

# RK Academy

One Step Ahead To Your Success...

CLASS – XII  
SUB – MATH

FM – 80  
TIME – 3 HRS

## General Instructions:

1. This Question paper contains - **five sections** A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. **Section A** has 18 **MCQ's** and **02** Assertion-Reason based questions of 1 mark each.
3. **Section B** has 5 **Very Short Answer (VSA)-type** questions of 2 marks each.
4. **Section C** has 6 **Short Answer (SA)-type** questions of 3 marks each.
5. **Section D** has 4 **Long Answer (LA)-type** questions of 5 marks each.
6. **Section E** has 3 **source based/case based/passage based/integrated units of assessment**(4 marks each) with sub parts.

## SECTION-A

1.  $\cos^{-1}(\cos \frac{7\pi}{6})$  is equal to (a)  $\frac{7\pi}{6}$  (b)  $\frac{5\pi}{6}$  (c)  $\frac{\pi}{3}$  (d)  $\frac{\pi}{6}$ .
2. The principal value of  $\tan^{-1}(-\sqrt{3})$  is (a)  $-\frac{\pi}{3}$  (b)  $-\frac{\pi}{6}$  (c)  $\frac{\pi}{6}$  (d)  $\frac{\pi}{3}$ .
3. What must be the matrix X if  $\begin{bmatrix} 2 & -5 \\ 4 & 6 \end{bmatrix} + 3X = \begin{bmatrix} 8 & 4 \\ 1 & 0 \end{bmatrix}$ . (a)  $\begin{bmatrix} 2 & 3 \\ -1 & -2 \end{bmatrix}$  (b)  $\begin{bmatrix} 5 & 14 \\ -7 & 16 \end{bmatrix}$  (c)  $\begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix}$ .
4. Which of the following can be both a symmetric and skew-symmetric matrix?  
(a) Unit Matrix (b) Diagonal Matrix (c) Null Matrix (d) Row Matrix.
5. The value of  $x-y+z$  from the following equation is  $\begin{bmatrix} x+y+z \\ x+z \\ y+z \end{bmatrix} = \begin{bmatrix} 9 \\ 5 \\ 7 \end{bmatrix}$ .
6. If  $A = \begin{bmatrix} a & 0 & 0 \\ 0 & a & 0 \\ 0 & 0 & a \end{bmatrix}$ , then the value of  $|adj A|$  is (a)  $a^{27}$  (b)  $a^9$  (c)  $a^6$  (d)  $a^2$ .
7. The equation  $\begin{vmatrix} x & 3 & 4 \\ 1 & 2 & 1 \\ 1 & 4 & 1 \end{vmatrix} = 0$  is satisfied for (a)  $x=1$  (b)  $x=2$  (c)  $x=3$  (d)  $x=4$ .
8. If  $y = \sin^{-1} x$ , then  $(1-x^2)y_2$  is equal to (a)  $xy_1$  (b)  $xy$  (c)  $xy_2$  (d)  $x^2$ .
9. If  $x = t^2$  and  $y = t^3$ , then  $\frac{d^2y}{dx^2}$  is equal to (a)  $\frac{3}{2}$  (b)  $\frac{3}{4t}$  (c)  $\frac{3}{2t}$  (d)  $\frac{3}{4}$ .
10. What is the angle between vectors  $\vec{a}$  and  $\vec{b}$  if  $|\vec{a}| = 1$ ,  $|\vec{b}| = 2$ , and  $\vec{a} \times \vec{b} = \hat{i} + \hat{j} + \hat{k}$ ?  
(a)  $\pi/2$  (b)  $\pi/3$  (c)  $2\pi/3$  (d)  $\pi/6$ .
11. A point out of following points lie in plane represented by  $2x + 3y \leq 12$  is  
(a) (0,3) (b) (3,3) (c) (4,3) (d) (0,5).
12. If  $\vec{a}$  and  $\vec{b}$  are unit vectors, then the angle between  $\vec{a}$  and  $\vec{b}$  for  $\sqrt{3}\vec{a} - \vec{b}$  to be a unit vector is  
(a)  $30^\circ$  (b)  $45^\circ$  (c)  $60^\circ$  (d)  $90^\circ$
13. P is the point on the line segment joining the points (3,2,-1) and (6,2,-2). If x coordinates of P is 5, then the y coordinate is (a) 2 (b) 1 (c) -1 (d) -2.
14. If the line makes an angle of  $\pi/4$  with each of y and z axes, then the angle which it makes with x-axis is  
(a) 0 (b)  $\pi$  (c)  $\pi/2$  (d)  $\pi/4$ .
15. The domain of the function  $\sin^{-1}x$  is (a)  $[-1,1]$  (b)  $(-1,1)$  (c)  $(0,1)$  (d)  $(-1,0)$ .
16. P is the point on the line segment joining the points (3,2,-1) and (6,2,-2). If x co-ordinate of P is 5, then its y co-ordinate is (a) 2 (b) 1 (c) -1 (d) -2
17. The angle between the lines  $2x=3y=-z$  and  $6x=-y=-4z$  is (a)  $0^\circ$  (b)  $30^\circ$  (c)  $45^\circ$  (d)  $90^\circ$
18. If A is a non-singular matrix of order 3 then  $|AA^{-1}|$  is equal to.  
(a) 1 (b)  $|AA|$  (c)  $|A^{-1}|$  (d) -1

