QL

QUARTERLY EXAMINATION - 2024

10 - Std

MATHS

Time : 3.00 Hrs. SALEM DISTRICT MARKS : 100

PART - A

I **Answer all the questions.** 14 X 1 = 14

Choose the correct answer from the given four alternatives.

1. If there are 1024 relations from a set A = {1,2,3,4,5} to a set B, then the number of elements in B is ..... .

   a) 3 b) 2 c) 4 d) 8

2. If the ordered pairs (a, -1) and (5, b) belong to {(x,y) / y = 2x + 3}, then the values of `a' and `b' are

   a) (-13, 2) b) (2, 13) c) (2, -13) d) (-2, 13)

3. The least number that is divisible by all the numbers from 1 to 10 (both inclusive) is

   a) 2025 b) 5220 c) 5025 d) 2520

4. If t_n is the n^{th} term of an A.P. then $t_{2n} - t_n$ is

   a) nd b) 2nd c) 2d d) 3nd

5. The sequence $\sqrt{11}, \sqrt{55}, 5\sqrt{11}, 5\sqrt{55}, 25\sqrt{11}, \ldots\ldots$ represents

   a) an A.P. only b) a G.P. only

   c) neither A.P nor G.P d) both A.P and G.P

6. If (x - 6) is the HCF of $x^2 - 2x - 24$ and $x^2 - kx - 6$ then the value of k is

   a) 3 b) 5 c) 6 d) 8

7. Which of the following should be added to make $x^4 + 64$ a perfect square?

   a) $4x^2$ b) $16x^2$ c) $8x^2$ d) $-8x^2$

8. A quadratic equation whose one zero is 5 and the sum of the zeroes is 0 is given by the equation

   a) $x^2 - 5x = 0$ b) $x^2 - 5x + 5 = 0$ c) $x^2 - 25 = 0$ d) $x^2 - 5 = 0$

9. The perimeters of two similar triangles ΔABC and ΔPQR are 36cm and 24cm respectively. If PQ = 10 cm, the length of AB is ..... .

a) $6\frac{2}{3}$ cm b) $\frac{10\sqrt{6}}{3}$ cm c) $66\frac{2}{3}$ cm d) 15 cm

10. In a ΔABC , AD is the bisector of $\angle BAC$. If AB = 8cm, BD = 6cm and DC = 3cm. The length of the side AC is ..... .

a) 6 cm b) 4cm c) 3 cm d) 8 cm

11. The straight line given by the equation x = 11 is

a) Parallel to x axis b) parallel to y axis

c) passing through the origin d) passing through the point (0, 11)

12. If (5,7), (3, p) and (6, 6) are collinear then the value of p is

a) 3 b) 6 c) 9 d) 12

13. (2,1) is the point of intersection of two lines

a) x - y - 3 = 0; 3x - y - 7 = 0 b) x + y = 3; 3x + y = 7

c) 3x + y = 3; x + y = 7 d) x + 3y - 3 = 0; x - y - 7 = 0

14. If $5x = \sec\theta$ and $\frac{5}{y} = \tan\theta$, then $x^2 - \frac{1}{y^2}$ is equal to

a) 25 b) $\frac{1}{25}$ c) 5 d) 1

PART - B

II Answer any 10 questions.

Question No. 28 is compulsory. 10 X 2 = 20

15. A relation R is given by the set $\{(x,y) / y = x + 3, x \in \{0,1,2,3,4,5\}\}$ Determine its domain and range.

16. Let f be a function from R to R defined by f(x) = 3x - 5. Find the values of a and b given that (a, 4) and (1, b) belong to f.

17. If $f(x) = x^2 - 1$, g(x) = x - 2 find a, gof (a) = 1.

18. Solve : $5x \equiv 4 \pmod 6$

19. In a G.P. 729, 243, 81, ... find t_7.

20. If 1 + 2 + 3 + ... + k = 325 then find

$1^3 + 2^3 + 3^3 + ... + k^3$,

21. Find the excluded value of the rational expression $\frac{t}{t^2-5t+6}$.

22. Simplify : $\frac{x^3}{x-y}+\frac{y^3}{y-x}$.

23. Determine the nature of the roots of the quadratic equation $15x^2 + 11x + 2 = 0$.

24. If ΔABC is similar to ΔDEF such that BC = 3cm, EF = 4cm and area of ΔABC = 54cm². Find the are of ΔDEF.

25. Find the slope of a line joining the points (-6, 1) and (-3, 2).

26. Show that the straight lines x - 2y + 3 = 0, 6x + 3y + 8 = 0 are perpendicular.

27. Prove that $\sqrt{\frac{1+\sin\theta}{1-\sin\theta}} = \sec\theta + \tan\theta$.

28. Find the equation of straight line whose slope is -4 and passing through the point (1,2).

PART - C

III Answer any 10 question.

