Basic Set-I

SEE MODEL SET- 1

Optional- I (Mathematics)

Time: 3 hours F.M.: 75

Answer all the questions.

Group-A 10 × 1 = 10

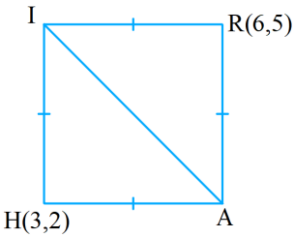
1. For a function f: A $\rightarrow$ B, write the condition of existence of inverse function f^{-1}.
2. What is the remainder when a polynomial p (x) is divided by (x – c)?
3. Is the set of rational numbers continuous on number line? Give reason.
4. Find the determinant of the matrix A= $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$.
5. If θ is the angle between the pair of lines represented by $ax^2 + 2hxy + by^2 = 0$, find the value of tanθ.
6. Which geometric figure will be formed if a plane intersects a cone parallel to its base? Write.
7. Write the formula of cos2A in terms of sin$A$.
8. What acute value of θ is valid for tanθ = 1?
9. Define scalar product of two vectors $\vec{a}$ and $\vec{b}$.
10. If O is the centre of circle, radius = r and P' is inversion of point P, write down the relation of OP, OP' and r.

Group-B 8× 2 = 16

11. Find the remainder when a polynomial x^3 –5 is divided (x – 3).
12. Draw the graph of $x + 2y \leq 8$.
13. Find the values of D_1 and D_2 from system of equation $y = 2x$ and $x + 2y = 10$ by using Cramer's rule.
14. Find the obtuse angle between the lines $2x – y + 3 = 0$ and $x – 3y + 4 = 0$
15. Prove that: $\frac{\cos 2\theta}{1 + \sin 2\theta} = \frac{1 - \tan\theta}{1 + \tan\theta}$
16. If tan$A$ + cot$A$ = 4, find the value of A. $(0^o \leq A \leq 180^o)$
17. The position vectors of vertices of triangle ABC are $\vec{i} + 5\vec{j}$, $2\vec{i}$ and $\vec{j}$ respectively, find the position vector of its centroid G.
18. In a continuous distribution, if the first quartile is 20 and quartile deviation is 20, find the third quartile and coefficient of quartile deviation of the distribution.

Group-C 11 × 3 = 33

19. Two functions f and g defined as $f(x) = 3x – b$ and $g(x) = 5x – 3$ are real valued functions. If $f^{-1}(11) = g^{-1}(22)$, find the value of b.
20. Solve the quadratic equation $x^2 + 2x – 3 = 0$ graphically.
21. A real valued function f: $R \rightarrow R$ is defined by $f(x) = x + 4$. Find the values of $f(1.999)$, $f(2.001)$ and $f(2)$. Is f continuous at $x = 2$?
22. Solve the following equation by using inverse matrix method:
    $2x + 5 = 4(y + 1) – 1$ and $3x + 4 = 5(y + 1) – 3$
23. Two opposite corners of a square HARI are H (3, 2) and R (3, 6). Find the equations of diagonal AI.



24. Prove that: $\sin^3\theta \cdot \cos^2\theta = \frac{1}{16}(2\sin\theta - \sin 5\theta + \sin 3\theta)$
25. If $\alpha + \beta + \gamma = 180^o$, prove that: $\frac{\sin 2\alpha + \sin 2\beta + \sin 2\gamma}{\sin\alpha.\sin\beta.\sin\gamma} = 4$
26. A dog of height 2 ft. stands on a table. The angle subtended by the dog and the table at a bone placed on the floor of are 30° and 30° respectively. Find the height of table.

27. Find the 2×2 matrix which transformed the unit square matrix $\begin{pmatrix} 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 \end{pmatrix}$ into a parallelogram $\begin{pmatrix} 0 & 6 & 8 & 2 \\ 0 & 2 & 6 & 4 \end{pmatrix}$.

