

**Model Question – 3**

**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) What is the value of C (12, 9)?  
a. 120                      b. 220                      c. 240                      d. 260
- 2) The polar form of the complex number  $2 + 2i$  is

a.  $2\sqrt{2}\left(\cos\frac{\pi}{4}+i\sin\frac{\pi}{4}\right)$       b.  $2\left(\cos\frac{\pi}{4}+i\sin\frac{\pi}{4}\right)$   
c.  $4\left(\cos\frac{\pi}{4}+i\sin\frac{\pi}{4}\right)$       d.  $2\sqrt{2}\left(\sin\frac{\pi}{4}+i\cos\frac{\pi}{4}\right)$

3) The value of  $\cos\left(\text{Arc cos}\frac{2}{3}\right)$  is

a.  $\frac{\pi}{4}$       b.  $\frac{4}{3}$       c.  $\frac{2}{3}$       d.  $-\frac{4}{3}$

4) The vertices of the ellipse  $\frac{x^2}{4} + \frac{y^2}{9} = 1$  are

a.  $(\pm 2, 0)$       b.  $(\pm 3, 0)$       c.  $(0, \pm 2)$       d.  $(0, \pm 3)$

5) If  $|\vec{a}| = \sqrt{14}$ ,  $|\vec{b}| = \sqrt{29}$  and  $\vec{a} \cdot \vec{b} = 20$ , then the value of  $\vec{a} \times \vec{b}$  is

a.  $\sqrt{6}$       b.  $2\sqrt{6}$       c. 12      d. 14

6) What is the seventh term of  $(2x+y)^{12}$ ?

a.  $C(12,7) 2^6 x^6 y^6$       b.  $C(12,6) 2^6 x^6 y^6$   
c.  $C(12,6) 2^7 x^7 y^7$       d.  $C(12,6) x^6 y^6$

7) Given that  $\sum xy = 92$ ,  $\sum x^2 = 76$ ,  $\sum y^2 = 186$  and  $n = 6$ . What is the correlation coefficient between x and y?

a. 0.37      b. 0.47      c. -0.67      d. 0.77

8) What is the value of  $\lim_{x \rightarrow \frac{\pi}{2}} \frac{\sec 3x}{\sec x}$ ?

a.  $\frac{1}{3}$       b.  $-\frac{1}{3}$       c. 3      d. 2

9) The value of the integral  $\int \frac{1}{a^2 + x^2} dx$  is

a.  $\frac{1}{a} \tan^{-1} \frac{x}{a} + C$       b.  $\frac{1}{a} \cos^{-1} \frac{x}{a} + C$   
c.  $\frac{1}{a} \sin^{-1} \frac{x}{a} + C$       d.  $\frac{1}{a} \sec^{-1} \frac{x}{a} + C$

10) The highest point reached by a projectile is 20 m above the horizontal. If the initial velocity is  $20\sqrt{2}$  m/s, the angle of projection when  $g = 10 \text{ m/s}^2$  is

a.  $30^\circ$       b.  $60^\circ$       c.  $45^\circ$       d.  $75^\circ$

OR

A manufacturer sells a product at \$8 per unit, selling all that is produced. Fixed cost is \$ 5000 and variable cost per unit is  $\frac{22}{9}$  dollars. What is the total revenue at the break even point?

- a. 5200                      b. 6000                      c. 7000                      d.7200

- 11) If the equation  $x^2 - (3a - 1)x + 2(a^2 - 1) = 0$  has equal roots, then the value of a is  
 a. 3                      b. 4                      c. -3                      d.-4

**Group “B”**

**Short answer questions:**

**8X5=40**

12) From 6 gentlemen and 4 ladies, a committee of 5 is to be formed. In how many ways can this be done so as to include at least one lady?

13) Let  $G = \mathbb{Q} - \{1\}$ , the set of all rational numbers without 1. Suppose an operation  $*$  defined on  $G$  is given by

$$a * b = a + b - ab$$

Show that the system is a group.

14) Find the coordinates of the vertices, eccentricity and foci of the curve:

$$9x^2 - 16y^2 - 18x - 64y - 199 = 0.$$

15) Verify Rolle's theorem for the function  $f(x) = \sqrt{1-x^2}$  in the interval  $[-1, 1]$

16) Evaluate:  $\int \frac{dx}{2 + \cos x}$

17) Calculate the coefficient of correlation from the following:

X	14	16	19	22	24	30
Y	14	22	20	24	23	26

18) Solve the following system of equations using Gaussian elimination method:

$$2x_1 + 3x_3 = 7$$

$$3x_1 - 2x_2 + 2x_3 = 1$$

$$2x_1 + 3x_2 - 3x_3 = 5$$

19) A balloon is rising with an acceleration  $f$ . Prove that the fraction of the weight of the balloon

which must be emptied out of the balloon in order to double the acceleration is  $\frac{f}{g + 2f}$

**Group “C”**

**Long answer questions:**

**3X8=24**

20)

a) Solve:  $\sin x \frac{dy}{dx} + (\cos x)y = x \sin x$  3

b) Find the derivative of  $x^{\cos x}$ . 3

c) Show that:  $\frac{2}{3!} + \frac{4}{5!} + \frac{6}{7!} + \dots = \frac{1}{e}$  3

21)

a) Define vector product of two vectors. Interpret it geometrically. 3

b) Use vector method to prove that:  $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$  5

22)

a) Find the polar form of the complex number  $-1 + \sqrt{3}i$

b) Solve:  $2 \frac{dy}{dx} = \frac{y}{x} + \frac{y^2}{x^2}$  3

c) Sum to infinity:  $1 + \frac{3}{4} + \frac{7}{16} + \frac{15}{64} + \dots$  3

**Answers:**

**Group A**

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

**Group B**

12) 246
14) Vertices = (5, -2) and (-3, -2) $e = \frac{5}{4}$ Foci = (6, -2) and (-4, -2)
16) $\frac{2}{\sqrt{3}} \tan^{-1} \left( \frac{1}{\sqrt{3}} \tan \frac{x}{2} \right) + c$
17) 0.542
18) $x_1=1, x_2=2, x_3=1$

**Group C**

20) (a) $y \sin x = -x \cos x + \sin x + C$ (b) $x^{\cos x} \left( \frac{\cos x}{x} - \sin x \log x \right)$
22) (a) $2(\cos 150^\circ + i \sin 150^\circ)$

$$(b) \pm \frac{1}{\sqrt{2}}(1 + \sqrt{3}i)$$

$$(c) \frac{8}{3}$$