Question No. 42 is compulsory. 10 X 5 = 50

29. Let A = {x ∈ W / x < 2}, B = {x ∈ N / 1 < x ≤ 4} and C = {3, 5} verify that A X (B ∩ C) = (A X B) ∩ (A X C).

30. Let $f : A \to B$ be a function defined by $f(x)=\frac{x}{2}-1$, where A = {2,4,6,10,12}, B = {0,1,2,4,5,9}. Represent f by i) a set of ordered pairs ii) a table iii) an arrow diagram iv) a graph.

31. If f(x) = x², b(x) = 3x and h(x) = x - 2, prove that (fog) oh = fo(foh).

32. The 13th term of a n A.P is 3 and the sum of first 13 terms is 234. Find the common difference and the sum of first 21 terms.

33. Find the sum of n terms of the series 3 + 33 + 333 + ... to x terms.

34. There are 12 pieces of five, ten and twenty rupee currencies whose total value is Rs. 105. When first 2 sorts are interchanged in their numbers its value will be increased by Rs. 20. Find the number of currencies in each sort.

35. Find the square root of the polynomial $37x^2 - 28x^3 + 4x^4 + 42x + 9$ by division method.

36. The roots of the equitation $x^2 + 6x - 4 = 0$ are α, β. Find the quadratic equation whose roots are α^2 and β^2.

37. State and prove Thales theorem.

38. Find the area of the quadrilateral formed by the points (8, 6), (5, 11), (-5, 12) and (-4, 3).

39. Find the equation of a straight line passing through (1,-4) and has intercepts which are in the ratio 2 : 5.

40. Find the equation of the perpendicular bisector of the line joining the points A(-4, 2) and B (6, -4).

41. If $\cot\theta + \tan\theta = x$ and $\sec\theta - \cos\theta = y$ then prove that $(x^2y)^{2/3} - (xy^2)^{2/3} = 1$.

42. Swathi has 15 ice cubes of different sizes 9cm, 10cm, 11cm, ... 23cm. How much volume of ice cubes can be used to prepare some fruit juice with these ice cubes?

PART - D

IV Answer all the questions. 2 X 8 = 16

43. a) Construct a triangle similar to a given triangle ABC with its sides equal to $\frac{6}{5}$ of the corresponding sides of the triangle ABC (scale factor $\frac{6}{5} > 1$) ***(OR)***
b) Construct a triangle ΔPQR such that QR = 5cm, $\angle P = 30^o$ and the altitude from P to QR is of length 4.2cm.

44. a) A bus is travelling at a uniform speed of 50km/hr. Draw the distance - time graph and hence find.
i) the constant of variation.
ii) how for will it travel in 90 minutes?
iii) the time required to cover a distance of 300km from the graph. ***(OR)***
b) The following table shows the data about the number of pipes and the time taken to fill the same tank.

No. of pipes (X)	2	3	6	9
Time taken (Y) (in mts)	45	30	15	10

Draw the graph for the above data and hence.
i) Find the time taken to fill the tank when five pipes are used.
ii) Find the number of pipes when the time is 9 minutes.

QUARTERLY EXAMINATION – 2024

10th Maths

Answer key.

PART – A

1) (B) 2

2) (D) (-2, 13)

3) (D) 2500

4) (C) 2d

5) (A) an A.P only

6) (B) 5

7) (B) $16x^2$

8) (C) $x^2 - 25 = 0$

9) (D) 15cm

10) (B) 4cm

11) (B) Parallel to y axis

12) (C) 9

13) (B) $x+y=3$; $3x+y=7$

14) (B) $\frac{1}{25}$

PART – B

II

15) $y = x+3$

Domain of $R = \{0, 1, 2, 3, 4, 5\}$

Range of $R = \{3, 4, 5, 6, 7, 8\}$

16) $f(x) = 3x-5$

$f(a) = 4$

$3a-5 = 4$

$\boxed{a = 3}$

$f(1) = b$

$3(1)-5 = b$

$\boxed{b = -2}$

17) $f(x) = x^2-1$, $g(x) = x-2$

Given $gof(a) = 1$

$g(f(a)) = 1$

$g(a^2-1) = 1$

$a^2-1-2 = 1$

$a^2-3 = 1$

$a^2 = 4$

$\boxed{a = \pm 2}$

18) $5x \equiv 4 \pmod 6$

$5x-4 = 6n$ for some integer n.

