MATHS

BOOKS - USHA MATHS (ODIA ENGLISH)

RELATION AND FUNCTION INVERSE TRIGONOMETRIC FUNCTIONS LINEAR PROGRAMMING

Exercise

1. If a set has n elements, how many relations are there from A to A?

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2. Let A={1,2,3}, B={4,5}. Determine all relations from A to B.

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3. Let A={1,2,3}, B={4,5}. Determine all relations from B to A.

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4. Let A={1,2,3}, B={4,5}. Is there any relation which both a relation from A to B and from B to A?

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5. Let A={1,2,3}, B={4,5}. Determine all relations from A to A.

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6. Let A={1,2,3}, B={4,5}. Determine all relations from B to B.

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7. Mark the following as true (T) or false (F). ϕ is a relation from set A to set B.

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8. Mark as true (T) or false (F). $A \times B$ is a relation from A to B

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9. Mark as true (T) or false (F). $\phi \times \phi$ is a relation from A to B

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10. Mark as true (T) or false (F). A relation cannot be both symmetric ad anti-systemetic.

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11. Mark as true (T) or false (F). For any equivalence relation R on a set A, $dom \cdot (R) = A$

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12. Mark as true (T) or false (F). The relation $R = \{(1, 1), (2, 2), (3, 3)\}$ on the set $A = \{1, 2, 3\}$ is symmetric only.

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13. What is the total number of relations from a set A to set B, where $|A| = 3$ and $|B| = 2$?

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14. What is the partition of the set $\{1, 2\}$ induced by the equivalence relation $\{(1, 1), (2, 2)\}$?

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15. Let $R = \{(x, y) : x < y, x, y \in N\}$. Check if R is reflexive, symmetric or transitive.

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16. If a relation is symmetric and transitive on any non-empty set, then it is reflexive. Is it true or false? State with reason.

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17. Let R be a relation in the set of natural numbers N defined by xRy if and only if $x + y = 18$. Is R an equivalence relation?

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18. Write true or false in the following with reason or by suitable example.

If $A = \{5, 7, 8\}$ and $B = \{10, 11, 12, 13, 15\}$ then $R = \{(5, 10), (5, 11), (7, 12), (8, 15)\}$, is a function from A to B.

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19. Write true or false in the following with reason or by suitable example.

Sum of two characteristic function is a characteristic function.

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20. Compute the following remainder function. $r_3(185)$

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21. Compute the following remainder function. $r_6(-500)$

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22. Mark as true (T) or false (F). The function $f: R \rightarrow [-1, 1]$ defined by $f(x) = \sin x$ is onto.

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23. Mark as true (T) or false (F). The function $f: R \rightarrow R$ defined by $f(x) = \sin x$ is bijective.

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24. Mark as true (T) or false (F). The greatest integer function is not onto.

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25. Mark as true (T) or false (F). The identity function is an odd function.

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26. Mark as true (T) or false (F). Let $f: R \rightarrow R$ is defined by $f(x) = x^2 + 1$. Then $f^{-1}(17) = \{4, -4\}$.

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27. Mark as true (T) or false (F). Let $|A| = 3$, $|B| = 5$. Then the number of one function from A to B is 120.

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28. Mark as true (T) or false (F). If $|A| = 5$, $|B| = 2$, then the number of one-one function from A to B is 20.

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29. Let $f(x) = x^2$ and $g(x) = \sqrt{x}$. Then find (gof)(4).

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30. Find a linear function f which maps $[-1, 1]$ onto $[0, 2]$.

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31. Find the range of the function $f(x) = \frac{1}{2 - \sin 3x}$

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32. If $A = \{a, b, c\}$ and $B = \{1, 2\}$, then find all functions from A to B.

How many of these are surjective?

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33. If $A = \{a, b, c\}$ and $B = \{1, 2\}$, then find all functions from A to B.

How many of these are injective?

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34. If $A = \{a, b, c\}$ and $B = \{1, 2\}$, then find all functions from A to B. How many of these are bijective?

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35. Give an example of a function which is onto but not one-one.

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36. Give an example of a function which is one-one but not onto.

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37. Give an example of a function which is neither one-one nor onto

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38. Give an example of a function which is onto but not one-one.

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39. If f and g are even functions, what can you say about fog?

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40. Fill in the blanks choosing correct answer from the brackets. If $\sin\left(\cos^{-1}x\right)=1$ then x= ____ $\left(0, \frac{1}{2}, 1\right)$

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41. Fill in the blanks choosing correct answer from the brackets. If $x^{-1}\tan\left(\cot^{-1}\frac{1}{x}\right)$ = ____ (x^(-1),1,x)

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42. Fill in the blanks choosing correct answer from the brackets. The principal value of $\sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)$ is ____ $\left(-\frac{2\pi}{3}, -\frac{\pi}{3}, \frac{4\pi}{3}\right)$

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43. $\tan^{-1}2+\tan^{-1}3$ = _____ $\left(-\frac{\pi}{4}, \frac{3\pi}{4}, \frac{\pi}{4}\right)$

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44. Fill in the blank choosing correct answer from the brackets if the value of $\sin^{-1}x=\frac{\pi}{5}$ for some $x\in(-1,1)$then the value of $\cos^{-1}xis\_ \_\_$.

