

MID TERM EXAMINATION

5/9/24

MATHEMATICS (041)

SET - II

10123

Time allowed: 3 hours

Maximum Marks: 80

General Instructions:

1. This Question Paper has 5 sections A, B, C, D and E.
2. Section-A has 20 MCQs carrying 1 mark each.
3. Section-B has 5 questions carrying 02 marks each.
4. Section-C has 6 questions carrying 03 marks each.
5. Section-D has 4 questions carrying 05 marks each.
6. Section-E has 3 case based integrated units of assessment (04 marks each) with sub-parts of the values of 1, 1 and 2 marks each, respectively.
7. All Questions are compulsory. However, an internal choice in 2 questions of 5 marks, 2 questions of 3 marks and 2 questions of 2 marks has been provided. An internal choice has been provided in the 2 marks questions of Section E.
8. Draw neat figures wherever required. Take $\pi = 22/7$ wherever required if not stated.

SECTION-A

Section A consists of 20 questions of 1 mark each.

Q1. Which of the following quadratic equations has product of its roots as 4?

(a) $2x^2 - 4x + 8 = 0$ (b) $-x^2 + 4x + 4 = 0$

(c) $\sqrt{2}x^2 - \frac{4}{\sqrt{2}}x + 1 = 0$ (d) $4x^2 - 4x + 4 = 0$

Q2.

If $x = a$ and $y = b$ is the solution of the equations $x - y = 2$ and $x + y = 4$, then the values of a and b are

(a) 3 and 5	(b) 5 and 3
(c) 3 and 1	(d) -1 and -3

Q3. $-2\cos^2\theta (1 + \tan^2\theta) =$ _____

(a) 3	(b) -2
(c) -1	(d) 2

(1)

Q4. If 'p' and 'q' are natural numbers and 'p' is a multiple of 'q' then what is the HCF of 'p' and 'q'?

(a) pq (b) p
(c) q (d) $p + q$

Q5. If $\Delta ABC \sim \Delta QPR$ such that $AC = 6 \text{ cm}$, $BC = 5 \text{ cm}$, $QR = 3 \text{ cm}$ and $PR = x \text{ cm}$, then the value of x is

(a) 3.6 cm (b) 2.5 cm
(c) 10 cm (d) 3.2 cm

Q6. The distance of the point $(-6, 8)$ from origin is

(a) 6 units (b) 2 units
(c) 8 units (d) 10 units

Q7. If ΔABC is right angled at C, then the value of $\sec(A + B)$ is

(a) 0 (b) 1
(c) $\frac{2}{\sqrt{3}}$ (d) not defined

Q8. A solid sphere is cut into two hemispheres. The ratio of the surface areas of sphere to that of the two hemispheres taken together is

(a) $1 : 1$ (b) $1 : 4$
(c) $2 : 3$ (d) $3 : 2$

Q9. In a family of two children, the probability of having at most one girl is

(a) $\frac{1}{2}$ (b) $\frac{2}{5}$
(c) $\frac{3}{4}$ (d) $\frac{1}{4}$

Q10. If the mean and the median of a data are 12 and 15 respectively, then its mode is

(a) 13.5 (b) 21
(c) 6 (d) 14

Q11. If $x = 0.3$ is a zero of the polynomial $x^2 - 0.9k$, then $k =$

(a) 1 (b) 10
(c) 0.1 (d) 0.01

Q12. The HCF and LCM of two numbers are 9 and 360 respectively. If one of the numbers is 45, then the other number is

(a) 18 (b) 36
(c) 54 (d) 72

Q13. Two identical cones having same base radius r , and height h are joined together along their bases. The volume of the solid formed is

(a) $\frac{1}{3}\pi r^2 h$ (b) $\frac{2}{3}\pi r^3$
 (c) $\frac{2}{3}\pi r^2 h$ (d) $2\pi rl$

Q14. In a frequency distribution, the class mark of an interval is 10 and the width of the class is 6. The upper limit of the class is

(a) 7 (b) 13
(c) 16 (d) 12

Q15 A die is rolled twice. The probability of getting a sum equal to 10 is

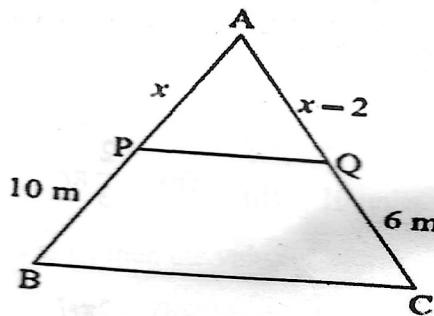
(a) $\frac{1}{12}$ (b) $\frac{1}{36}$
(c) $\frac{1}{6}$ (d) $\frac{1}{4}$