$5x-4$ is a multiple of 6

$x = \frac{6n+4}{5}$; $n = 1, 6, 11, 16, \ldots$

$n = 1 \Rightarrow x = \frac{6\times1+4}{5} = 2$

∴ The least positive value of x is 2.

20) $1+2+3+\ldots+k = 325$

$\frac{n(n+1)}{2} = 325$ — (1)

To find $1^3+2^3+3^3+\ldots+k^3 = \sum n^3$

$= \left(\frac{n(n+1)}{2}\right)^2$

$= (325)^2$

$= 105625$

19) 20)

729, 243, 81, ...

$a = 729$, $r = \frac{t_2}{t_1} = \frac{243}{729} = \frac{1}{3}$

$t_7 = ar^{n-1}$

$= (729)\left(\frac{1}{3}\right)^{7-1}$

$= 3^6 \times \frac{1}{3^6}$

$\boxed{t_7 = 1}$

21) $\frac{t}{t^2-5t+6}$

$t^2-5t+6 = 0$

$\Rightarrow (t-2)(t-3) = 0$

$t = 2, 3$

∴ The excluded value are 2, 3

22) $\frac{x^3}{x-y} + \frac{y^3}{y-x} = \frac{x^3}{x-y} - \frac{y^3}{x-y}$

$= \frac{x^3 - y^3}{x-y}$

$= \frac{(x-y)(x^2+xy+y^2)}{x-y}$

$= x^2+xy+y^2$

23) $15x^2+11x+2=0$

$a=15,\ b=11,\ c=2$

$\Delta = b^2-4ac$

$= (11)^2 - 4\times 2\times 15$

$= 121 - 120$

$\Delta = 1 > 0$

∴ The roots are real and unequal.

24) $\frac{\text{Area}(\Delta ABC)}{\text{Area}(\Delta DEF)} = \frac{BC^2}{EF^2}$

$\Rightarrow \frac{54}{\text{Area}(\Delta DEF)} = \frac{3^2}{4^2}$

$\text{Area}(\Delta DEF) = \frac{16\times 54}{9}$

$= 96\ cm^2$

25) $(-6,1)$ and $(-3,2)$

$\text{Slope } (m) = \frac{y_2-y_1}{x_2-x_1}$

$= \frac{+2-1}{-3+6}$

$\boxed{m = \frac{1}{3}}$

26) Slope $m_1 = \frac{-1}{-2} = \frac{1}{2}$

Slope $m_2 = \frac{-6}{3} = -2$

Now $m_1 \times m_2 = \frac{1}{2}\times -2 = -1$

∴ Two straight lines are perpendicular.

27) $\sqrt{\frac{1+\sin\theta}{1-\sin\theta}} = \sqrt{\frac{1+\sin\theta}{1-\sin\theta}\times\frac{1+\sin\theta}{1+\sin\theta}}$

$= \sqrt{\frac{(1+\sin\theta)^2}{1-\sin^2\theta}}$

$= \sqrt{\left(\frac{1+\sin\theta}{\cos\theta}\right)^2}$

$= \frac{1+\sin\theta}{\cos\theta}$

$= \frac{1}{\cos\theta} + \frac{\sin\theta}{\cos\theta}$

$= \sec\theta + \tan\theta$

28) $(x_1,y_1) = (1,2)$, slope $m = -4$

Equation of the straight line

$y-y_1 = m(x-x_1)$

$y-2 = -4(x-1)$

$y-2 = -4x+4$

$4x+y-2-4=0$

$\boxed{4x+y-6=0}$

PART - C

III

29) $A=\{a,1\}$, $B=\{2,3,4\}$, $C=\{3,5\}$

$A\times(B\cap C) = (A\times B)\cap(A\times C)$

$B\cap C = \{3\}$

$A\times(B\cap C) = \{(a,3),(1,3)\}$ — ①

$A\times B = \{(a,2),(a,3),(a,4),(1,2),(1,3),(1,4)\}$

$A\times C = \{(a,3),(a,5),(1,3),(1,5)\}$

$(A\times B)\cap(A\times C) = \{(a,3),(1,3)\}$ — ②

From ① and ②

$A\times(B\cap C) = (A\times B)\cap(A\times C)$

30) $f(x) = \frac{x}{2} - 1$

$f(2)=0,\ f(4)=1,\ f(6)=2,\ f(10)=4$

$f(12)=5$

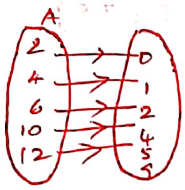
(i) set of ordered pairs.

