_{n=1}^{\infty} \frac{n^2}{(n+1)!} = e - 1$  6

b) solve by row-equivalent matrices method the system of equations

$$8x - 3y = -31$$

$$2x + 6y = 26 \qquad 2$$

21)

- a) Find the direction cosines  $l, m, n$  of two lines which satisfies the equations  $l + m + n = 0$   
and  $2lm - mn + 2nl = 0$  4
- b) Prove by vector method:  $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$  4

22)

- a) Using first principle, find the derivative of  $\log(\tan x)$  6
- b) Discuss the applicability of Rolle's theorem for  $f(x) = \frac{1}{x^2 - 1}$  in  $[-2, 2]$  2

**Answers:**

**Group A**

1) (c)	2) (c)	3) (a)	4) (b)
5) (a)	6) (a)	7) (a)	8) (d)
9) (b)	10) (a)	11) (b)	

**Group B**

12) (b) $\pm 30$
13) $\pm(\sqrt{6} + \sqrt{2}i)$
15) (a) 0.405 (b) (i) $\frac{125}{216}$ (ii) $\frac{5}{72}$ (iii) $\frac{1}{216}$
16) (a) $\frac{2}{3}$ (b) $\sqrt{2} \tan^{-1}\left(\sqrt{2} \tan \frac{x}{2}\right) + C$
17) (a) $\cot(y/x) = \log x + c$ (b) (0, 4), (0, -4)
18) $Max f = 110, x_1 = 10, x_2 = 20$
19) (b) 0.5 km/h

**Group C**

20) (b) (-2, 5)
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21)

(a)  $\frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}}, \frac{-2}{\sqrt{6}}$  and  $-\frac{1}{\sqrt{6}}, \frac{2}{\sqrt{6}}, \frac{-1}{\sqrt{6}}$

22)

(a)  $2 \operatorname{cosec} 2x$