## ASSERTION-REASON BASED QUESTIONS

In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R).  
Choose the correct answer out of the following choices.

- (a) Both A and R are true and R is the correct explanation of A.  
(b) Both A and R are true but R is not the correct explanation of A.  
(c) A is true but R is false.  
(d) A is false but R is true.
19. Assertion (A) : Determinant is a number associated with square matrix  
Reason (R) : Determinant is a square matrix.

20. Assertion (A): The direction cosines of the vector  $\vec{A} = 2\hat{i} + 4\hat{j} - 5\hat{k}$  are  $\frac{2}{\sqrt{45}}, \frac{4}{\sqrt{45}}, -\frac{5}{\sqrt{45}}$ .

Reason (R) : A vector having zero magnitude and arbitrary direction is called zero vector or null vector.

## SECTION-B

21. Find the position vector of a point A in space such that  $\vec{OA}$  is inclined at  $60^\circ$  to OX and at  $45^\circ$  to OY and  $|\vec{OA}| = 10$  units.  
Or  
Prove that the line through A(0,-1,-1) and B(4,5,1) intersects the line through C(3,9,4) and D(-4,4,4).
22. Find  $\int 2x^3 e^{x^2} dx$ .
23. Find the minor and cofactors of diagonal elements of the matrix  $\begin{bmatrix} 3 & -1 & 3 \\ 4 & 2 & 2 \\ 1 & 3 & 1 \end{bmatrix}$ .
24. If  $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & x \\ -2 & 2 & -1 \end{bmatrix}$  is a matrix satisfying  $AA' = 9I$ , find x.
25. If  $y = x^3 \log\left(\frac{1}{x}\right)$ , then prove that  $x \frac{d^2y}{dx^2} - 2 \frac{dy}{dx} + 3x^2 = 0$ .

## SECTION-C

26. If  $x = e^{\frac{x}{y}}$ , then prove that  $\frac{dy}{dx} = \frac{x-y}{x \log x}$ .
27.  $\tan^{-1}\left(\tan \frac{5\pi}{6}\right) + \cos^{-1}\left(\cos \frac{13\pi}{6}\right)$ .
28. Express the matrix  $B = \begin{bmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{bmatrix}$  as the sum of a symmetric and skew symmetric matrix.

**OR**

If  $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{bmatrix}$ , then show that  $A^3 - 23A - 40I = O$ .

29. Find the coordinates of the foot of the perpendicular drawn from the point P(-1,-2,-1) to the line joining A(2,4,6) and B(4,5,2).
30. If a line has direction ratios 2,-1,-2 determine its direction cosines.
31. Solve the following linear programming graphically Minimize  $Z = 2x + y$   
Subject to constraints  $3x + y \geq 9$ ,  $x + y \geq 7$ ,  $x + 2y \geq 8$ ,  $x, y \geq 0$ .

## SECTION-D

32. Solve the following LPP graphically maximize and minimize  $Z = 0.04x + 0.06y$  subject to constraints  $0.2x + 0.1y \geq 100$ ,  $0.5x + y \geq 400$  and  $x, y \geq 0$ . Also find the difference between maximum and minimum value of Z.

**OR**

Maximize and minimize  $Z = 3x - 4y$  subject to constraints  $x - 2y \leq 0$ ,  $-3x + y \leq 4$ ,  $x - y \leq 6$ ,  $x, y \geq 0$ .

33. Find x, y and z if  $A = \begin{bmatrix} 0 & 2y & z \\ x & y & -z \\ x & -y & z \end{bmatrix}$  satisfies  $A' = A^{-1}$ .