28. Find the mean deviation from the mean. Also, calculate its coefficient.

Marks obtained	0-10	30-40	40-50	10-20	20-30
No. of students	3	3	4	5	7

29. An analysis of monthly wages paid to the works in firm-A and firm-B belonging to the same industry given the following results:

Average monthly wage	Rs. 15,000	Rs. 12,000
Standard deviation	5	6

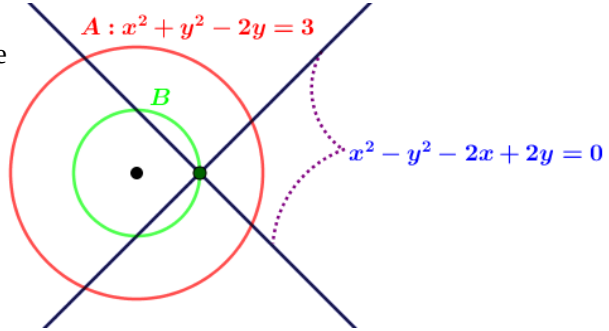
(a) Examine which firm A or B has greater variability in wage distribution.

(b) Which firm has more homogeneity? Give Reason.

Group-D $4 \times 4 = 16$

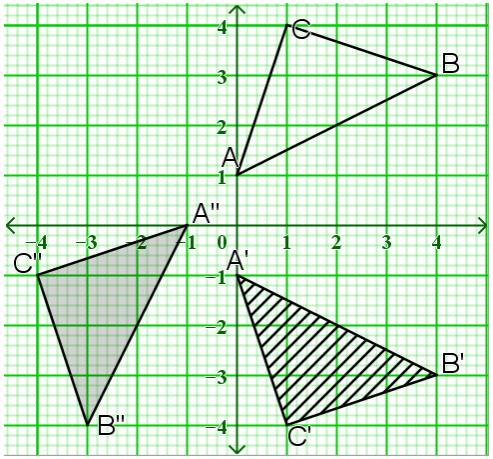
30. The sum of three numbers in GP is 13. If 1, 2 and 7 are subtracted from the numbers respectively; the resulting numbers form an AP. Find the original numbers.

31. Circle-B is concentric with the circle A: $x^2 + y^2 - 2y = 3$ and passes through the point of intersection of line pairs $x^2 - y^2 - 2x + 2y = 0$. Find the equation of circle-B.



32. By using vector method, prove that the diagonals of a rectangle are equal.

33. In the graph given alongside, image of ΔABC is $\Delta A'B'C'$ and image of $\Delta A'B'C'$ is $\Delta A''B''C''$.



(a) By what transformation the image of the triangle ΔABC is $\Delta A'B'C'$? Write with reason

(b) By what transformation the image of the triangle $\Delta A'B'C'$ is $\Delta A''B''C''$? Write with reason

(c) Write the name of transformation which represents the combined transformation of above two transformations? Write with reason.

THE END

Answer Key

(1) One to one and onto (2) R = p (*c*) (3) Not continuous (4) $ad - bc$

(5) $\tan\theta = \pm \frac{2\sqrt{h^2 - ab}}{a + b}$ (6) Circle (7) $1 - 2\sin^2 A$ (8) 45°

(10) $OP \times OP' = r^2$ (11) 22 (13) 10, 20 (14) 135°

(16) 15°, 75° (17) $\vec{i} + 2\vec{j}$ (18) 60, 0.5 (19) 4

(20) -3, 1 (21) 5.999, 6.004, Yes (22) 1, 1

(23) $x + y = 1$ (26) 1 ft, (27) $\begin{pmatrix} 6 & 2 \\ 2 & 4 \end{pmatrix}$ (28) 10, 0.4

(29) (a) B (b) A (30) 1, 3, 9 (31) $x^2 + y^2 - 2y = 0$

(33) (a) Reflection on *x*-axis (b) Rotation through -90° or 270° about origin
(c) Reflection about $y = -x$