COMMON HALF YEARLY EXAMINATION - 2024 Reg. No.

X - MATHS

Time Allowed : 3-00 Hrs. *Maximum Marks: 100*

I. Choose the correct answer. **(14x1=14)**

1. If g = {(1,1), (2,3), (3,5), (4,7)} is a function given by g(x) = $\alpha x + \beta$ then the values of α and β are a) (1,2) b) (-1,2) c) (2,-1) d) (-1,-2)
2. Read the following statement carefully
   i) The graph of constant function represents the line parallel to x-axis
   ii) Composition of function is always associative.
   iii) The graph of modulus function is always to be in first and fourth quadrant.
   iv) Identity function has same and equal element in both domain and range.
   In the above statement which one of the following is correct
   a) i, ii, iii only b) i, ii, iv only c) ii, iii, iv only d) All are correct
3. If 2 + 4 + 6 + ... + 2k = 90 then find k
   a) 8 b) 9 c) 10 d) 11
4. $\frac{x}{x^2-25} - \frac{8}{x^2+6x+5}$ gives
   a) $\frac{x^2-7x+40}{(x-5)(x+5)}$ b) $\frac{x^2+7x+40}{(x-5)(x+5)(x+1)}$ c) $\frac{x^2-7x+40}{(x^2-25)(x+1)}$ d) $\frac{x^2+10}{(x^2-25)(x+1)}$
5. If number of columns and rows are not equal in a matrix then it is said to be a
   a) Diagonal matrix b) Rectangular matrix c) Square matrix d) Identity matrix
6. If in Δ ABC, DE || BC AB=3.6cm AC=2.4cm and AD=2.1cm then the length of AE is
   a) 1.4 cm b) 1.8 cm c) 1.2 cm d) 1.05 cm
7. How many tangents can be drawn to the circle from an exterior point?
   a) One b) Two c) Zero d) Infinite
8. The Straight line given by the equation X =11 is
   a) Parallel to X axis b) Paralled to Y axis
   c) Passing through the origin d) Passing through the point (0,11)
9. The equation of a line passing through the origin and perpendicular to the line 7x - 3y + 4 = 0 is
   a) 7x - 3y + 4 = 0 b) 3x - 7y + 4 = 0 c) 3x + 7y = 0 d) 7x - 3y = 0
10. If sin θ + cos θ = a and sec θ + cosec θ = b then the value of b (a^2 -1) is equal to
    a) 2a b) 3a c) 0 d) 2 ab
11. The electric pole subtends an angle of 30^0 at a point on the same level as its foot. At a second Point "b" metres above the first, the depression of the foot of the pole is 60^0 the height of the pole (in metres) is equal to
    a) $\sqrt{3}$ b b) $\frac{b}{3}$ c) $\frac{b}{\sqrt{3}}$ d) $\frac{b}{2}$
12. The height of a right circular cone whose radius is 5 cm and slant height is 13 cm will be
    a) 12 cm b) 10 cm c) 13 cm d) 5 cm
13. Which of the following incorrect?
    a) P(A) > 1 b) $0 \le P \le 1$ c) P (ϕ) = 0 d) P (A) P $(\overline{A})$ = 1
14. The standard deviation of a data is 3. If each value is multiplied by 5 then the new varience is
    a) 3 b) 15 c) 5 d) 225

II. Answer any 10 questions. (Q.No.28 is compulsory) **(10x2=20)**

15. If A x B = { (3, 2), (3, 4), (5, 2), (5, 4) } then find A and B.
16. Given the function $f : x \to x^2 - 5x + 6$ evaluate i) $f(-1)$ ii) $f(2)$
17. Find the HCF of 252525 and 363636
18. Find the sum $3 + 1 + \frac{1}{3} + \ldots\ldots \infty$

19. If $A = \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$ $B = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$ find AB
20. In ΔABC, if DE $\parallel$ BC, AD = x, DB = x - 2, AE = x + 2 and EC = x - 1 then find the lengths of the sides AB and AC
21. Find the slope of a line joining the given points (-6,1) and (-3, 2)
22. Prove that $\sec\theta - \cos\theta = \tan\theta \sin\theta$
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 $10\sqrt{3}$ m.
24. The slant height of a frustum of a cone is 5 cm and the radii of its ends are 4 cm and 1 cm. Find its curved surface area.
25. The radius of a sphere increases by 25%. Find the percentage increase in its surface area.
26. Find the standard deviation of first 21 natural numbers.
27. A coin is tossed thrice. What is the probability of getting two consecutive tails?
28. Find the equation of a line whose inclination is 30° and making an intercept -3 on the y axis.