Q16. The condition for which the pair of equations $ax + 2y = 7$ and $3x + by = 16$ represent parallel lines is

(a) $ab = \frac{7}{16}$ (b) $ab = 6$
(c) $ab = 3$ (d) $ab = 2$

Q17. If $P\left(\frac{a}{3}, 4\right)$ is the mid point of the line segment joining the points $Q(-6, 5)$ and $R(-2, 3)$, then the value of a is

Q18. In $\triangle ABC$, $PQ \parallel BC$; $AP = xm$, $PB = 10m$, $AQ = (x - 2)m$, $QC = 6m$ then the value of x is (d) - 6



(a) 3 (b) 5
(c) 4 (d) 8

(d) 8

Q19. Assertion (A) : The ratio of total surface area of a solid hemisphere to the square of its radius is $3\pi : 1$.

Reason (R) : The total surface area of a sphere is $4\pi r^2$

(a) Both assertion (A) and reason (R) are true, and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true, and reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true, but reason (R) is false.

(d) Assertion (A) is false, but reason (R) is true.

Q20 Assertion (A) : Sum and product of the zeroes of $f(x) = x^2 - 4x - 5$ are 4 and 5 respectively.

Reason (R) : If α, β are the zeroes of a quadratic polynomial $ax^2 + bx + c$, then

$$\alpha + \beta = \frac{-b}{a} \text{ and } \alpha\beta = \frac{c}{a}$$

- (a) Both assertion (A) and reason (R) are true, and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true, and reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true, but reason (R) is false.
- (d) Assertion (A) is false, but reason (R) is true.

SECTION-B

Section B consists of 5 questions of 2 marks each

Q21. The king, queen and jack of clubs are removed from a deck of playing cards. One card is drawn at random from the remaining cards. Determine the probability of getting

- (a) a red card
- (b) a face card

Q22. Find the ratio in which the line segment joining the points A (6, 3) and B (-2, -5) is divided by the x -axis.

Q23. Geometrically derive the value of $\cos 45^\circ$.

OR

If $\tan(3x + 30)^\circ = 1$, then find the value of x .

Q24. Three cubes each of volume 64 cm^3 are joined together end to end to form a cuboid. Find the total surface area of the cuboid so formed.

OR

A solid toy is in the form of a hemisphere surmounted by a right circular cone. The slant height of the cone is 5 cm and the diameter of the base is 6 cm. Find the surface area of the toy.

Q25. Show that $3 \times 7 \times 11 + 5 \times 7$ is a composite number.

SECTION-C

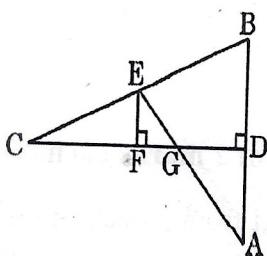
Section C consists of 6 questions of 3 marks each

Q26. If α, β are zeroes of the quadratic polynomial $x^2 - 5x + k$ such that $\alpha - \beta = 1$, find the value of k .

OR

Find the zeroes of the polynomial $x^2 - 2x - 8$ and verify the relationship between the zeroes and the coefficients.

Q27. In the given figure; CD is the perpendicular bisector of AB, $EF \perp CD$ and AE intersects CD at G. Show that $\triangle CFE \sim \triangle CDB$. Hence, show that $CF \times CB = CE \times CD$.



Q28. Given that $\sqrt{2}$ is irrational, show that $3 + 7\sqrt{2}$ is irrational.

Q29. If $4\cot^2 45^\circ - \sec^2 60^\circ + \sin^2 60^\circ + p = \frac{3}{4}$, find p.

Q30. Solve for x and y : $x - \frac{2}{3}y = \frac{8}{3}$ and $\frac{2x}{5} - y = \frac{-2}{5}$

Q31. Find the mean of the following distribution.

Marks	0-20	20-40	40-60	60-80	80-100
No. of students	15	18	21	29	17

OR

The mode of the following distribution is 55. Find the missing frequency x .

Class	0-15	15-30	30-45	45-60	60-75	75-90
Frequency	10	7	x	15	10	12

(6)

SECTION-D**Section D consists of 4 questions of 5 marks each**

Q32. The median of the following data is 35. Find the values of x and y , if the sum of all the frequencies is 170.

Class	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	10	20	x	40	y	25	15

Q33. ~~Solve the system of linear equations $2x + y - 6 = 0$ and $4x - 2y - 4 = 0$ graphically. Determine the coordinates of the vertices of the triangle formed by these lines and the y-axis. Also, find the area of the triangle.~~

OR

Seven times a two-digit number is equal to four times the number obtained by reversing the digits. If the difference between the digits is 3, find the number.

