

COMMON SECOND MID-TERM TEST - 2022

R

Standard X

Reg.No.

MATHEMATICS

Time : 3.00 hrs

Marks : 100

Part - I

I. Choose the correct answer:

14 x 1 = 14

1. If A is a 2 x 3 matrix and B is a 3 x 4 matrix, how many columns does AB have

- a) 3 b) 4 c) 2 d) 5

2. In a quadratic equation, if $\Delta = 0$, then the nature of roots are _____

- a) real and unequal roots b) real and equal roots
c) no real root d) none of these

3. Transpose of a column matrix is

- a) unit matrix b) diagonal matrix c) column matrix d) row matrix

4. Find the matrix X if $2X + \begin{pmatrix} 1 & 3 \\ 5 & 7 \end{pmatrix} = \begin{pmatrix} 5 & 7 \\ 9 & 5 \end{pmatrix}$

- a) $\begin{pmatrix} -2 & -2 \\ 2 & -1 \end{pmatrix}$ b) $\begin{pmatrix} 2 & 2 \\ 2 & -1 \end{pmatrix}$ c) $\begin{pmatrix} 1 & 2 \\ 2 & 2 \end{pmatrix}$ d) $\begin{pmatrix} 2 & 1 \\ 2 & 2 \end{pmatrix}$

5. In the adjacent figure $\angle BAC = 90^\circ$ and $AD \perp BC$ then

- a) $BD \cdot DC = BC^2$ b) $AB \cdot AC = BC^2$
c) $BD \cdot CD = AD^2$ d) $AB \cdot AC = AD^2$



6. Two poles of height 6m and 11m stand vertically on a plane ground. If the distance between their feet is 12m, what is the distance between their tops?

- a) 13m b) 14 m c) 15 m d) 12.8 m

7. If the ratio of the height of a tower and the length of its shadow is $\sqrt{3} : 1$, then the angle of elevation of the sun has measure

- a) 45° b) 30° c) 90° d) 60°

8. A tower is 60 m high. Its shadow is x metres shorter when the sun's altitude is 45° than when it has been 30° , then x is equal to

- a) 41.92 m b) 43.92 m c) 43 m d) 45.6 m

9. The angle of elevation of a cloud from a point h metres above a lake is β . The angle of depression of its reflection in the lake is 45° . The height of location of the cloud from the lake is

- a) $\frac{h(1 + \tan \beta)}{1 - \tan \beta}$ b) $\frac{h(1 - \tan \beta)}{1 + \tan \beta}$ c) $h \tan(45^\circ - \beta)$ d) none of these

10. Which instrument is used in measuring the angle between an object and the eye of the observer?

- a) microscope b) theodolite c) telescope d) clinometer

11. If two solid hemispheres of same base radius r units are joined together along their bases, then curved surface area of this new solid is

- a) $4\pi r^2$ sq. units b) $6\pi r^2$ sq. units c) $3\pi r^2$ sq. units d) $8\pi r^2$ sq. units

12. The total surface area of a cylinder whose radius is $\frac{1}{3}$ of its height is
 a) $\frac{9\pi h^2}{8}$ sq.units b) $24\pi h^2$ sq.units c) $\frac{8\pi h^2}{9}$ sq.units d) $\frac{56\pi h^2}{9}$ sq.units
13. The total surface area of a hemisphere is how much times the square of its radius
 a) π b) 4π c) 3π d) 2π
14. The ratio of the volumes of a cylinder, a cone and sphere, if each has the same diameter and same height is
 a) ~~1:2:3~~ b) 2:1:3 c) 1:3:2 d) 3:1:2

Part - II

II. Answer any 10 questions. (Q.No.28 is compulsory)

10 x 2 = 20

15. Determine the nature of roots for the following quadratic equation : $9x^2 - 24x + 16 = 0$
16. If the difference between a number and its reciprocal is $\frac{24}{5}$, find the number.
17. Define Null matrix.
18. Construct a 3 x 3 matrix whose elements are given by $a_{ij} = |i - 2j|$

19. If $A = \begin{pmatrix} 5 & 2 & 2 \\ -\sqrt{17} & 0.7 & \frac{5}{2} \\ 8 & 3 & 1 \end{pmatrix}$, then verify $(A^T)^T = A$.

20. If A is of order p x q and B is order q x r, what is the order of AB and BA?
21. A man goes 18m due east and then 24m due north. Find the distance of his current position from the starting point.
22. What length of ladder is needed to reach a height of 7 ft along the wall when the base of the ladder is 4 ft from the wall? Round off your answer to the next tenth place.
23. Find the angle of elevation of the top of a tower from a point on the ground, which is 30m away from the foot of a tower of height $10\sqrt{3}$.
24. A player sitting on the top of a tower of height 20m observes the angle of depression of a ball lying on the ground as 60° . Find the distance between the foot of the tower and the ball.
25. If the base area of a hemispherical solid is 1386 sq.metres, then find its total surface area.
26. Find the volume of a cylinder whose height is 2m and whose base area is 250 m^2 .
27. If the ratio of radii of two squares is 4:7, find the ratio of their volumes.