III. Answer any 10 questions. (Q.No.42 is compulsory) ***(10x5=50)***

29. Let A = { x ∈ N / 1< x <4} B = {x ∈ W /0≤ x <2} and C = {1,2 } then verify that A X (B ∩ C) = (AXB) ∩ (AXC)
30. Let f : A → 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 by i) set of ordered pairs ii) a table iii) an arrow Diagram (iv) a graph
31. The 13^{th} term of an A.P is 3 and the sum of first 13 terms is 234. Find the common difference and the sum of first 21 terms.
32. Find the sum of $10^3 + 11^3 + 12^3 + \ldots\ldots + 20^3$
33. If $A = \begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}$ show that $A^2 - 4A + 5I_2 = 0$
34. If $9x^4 + 12x^3 + 28x^2 + ax + b$ is a perfect square, find the values of a and b
35. Find the value of k, if the area of a quadrilateral is 28 sq.units, whose vertices are taken in the order (-4, -2), (-3, k), (3, -2) and (2, 3)
36. Find the equation of a straight line passing through (-8, 4) and making equal intercepts on the co ordinate axes.
37. From a point on the ground, the angles of elevation of the bottom and top of a tower fixed at the top of a 30 m high building are 45° and 60° respectively. Find the height of the tower. $(\sqrt{3} = 1.732)$
38. A container open at the top is in the form of a frustum of a Cone of height 16 cm with radii of its lower and upper ends are 8 cm and 20 cm respectively. Find the cost of milk which can completely fill a container at the rate of ₹ 40 per litre.
39. State and Prove Angle Bisector Theorem.
40. Find the Co efficient of variation of 18, 20,15,12, 25.
41. Two dice are rolled, Find the Probabiliaty that the sum of outcomes is equal to 4.
42. A metallic sphere of radius 16 cm is melted and recast into small spheres each of radius 2 cm. How many small spheres can be obtained?

IV. Answer all the questions. ***(2x8=16)***

43. a) Take a point which is 11cm away from the centre of a circle of radius 4cm and draw the two tangents to the circle from that point. ***(OR)***
    b) Draw a triangle ABC of base BC = 8 cm ∠A = 60° and the bisector of ∠A meets BC at D such that BD = 6 cm
44. a) Draw the graph of $Y = x^2 + x - 2$ and hence solve $x^2 + x - 2 = 0$ ***(OR)***
    b) Graph the following linear function $y = \frac{1}{2}x$ Identify the constant of variation and verify it with the graph.
    Also (i) find y when x = 9 (ii) find x when y = 7.5

Trichy - 16-12-24 Half yearly exam - 2024-25

Subject - Maths Std: 10th

Choose the correct answer

1) a) (2, -1)

2) b) i, ii, iv only

3) b) 9

4) c) $\frac{x^2-7x+4}{(x^2-25)(x+1)}$

5) b) Rectangular matrix

6) a) 1.4 cm

7) b) Two

8) b) parallel to y axis

9) c) $3x+7y=0$

10) a) 2a

11) b) b/3

12) a) 12 cm

13) d) $P(A) > 1$

14) d) 225

15)

16) $f(-1) = 12$, $f(2) = 0$

17) $367636 = (252525)(1) + 111111$

$252525 = (111111)2 + 30303$

$30303 = (20202)(1) + 10101$

$20202 = (10101)(2) + 0$

HCF = 10101

18) $a = 3$, $r = 1/3$, $S_\infty = \frac{a}{1-r}$

$S_\infty = 9/2$

19) $AB = \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$

$= \begin{bmatrix} 1-1 & 1+1 \\ -1+1 & -1+1 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