Q34. State and prove Basic Proportionality Theorem.

Q35. If $\frac{x}{a} \cos\theta + \frac{y}{b} \sin\theta = 1$ and $\frac{x}{a} \sin\theta - \frac{y}{b} \cos\theta = 1$, prove that $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 2$ (5)

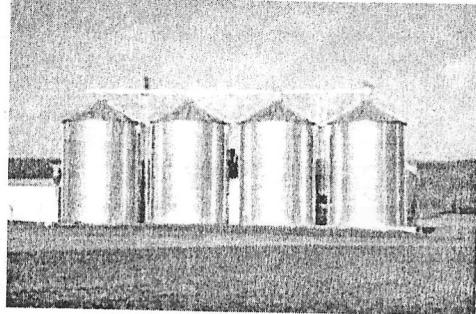
OR

(a) Prove that: $\sec A (1 - \sin A) (\sec A + \tan A) = 1$ (3)
 (b) Express sin A and cot A in terms of cos A (2)

SECTION-E

Q36. **CASE STUDY - I**

Silo : A silo is a structure for storing bulk materials. Silos are used in agriculture to store grain or fermented feed known as silage. Silos are commonly used for bulk storage of grain, coal, cement, carbon black, woodchips, food products and sawdust. A silo is in the shape of cylinder surmounted by a conical top. The height and diameter of cylindrical part are 40 feet and 42 feet respectively and the slant height of conical part is 29 feet.



(7)

Based on the above information, answer the following questions:

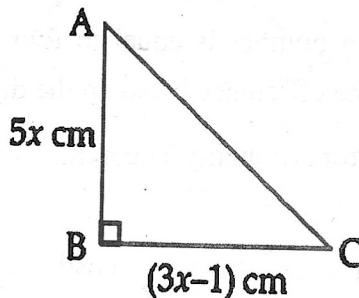
(i) Find the height of the conical part. (1)
(ii) Calculate the total surface area of the silo. (2)

OR

Determine the volume of the silo. (2)
(iii) Find the area of the base of the silo. (1)

Q37. CASE STUDY – II

There is a triangular design as shown in the figure. The sides of the right angled triangle are $5x$ cm and $(3x - 1)$ cm and the area of the triangle is 60 cm^2 .



On the basis of the above information, answer the following questions:

(i) Form a quadratic equation for the above situation. (1)
(ii) Solve the above quadratic equation and find the value(s) of x . (2)

OR

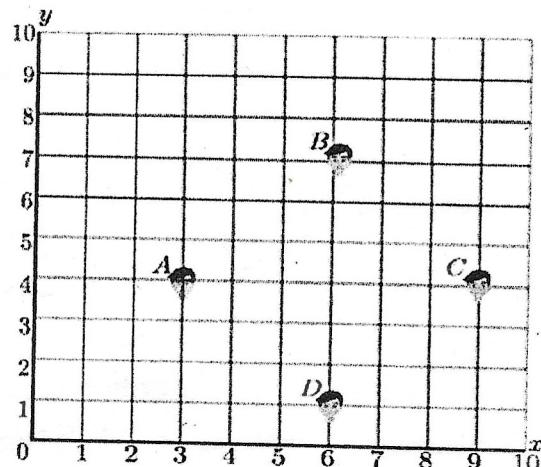
For what value(s) of k , the quadratic equation $9x^2 + 6kx + 4 = 0$ has equal roots? (2)

(iii) Find the discriminant of the quadratic equation $3\sqrt{3}x^2 + 10x + \sqrt{3} = 0$ (1)

Q38. CASE STUDY – III

Morning assembly is an integral part of a school's schedule. Almost all the schools conduct morning assemblies which include prayers, information of latest happenings, inspiring thoughts, speech, national anthem, etc. Morning assembly is important for a child's development. The positive effects of attending school assemblies can be

felt throughout life. In school assembly, students always stand in rows and columns and this makes a coordinate system. Suppose a school has 100 students and they all assemble in prayer hall in 10 rows as given below. Four friends Amar, Bharat, Colin and David are represented by A, B, C and D respectively.



Based on the above information, answer the following questions:

- (i) Find the distance between Amar and Bharat. (1)
- (ii) Find the coordinates of a point M on the y-axis, which is equidistant from points B and C. (2)

OR

Find the coordinates of a point P which divides the line segment BD in the ratio 3 : 2. (2)

- (iii) Find the coordinates of the mid point of AC. (1)

(9)