$\left(\frac{3\pi}{10}, \frac{5\pi}{10}, \frac{7\pi}{10}\right)$

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45. Find the value of the following: $\sin\left(\sin^{-1}\frac{1}{2}+\cos^{-1}\frac{1}{2}\right)$

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46. If $\sin^{-1}\frac{1}{3} = A$, find cosA

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47. Express the value of the following in simplest form.

$$\tan\left\{\frac{1}{2}\sin^{-1}\frac{2x}{1+x^2} + \frac{1}{2}\cos^{-1}\frac{1-y^2}{1+y^2}\right\}$$

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48. Fill up the blanks. $\sin^{-}\left(\sin\frac{2\pi}{3}\right)$ = _____

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49. Fill up the blanks. $\tan^{-1}\left(\tan\frac{3\pi}{4}\right)$ = _____

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50. What is the value of $\cos^{-1}\left(\cos\frac{7\pi}{6}\right)$?

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51. Write the given LPP in matrix form: Maximize $Z = 50x + 60y$ subject to the constraints $5x + 8y = 200, 10x + 8y = 240, x \geq 0, y \geq 0.$

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52. Let an LPP be as follows: Maximize $Z = 3x_1 + 5x_2$ subject to $x_1 + 2x_2 \leq 12, 2x_1 + 5x_2 \leq 20$ and $x_1, x_2 \geq 0$. Test whether the points (2,3) and (-3,4) are feasible solutions or not.

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53. Write the solution of the following LPP

Maximise $Z = 2x + 3y$

Subject to $x, y \geq 0, x + y \leq 1.$

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54. Write the solution of the following LPP

Maximise $Z = x + y$

Subject to $3x + 4y \leq 12, x \geq 0, y \geq 0$

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55. Write the solution of the following LPP: Maximize $Z = 3x + 5y$ subject to $2x + 3y \leq 6, x, y \geq 0.$

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56. What is the domain of $f(x) = \sqrt{x^2 - 5x + 6}$.

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57. Find least non negative integer r such that $7 \times 13 \times 23 \times 413 \equiv r \pmod{11}$

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58. Find least non negative integer r such that $6 \times 18 \times 27 \times (-225) \equiv r \pmod{8}$

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59. Find least non negative integer r such that $1237 \pmod{4} + 985 \pmod{4} \equiv r \pmod{4}$

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60. Find least positive integer x, satisfying

$276x + 128 = 4$ (mod 7).

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61. State true or false with reason. "The operation $*$ defined by $a * b = \sqrt{a^2 + b^2}$ on Q^+" is a binary operation.

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62. What does the solution set of the inequation $2x + y > 5$ represents?

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63. If $\sin^{-1}\frac{x}{5} + \cos ec^{-1}\frac{5}{4} = \frac{\pi}{2}$, then what is the value of x?

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64. What is the value of $\sin\left(\tan^{-1}x+\tan^{-1}\frac{1}{x}\right), x>0$?

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65. Express each of e^x function as the sum of an even function and an odd function.

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66. Express each of x^2 function as the sum of an even function and an odd function.

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67. Let f(x)=$\begin{cases}1 & x\in Q\\ 0 & x\in R-Q\end{cases}$ and g(x)=$\begin{cases}1 & x\in R-Q\\ 0 & x\in Q\end{cases}$, find (f+g)(x) and (fg)(x).

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68. Prove that the following sets are equivalent

{1, 2, 3, 4, 5, 6.....}, (2, 4, 6, 8, 10,...)

(1,3,5, 7, 9,...), {1, 4, 9, 16, 25...)

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69. Determine if the binaary operation o on the set R of real numbers defined by $aob = a + b - 3\ \forall a, b \in R$ is commutative/ associative.

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70. On the set R of real numbers, a binary operation o is defined by $a0b = a + b + a^2b \quad \forall a, b \in R.$ Prove that the operation is neither commutative nor associative.

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71. Find the idenity and inverse if any for the binary operation $*$ on Q-{0} defined by $a * b = \frac{ab}{4}, a, b \in Q - \{0\}$

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72. Find the identity elements if any for the binary operations defined by $a * b = a + b + 1, a, b \in Z$.

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73. Find the identity elements if any for the binary operations defined by $a * b = a + b + ab, a, b \in Q - \{-1\}$.

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74. Let $f: R \to (-1, 1)$ be defined by $f(x) = \frac{x}{1 + x^2}, x \in R$. Find f^{-1} if exists.

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75. Show that $A \times A$ is an equivalence relation on a non-empty set A. What is the corresponding equivalence class.

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76. Show that the relation S defined on set $N \times N$ by $(a, b)S(c, d) \Rightarrow a + d = b + c$ is an equivalence relation.

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77. Let R be the relation on Z defined by aRb iff a-b is an even integer. Show that R is an equivalence relation.