$f = \{(2,0),(4,1),(6,2),(10,4),(12,5)\}$

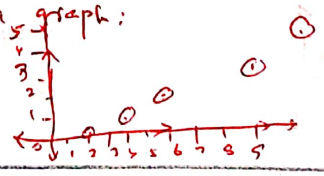
(ii) Table.

x	2	4	6	10	12
$f(x)$	0	1	2	4	5

(iii) an arrow diagram:



(iv) a graph:



31) $f(x) = x^2,\ g(x) = 3x,\ h(x) = x-2$

$(f\circ g)\circ h = f\circ(g\circ h)$

$f\circ g = (x^2)\circ(3x)$

$= (3x)^2$

$= 9x^2$

$(f\circ g)\circ h = 9x^2\circ(x-2)$

$= 9(x^2 - 4x + 4)$ ④

$= 9x^2 - 36x + 36$ — ①

$gof = (3x) \circ (x-2)$

$= 3(x-2)$

$= 3x - 6$

$f \circ (gof) = x^2 \circ (3x-6)$

$= (3x-6)^2$

$= 9x^2 - 36x + 36$ — ②

from ① and ②

$(f \circ (gof) = f \circ (gof))$

32) Given 13^{th} term $= 3$

$t_{13} = a + 12d = 3$ — ①

Sum of first 13 terms $= 234$

$\Rightarrow S_{13} = \frac{13}{2}(2a + 12d) = 234$

$2a + 12d = 36$ — ②

solving ① and ② we get

$a = 33,\ d = -5/2$

$\therefore d = -5/2$

Sum of first 21 terms S_{21}

$= \frac{21}{2}\left[2 \times 33 + (21-1) \times -\frac{5}{2}\right]$

$= \frac{21}{2}(66 - 50)$

$= 168$

34) $x + y + z = 12$ — ①

$5x + 10y + 20z = 105$

$\Rightarrow x + 2y + 4z = 21$ — ②

First 2 sets are interchanged

$10x + 5y + 20z = 125$

$2x + y + 4z = 25$ — ③

③ − ② $\Rightarrow x - y = 4$ — ④

$x = 7$ in eqn ④ $7 - y = 4$

$\boxed{y = 3}$

① × 4 $\Rightarrow 4x + 4y + 4z = 48$

② $\Rightarrow x + 2y + 4z = 21$

$3x + 2y = 27$

⑤ $\Rightarrow 3x + 2y = 27$

④ × 2 $\Rightarrow 2x - 2y = 8$.

$5x = 35$

$\boxed{x = 7}$

Substituting $x = 7,\ y = 3$ in ①

$7 + 3 + z = 12$

$\boxed{z = 12}$

∴ the number of currencies in five, ten and twenty rupee is 7, 3, 2.

35)

$2x^2 - 7x - 3$

$2x^2 \mid 4x^4 - 28x^3 + 37x^2 + 42x + 9$

$4x^4$

$-28x^3 + 37x^2$

$4x^2 - 7x$ $\quad -28x^3 + 49x^2$

$-12x^2 + 42x + 9$

$4x^2 - 7x - 3$ $\quad -12x^2 + 42x + 9$

$+1$

0

$\therefore \sqrt{4x^4 - 28x^3 + 37x^2 + 42x + 9} = |2x^2 - 7x - 3|$

33) $3 + 33 + 333 + \ldots$ to n terms

$S_n = 3 + 33 + 333 + \ldots$

$= 3(1 + 11 + 111 + \ldots)$

$= \frac{3}{9}(9 + 99 + 999 + \ldots \text{upto } n \text{ terms})$

$= \frac{1}{3}((10-1) + (100-1) + (1000-1) + \ldots \text{upto } n \text{ terms})$

$= \frac{1}{3}[(10 + 100 + 1000 + \ldots) - (1 + 1 + 1 + \ldots \text{upto } n \text{ terms})]$

$= \frac{1}{3}\left[\frac{a(r^n - 1)}{r - 1} - n\right]$, where $a = 10,\ r = 10$