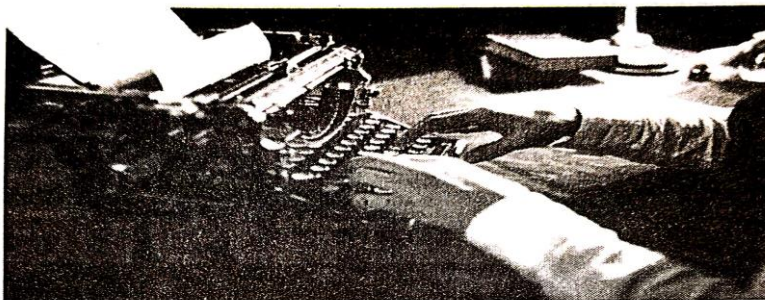
34. If  $x = \sqrt{m^{\tan^{-1}\theta}}$ ,  $y = \sqrt{m^{\cot^{-1}\theta}}$  prove that  $\frac{dy}{dx} = -\frac{y}{x}$ .

35. An amount of 5000 put into three investments at rate of interest of 6%, 7% and 8% per annum respectively. The total annual interest is 358. If the combined 70 more than the interest from the third, find the amount of each investment by matrix method.

## SECTION-E

36.

A typist charges ₹ 145 for typing 10 English and 3 Hindi pages, while charges for 3 English and 10 Hindi pages are ₹ 180. However, typist charged ₹ 2 per page from a poor student Shyam for 5 Hindi pages and ₹ 1 per page for 4 English pages.



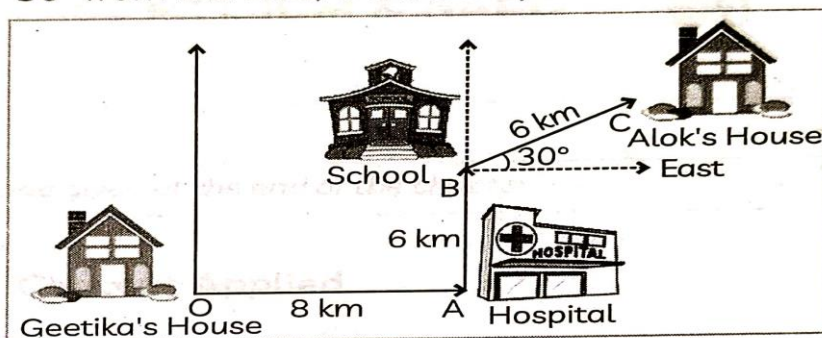
Let the charges for typing one English and one Hindi page be ₹  $x$  and ₹  $y$  respectively.

Based on the given information, answer the following questions:

- (A) Write the pair of linear equations formed with the given situation and also converting these in the matrix form  $AX = B$ .
- (B) Find the values of  $x$  and  $y$  and how much less was charged from the poor student?

37.

- Geetika's house is situated at Shalimar Bagh at point O. To go to Alok's house she first travels 8 km by bus in the East. Here at point A, a hospital is situated. From the hospital, Geetika takes an auto and goes 6 km in the North, here at point B school is situated. From school, she travels by bus to reach Alok's house which is at  $30^\circ$  from the East, 6 km from point B.

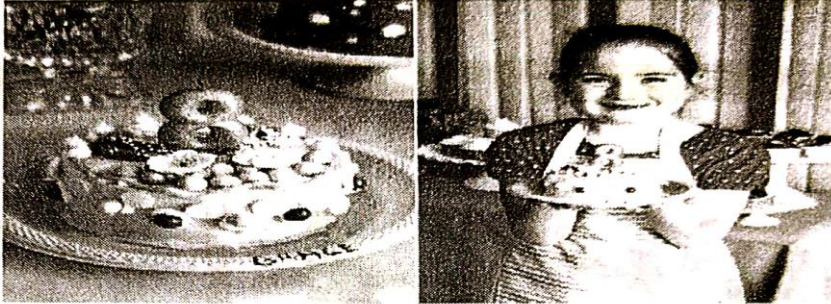


Based on the given information, answer the following questions:

- (A) What is the vector distance between Geetika's house and school?
- (B) What is the vector distance from school to Alok's house?
- (C) What is the vector distance from Geetika's house to Alok's house?

38.

On her birthday, Seema decided to donate some money to children of an orphanage home. If there were 8 children less, everyone would have got ₹ 10 more. However, if there were 16 children more, everyone would have got ₹ 10 less. Let the number of children be  $x$  and the amount distributed by Seema for one child be  $y$  (in ₹).



Based on given information, answer the following questions:

- (A) Find the equations in terms of  $x$  and  $y$  and express them in matrix form.
- (B) Find the number of children who were given some money by Seema.
- (C) How much amount Seema spends in donation to all the students of the Children?

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