28. If $A = \begin{pmatrix} 7 & 8 & 6 \\ 1 & 3 & 9 \\ -4 & 3 & -1 \end{pmatrix}$, $B = \begin{pmatrix} 4 & 11 & -3 \\ -1 & 2 & 4 \\ 7 & 5 & 0 \end{pmatrix}$, then find $2A + B$.

Part - III

III. Answer any 10 questions. (Q.No.42 is compulsory)

10 x 5 = 50

29. if a, b are real then show that the roots of the equation $(a - b)x^2 - 6(a + b)x - 9(a - b) = 0$ are real and unequal.
30. If $A = \begin{pmatrix} 1 & 1 \\ -1 & 3 \end{pmatrix}$, $B = \begin{pmatrix} 1 & 2 \\ -4 & 2 \end{pmatrix}$, $C = \begin{pmatrix} -7 & 6 \\ 3 & 2 \end{pmatrix}$, verify that $A(B + C) = AB + AC$

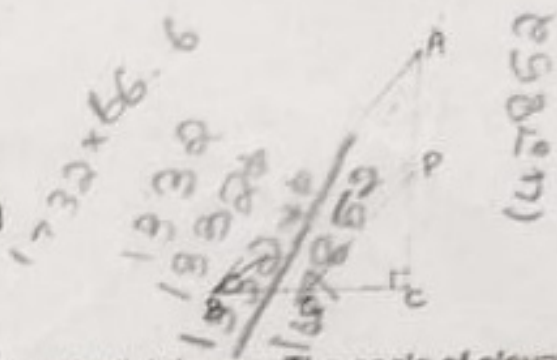
(3)

31. If $A = \begin{pmatrix} 1 & 2 & 1 \\ 2 & -1 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & -1 \\ -1 & 4 \\ 0 & 2 \end{pmatrix}$, show that $(AB)^T = B^T A^T$.

32. If $A = \begin{pmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{pmatrix}$, prove that $AA^T = I$

33. If $A = \begin{pmatrix} 3 & 1 \\ -1 & 2 \end{pmatrix}$, show that $A^2 - 5A + 7I_2 = 0$

34. P and Q are the mid-points of the sides CA and CB respectively of a ΔABC , right angled at C. Prove that $4(AQ^2 + BP^2) = 5AB^2$



35. Two ships are sailing in the sea on either sides of a lighthouse. The angle of elevation of the top of the lighthouse as observed from the ships are 30° and 45° respectively. If the lighthouse is 200 m high, find the distance between the two ships. ($\sqrt{3} = 1.732$)

36. An aeroplane at an altitude of 1800 m finds that two boats are sailing towards it in the same direction. The angles of depression of the boats as observed from the aeroplane for 60° and 30° respectively. Find the distance between the two boats. ($\sqrt{3} = 1.732$)

37. If the angle of elevation of a cloud from a point 'h' metres above a lake is θ_1 , and the angle of depression of its reflection in the lake is θ_2 . Prove that the height that the cloud

is located from the ground is $\frac{h(\tan \theta_1 + \tan \theta_2)}{\tan \theta_2 - \tan \theta_1}$

38. The radius and height of a cylinder are in the ratio 5:7 and its curved surface area is 5500 sq. cm. Find its radius and height.

39. If the radii of the circular ends of a frustum which is 45 cm high are 28 cm and 7 cm, find the volume of the frustum.

40. A capsule is in the shape of a cylinder with two hemisphere stuck to each of its ends. If the length of the entire capsule is 12 mm and the diameter of the capsule is 3mm, how much medicine it can hold?

41. Find the number of spherical lead shots each of the diameter 6 cm that can be made from a solid cuboids of lead having dimensions 24 cm x 22 cm x 12 cm.

42. State and prove Pythagoras Theorem.

Part - IV

2 x 8 = 16

IV. Answer all the questions.

43. a) Draw a circle of radius 4.5 cm. Take a point on the circle. Draw the tangent at that point using the alternate segment theorem. (OR)
 b) Draw a circle of diameter 6 cm from a point P, Which is 8 cm away from its centre. Draw two tangents PA and PB to the circle and measure their lengths.
44. a) Graph the following quadratic equations and state their nature of solutions.
 $x^2 + 4x + 4 = 0$ (OR)
 b) Draw the graph of $y = x^2 + 4x + 3$ and hence find the roots of $x^2 + x + 1 = 0$