$= \frac{1}{3}\left[\frac{10(10^n - 1)}{10 - 1} - n\right]$

$= \frac{1}{3}\left[\frac{10(10^n - 1)}{9} - n\right]$

$= \frac{10(10^n - 1)}{27} - \frac{n}{3}$

36) $x^2 + 6x - 4 = 0$

$a = 1,\ b = 6,\ c = -4$

$\alpha + \beta = \frac{-6}{1} = -6,\ \alpha\beta = \frac{-4}{1} = -4$

(i) α^2 and β^2

Sum of new roots $= \alpha^2 + \beta^2$

$= (\alpha + \beta)^2 - 2\alpha\beta$

$= (-6)^2 - 2(-4)$

$= 36 + 8$

$= 44$

Product of new roots $= \alpha^2 \cdot \beta^2$

$= (\alpha\beta)^2$

$= (-4)^2$

$= 16$

∴ The quadratic equation is

x^2 − (sum of roots) x + product of roots = 0

$\boxed{x^2 - 4x + 16 = 0}$

37) Thales theorem :

Statement — (1) marks

diagram — (1) marks

Proof — (3) marks.

38) A(8,6), B(5,11), C(−5,12), D(−4,3)

Area of the quadrilateral.

$$= \frac{1}{2}\begin{vmatrix} x_1 & x_2 & x_3 & x_4 & x_1 \\ y_1 & y_2 & y_3 & y_4 & y_1 \end{vmatrix}$$

$$= \frac{1}{2}\begin{vmatrix} 2 & 5 & 4 & 1 & 2 \\ 2 & 5 & 9 & 7 & 2 \end{vmatrix}$$

$$= \frac{1}{2}\left[\{(10+45+28+2) - (10+20+9+14)\} \right]$$

$$= \frac{1}{2}\{85 - 53\}$$

$$= \frac{1}{2}(32)$$

= 16 Sq. units.

39) Given $a : b = 2 : 5$

$$\frac{a}{b} = \frac{2}{5}$$

$$a = \frac{2b}{5}$$

The straight line equation is

$$\frac{x}{a} + \frac{y}{b} = 1$$

$$\frac{x}{2b/5} + \frac{y}{b} = 1$$

$$\frac{5x}{2b} + \frac{y}{b} = 1$$

$$\frac{5x + 2y}{2b} = 1$$

$5x + 2y = 2b$ — (1)

The passing through points is (1, −4)

$5(1) + 2(-4) = 2b$

$5 - 8 = 2b$

$\boxed{b = -3/2}$

$b = -3/2$ in (1)

$5x + 2y = 2b$

$5x + 2y = 2(-3/2)$

$\boxed{5x + 2y + 3 = 0}$

40) A D D

$D\left(\frac{-4+6}{2}, \frac{2-6}{2}\right) = (2/2, -3/2) = (1, -1)$

The equ of AB is

$$\frac{y-2}{-4-2} = \frac{x+4}{6+4}$$

$$\frac{y-2}{-6} = \frac{x+4}{10}$$

$10(y-2) = -6(x+4)$

$6x + 10y - 20 + 24 = 0$

$6x + 10y + 4 = 0$

$\div 2$] $3x + 5y + 2 = 0$ — (1)

The required straight line is perpendicular to equ (1). then the required Equation $5x - 3y + k = 0$

The passing through point is D(1, −1)

$5(1) - 3(-1) + k = 0$

$5 + 3 + k = 0$

$\boxed{k = -8}$

∴ The required equation of the 1st bisector $\boxed{5x - 3y - 8 = 0}$

41) Given $9^2 + 10^2 + 11^2 + \cdots + 23^2$

$= (1^2 + 2^2 + 3^2 + \cdots + 23^2) - (1^2 + 2^2 + 3^2 + \cdots + 8^2)$

$$= \frac{n(n+1)(2n+1)}{6} - \frac{n(n+1)(2n+1)}{6}$$

$$= \frac{23(23+1)(2\times23+1)}{6} - \frac{8(8+1)(16+1)}{6}$$

$$= \frac{23 \times 24 \times 47}{6} - \frac{8 \times 9 \times 17}{6}$$

$$= \frac{25944}{6} - \frac{1224}{6}$$

$= 4324 - 204$

$= 4120$

PART − D

IV

43) (a) Rough diagram — (2)
Fair diagram — (6) } (8) marks

(b) Rough diagram — (2)
Fair diagram — (6) } (8) marks

44) (a) (i) $y = \frac{5}{6}x$

(ii) 75 km

(iii) 360 minutes & 6 hours

(b) (i) 18 minutes

(ii) 10 pipes.

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