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78. Prove that $\cos\tan^{-1}\sin\cot^{-1}x=\sqrt{\frac{1+x^2}{2+x^2}}$.

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79. Directions (Q. Nos. 16-25) Prove the following

$\cos\left(2\tan^{-1}\frac{1}{7}\right)=\sin\left(4\tan^{-1}\frac{1}{3}\right)$.

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80. Prove that $2\tan^{-1}(\cos ec\tan^{-1}x-\tan\cot^{-1}x=\tan^{-1}x$.

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81. Prove that $\frac{1}{2}\cos^{-1}x=\sin^{-1}\sqrt{\frac{1-x}{2}}=\cos^{-1}\sqrt{\frac{1+x}{2}}$.

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82. If $\cos^{-1}x+\cos^{-1}y+\cos^{-1}z=\pi$, prove that $x^2+y^2+z^2+2xyz=1$.

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83. Slove: $\tan\left(\cos^{-1}x\right)=\sin\left(\cot^{-1}\frac{1}{2}\right)$

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84. Find the feasible region of the inequations $x+2y<8$, $2x+y<8$ and $x>0$, $y>0$.

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85. Find the feasible region of the inequations $2x_1+4x_2>40$, $3x_1+2x_2>60$, $x_1>0$, $x_2>0$

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86. Shade the feasible region satisfying ineuations $x_1 + 2x_2 \geq 10$, $2x_1 + 2x_2 \geq 12, 3x_1 + x_2 \geq 8$ and $x_1, x_2 \geq 0$.

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87. Shade the feasible region satisfying ineuations $x + 2y \leq 10$, $x + y \geq 1, x - y < 0$ and $x \geq 0, y \geq 0$.

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88. Shade the feasible region satisfying ineuations $4x + 3y \leq 60$, $2x - y \leq 0, x - 3 \geq 0$ and $x \geq 0, y \geq 0$.

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89. Prove that the following sets A,B,C D are equivalent. Where $A = \{1, 2, 3, 4, \ldots\}, B = \{2, 4, 6, 8, \ldots\}, C = \{1, 3, 5, 7, \}D = \{1, 8, 27, 64,$

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90. Let n be a positive integer,and a function f be defined as follows: $\begin{cases} 0 & n=1 \\ f\left(\left[\frac{n}{2}\right]\right)+1 & n>1 \end{cases}$ Then find f(35).

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91. Let f be an invertible function . Then prove that $\left(f^{-1}\right)^{-1}$ = f.

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92. If $P\left(\frac{A}{B}\right) > P(A)$ then prove that $P\left(\frac{B}{A}\right) > P(B)$

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93. If $:f(x)$=log$\left(\frac{1+x}{1-x}\right)$, then show that f(a)+f(b)=f$\left(\frac{a+b}{1+ab}\right)$and 2f(x)=f$\left(\frac{2x}{1+x^2}\right)$.

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94. If

$\sin^{-1}\left(\frac{x}{a}\right)+\sin^{-1}\left(\frac{y}{b}\right)=\alpha \text{prove that} \frac{x^2}{a^2}+\frac{2xy}{ab}\cos\alpha+\frac{y^2}{b^2}=\sin^2\alpha$

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95. If

$\sin^{-1}\left(\frac{x}{a}\right)+\sin^{-1}\left(\frac{y}{b}\right)=\alpha \text{prove that} \frac{x^2}{a^2}+\frac{2xy}{ab}\cos\alpha+\frac{y^2}{b^2}=\sin^2\alpha$

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96. Solve:$\sin^{-1}x+\sin^{-1}(1-x)=\cos^1 x$

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97. Solve $\sin^{-1}x+\sin^{-1}(1-x)=\frac{\pi}{2}$.

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98. If: $\tan\left(\pi\cos\frac{\theta}{2}\right) = \cot\left(\pi\sin\frac{\theta}{2}\right)$, then show that $\theta = \sin^1\left(\frac{3}{4}\right)$.

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99. Maximize Z=$6x_1 + 10x_2$ subject to $x_1 + 2x_2 > 10, 2x_1 + 2x_2 > 12, 3x_1 + x_2 > 8, x_1, x_2 > 0$

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100. Solve graphically $4x + 7y \leq 28$

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101. Let an LPP be as follows: Maximize $Z = 3x_1 + 5x_2$ subject to $x_1 + 2x_2 \leq 12, 2x_1 + 5x_2 \leq 20$ and $x_1, x_2 \geq 0$. Test whether the points

(2,3) and (-3,4) are feasible solutions or not.

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102. 11.Minimize Z=$20x_1 + 40x_2$subject to the constraints $36x_1 + 6x_2 \geq 108, 3x_1 + 12x_2 \geq 36, 20x_1 + 10x_2 \geq 100, x_1, x_2 \geq 0$

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103. Solve the following LPP graphically Maximize$z = 20x + 10y$

Subject to $x + 2y \leq 40$

$3x + y \geq 30$

$4x + 3y \geq 60$

$x, y \geq 0$

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