$AB = 0$

20) By Thales theorem

$\frac{AD}{DB} = \frac{AE}{EC}$

$\frac{x}{x-2} = \frac{x+2}{x-1}$

$x^2 - x = x^2 - 4 \Rightarrow x = 4$

$AB = 6$, $AC = 9$

21) $x_1 = -6$, $y_1 = -1$, $x_2 = -3$, $y_2 = 2$

slope $(m) = \frac{y_2-y_1}{x_2-x_1} = \frac{2-1}{-3+6}$

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

22) LHS $= \sec\theta - \cos\theta$

$= \frac{1}{\cos\theta} - \cos\theta$

$= \frac{1-\cos^2\theta}{\cos\theta} = \frac{\sin^2\theta}{\cos\theta}$

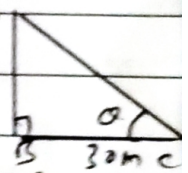
$= \frac{\sin\theta}{\cos\theta} \times \sin\theta$

$= \tan\theta \times \sin\theta$

23) $\tan\theta = \frac{AB}{BC}$

$= \frac{10\sqrt{3}}{30}$

$= \frac{1}{\sqrt{3}} \Rightarrow \theta = 30°$



24) $l = 5$ cm, $R = 4$ cm, $r = 1$ cm

CSA $= \pi(R+r)l$ sq.unit

$= \frac{22}{7}(4+1)5 = 78.57$ cm²

25) r = radius of a sphere

r_1 = radius of new sphere

$r_1 = \frac{5r}{4}$

Surface area of sphere $(A) = 4\pi r^2$

Surface area of new sphere $(A_1) = 4\pi r_1^2$

$A_1 = 4\pi\left(\frac{5r}{4}\right)^2 = \frac{25\pi r^2}{4}$

Increase in area $= A_1 - A = \frac{9\pi r^2}{4}$

Percentage increase in surface area

$= \frac{A_1 - A}{A} \times 100$

$= 56.25\%$

26) $n = 21$, $\sigma = \sqrt{\frac{n^2-1}{12}}$

$= \sqrt{\frac{21^2-1}{12}} = \sqrt{36.67} = 6.05$

27) $S = \{HHH, HTH, THH, TTH, HHT, HTT, THT, TTT\}$, $n(S) = 8$

$A = \{TTH, HTT, TTT\}$, $n(A) = 3$

$P(A) = \frac{3}{8}$

28) $\alpha = 30°$, y-intercept $(c) = -3$

slope $(m) = \tan\alpha \Rightarrow \tan 30° = \frac{1}{\sqrt{3}}$

$m = 1/\sqrt{3}$,

eqn: $y = mx + c$, $y = \frac{1}{\sqrt{3}}x - 3$

$x - \sqrt{3}y - 3\sqrt{3} = 0$

Part-III

29) $A = \{2, 3\}$, $B = \{0, 1\}$, $C = \{1, 2\}$

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

$A \times B = \{(2,0), (2,1), (3,0), (3,1)\}$

$A \times C = \{(2,1), (2,2), (3,1), (3,2)\}$

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

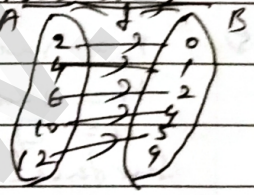
From ① and ②

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

30) (i) Set of ordered pairs

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

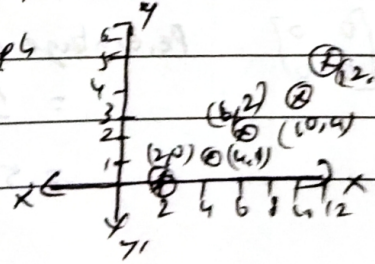
(iii) An arrow diagram



(ii) a table

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

(iv) a graph



31) $t_n = a + (n-1)d$

$a + 12d = 3$ — ①, $S_{12} = 234$

$2a + 12d = 36$ — ②

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

$S_{21} = \frac{21}{2}[2(33) + 20(-5/2)]$

$= 168$

32) $S_n = (1^3 + 2^3 + \cdots + 20^3) - (1^3 + 2^3 + \cdots + 9^3)$

$\Sigma n^3 = \left[\frac{n(n+1)}{2}\right]^2$

$= \left(\frac{20 \times 21}{2}\right)^2 - \left(\frac{9 \times 10}{2}\right)^2$

$= 42075$

33) $A^2 = \begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}\begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}$

$= \begin{bmatrix} -1 & -4 \\ 8 & 7 \end{bmatrix}$

$A^2 - 4A + 5I_2$

$= \begin{bmatrix} -1 & -4 \\ 8 & 7 \end{bmatrix} - \begin{bmatrix} 4 & -4 \\ 8 & 12 \end{bmatrix} + \begin{bmatrix} 5 & 0 \\ 0 & 5 \end{bmatrix}$

$= \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} = 0$

34)

$3x^2 + 2x + 4$

$3x^2$ | $9x^4 + 12x^3 + 28x^2 + ax + b$

$9x^4$

$6x^2 + 2x$ | $12x^3 + 24x^2$

$12x^3 + 4x^2$

$6x^2 + 4x + 4$ | $24x^2 + ax + b$

$24x^2 + 16x + 16$

0

$a = 16$, $b = 16$

35) $2A = \frac{1}{2}\begin{bmatrix} -4 & -3 & 3 & 2 & -4 \\ -2 & k & -2 & 3 & -2 \end{bmatrix}$

$-7k + 21 = 56$

$k = \frac{35}{-7}$

$k = -5$

36) In intercepts of eqn

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

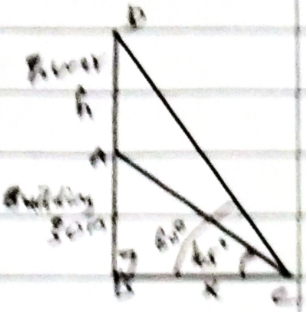
$a=b$ —(1)

$\frac{x}{a}+\frac{y}{a}=1$, At $x=-8, y=4$

$x+y=a$, $a=-4$

Eqn: $x+y+4=0$

37)



In $\triangle ABC$,

$\tan 45° = \frac{30}{x}$

$x = 30$

In $\triangle BCD$,

$\tan 60° = \frac{h+30}{x} \Rightarrow h = 30(\sqrt{3}-1)$

$h = 21.96$ m

38) $h = 16$ cm, $R = 20$ cm, $r = 8$ cm

Volume of the frustum

$= \frac{1}{3}\times\frac{22}{7}\times 16[20^2+20(8)+8^2]$

$= 10459.4$ cm^3

$= 10.4594$ litres

Cost of milk in the container

$= 40 \times 10.459$

$= ₹ 418.36$

39) Write and prove BPT

40) $n=5$

Assumed mean $A=18$

x_i	$d_i = x_i - A$ $= x-18$	d_i^2
12	−6	36
15	−3	9
(18) A	0	0
20	2	4
25	7	49
	$\Sigma d_i = 0$	$\Sigma d_i^2 = 98$

$\sigma = \sqrt{\frac{\Sigma d_i^2}{n} - \left(\frac{\Sigma d_i}{n}\right)^2}$

Variance $= \frac{\Sigma d_i^2}{n} - \left[\frac{\Sigma d_i}{n}\right]^2$

$= \sqrt{\frac{98}{5} - \left(\frac{0}{5}\right)^2}$

$\sigma = \sqrt{19.6}$

$\sigma = 4.427$

$\bar{x} = \frac{\Sigma x}{n} = \frac{90}{5} = 18$

$CV = \frac{\sigma}{\bar{x}} \times 100\%$

$= \frac{4.427}{18} \times 100$

$= 24.59\%$

41) $S = \{(1,1),(1,2),\ldots,(6,6)\}$

$n(S) = 36$

Let A be the event of the sum $=4$

$A = \{(1,3),(2,2),(3,1)\}$

$n(A) = 3$

$P(A) = \frac{n(A)}{n(S)} = \frac{1}{12}$ or $\frac{3}{36}$

42) Metallic sphere $R = 16$ cm

Small sphere $(r) = 2$ cm

No. of small spheres

$= \frac{\text{Vol. of metallic sphere}}{\text{Vol. of small sphere}}$

$= \frac{\frac{4}{3}\pi R^3}{\frac{4}{3}\pi r^3} = \frac{16\times16\times16}{2\times2\times2}$

$= 512$ spheres

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