MATHS

BOOKS - JEEVITH PUBLICATIONS MATHS (KANNADA ENGLISH)

RELATIONS AND FUNCTIONS

One Marks Questions With Answers

1. Give an example of a relation which is symmetric and transtric and transitive but not reflexive.

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2. Give an example of a relation which is symmetric but neither reflexive nor transitive.

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3. Give an example of a relation which is transitive but neither reflexive nor transitive.

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4. Give an example of a relation which is reflexive and symmetric but not transitive.

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5. Give an example of a relation which is reflexive and transitive but not symmetric.

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6. Define an equivalence relation.

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7. Define an reflexive relation.

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8. Define a symmetric relation.

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9. Define a transitive relation.

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10. Define an injective function.

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11. Define a surjective function.

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12. Define a bijective function.

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13. If $f: \{1, 3, 4\} \rightarrow \{1, 2, 5\}$ and $g: \{1, 2, 5\} \rightarrow \{1, 3\}$ are two functions given by $f = \{(1, 2), (3, 5), (4, 1)\}$ and $g\{(1, 3), (2, 3), (5, 1)\}$. Write down gof.

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14. Let * be a binary operation defined on the set of non-zero rational number, by $a * b = \frac{ab}{4}$. Find the identity element.

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15. $a * b = a^b \forall a, b \in Z$. Show that * is not a binary operation on Z by giving a counter example.

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16. The operation * defined $a * b = a$. Is * a binary operation on z.

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17. Give an example of a relation which is symmetric but neither reflexive nor transitive.

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18. Let * be a binary operation on N defined by $a * b = LCM$ of a and b. Find $20 * 16$.

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19. Let * be a binary operation on N defined by $a * b = LCM$ of a and b. Find $20 * 16$.

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20. Let * be defined on the set on $A = \{1, 2, 3, 4, 5\}$ by $a * b = HCF$ of a and b. Is *a binary operation on A.

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21. Let * be a Binary operation on the set Q of rational number's by $a \cdot b = (a - b)^2$. Prove that * is commutative.

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22. Let * be a Binary operation defined on N by $a * b = 2^{ab}$. Prove that * is commutative.

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23. Let * be a Binary operation defined on N by $a * b = 2^{ab}$. Prove that * is commutative.

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24. Let * be a Binary operation defined on N by $a * b = 2^{ab}$. Prove that * is commutative.

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25. Show that the binary operation * defined on R by $a * b = \frac{a+b}{2}$ is not associative by giving a counter example.

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26. Show that the binary operation * defined on R by $a * b = \frac{a+b}{2}$ is not associative by giving a counter example.

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27. Show that the binary operation * defined on R by $a * b = \frac{a+b}{2}$ is not associative by giving a counter example.

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28. If $f: \{(5, 2), (6, 3)\}, g = \{(2, 5), (3, 6)\}$ Write fog.

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29. Let R be the equivalence relation on z defined by $R = \{(a, b): 2 \text{divides} a - b\}$. Write the equivalence class [0].

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30. Let $f: R \rightarrow R$ be a function defined by $f(x) = 4x - 3 \forall x \in R$. Then Write f^{-1}.

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Two Marks Questions With Answers

1. Define binary operation on a set. Verify whether the operation * defined on Z, by $a * b = ab + 1$ is binary or not.

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2. Show that the signum function $f: R \to R$ given by

$$f(x) = \begin{cases} 1 & \text{if} \quad x > 0 \\ 0 & \text{if} \quad x = 0 \\ -1 & \text{if} \quad x < 0 \end{cases}$$ is neither one-one nor onto.

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3. A relation R is defined on the set $A = \{1, 2, 3, 4, 5, 6)$ by $R = \{(x, y) : y \text{is divisible by} x\}$. Verify whether R is symmetric and reflexive or not. Give reason.

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4. Prove that the greatest integer function $f: R \to R$ defined by $f(x) = [x]$, where [x] indicates the greatest integer not greater than x, is neither one-one nor onto.

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5. Show that the function $f: R \rightarrow R$, defined by $f(x) = \frac{1}{x}$ is one-one and onto, where R, is the set of all non-zero real numbers.

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6. Show that the Modulus function $f: R \rightarrow R$ given by $f(x) = [x]$ is neither one-one nor onto.

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7. Show that the function $f: N \rightarrow N$ defined by $f(x) = x^2, \forall x \in N$ is injective but not surjective.

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8. Show that the function $f: N \rightarrow N$ defined by $f(x) = x^2, \forall x \in N$ is injective but not surjective.

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9. Show that the function $f: R \rightarrow R$ defined by $f(x) = x^2 \forall x \in R$ is neither injective nor subjective.

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10. Show that the function $f: N \rightarrow N$ defined by $f(x) = x^3, \forall x \in N$ is injective but not surjective.

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11. Show that the function $f: Z \rightarrow Z$ defined by $f(x) = x^3, \forall x \in Z$ is injective but not surjective.

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12. Prove that the function $f: R \rightarrow R$ defined by $f(x) = 2x, \forall x \in R$ is bijective.

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13. Prove that the function $f: R \rightarrow R$ defined by $f(x) = 3 - 4x, \forall x \in R$ is bijective.

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14. A binary operation * on N defined as $a * b = a^3 + b^3$, show that * is commutative but not associative.

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15. A binary operation * on N defined as $a * b = \sqrt{a^2 + b^2}$, show that * is both cummutative and associative.

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Three Marks Questions With Answers

1. Verify whether the function $f: A \rightarrow B$, where A = R - {3} and B = R -{1}, defined by $f(x) = \frac{x-2}{x-3}$ is one-one and onto or not. Give reason.

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2. If * is a binary operation defined on $A = N \times N$ by $(a, b) * (c, d) = (a + c, b + d)$, prove that * is both commutative and associative. Find the identify if it exists.

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3. Show that the relation R in the set of all integers, Z defined by $R = \{(a, b): 2 \text{divides} a - b\}$ is an equivalence relation.

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4. Show that the relation R in the set of all natural number, N defined by

is an $R = \{(a, b) : |a - b| \text{is even}\}$ in an equivalence relation.

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5. Show that the relation R in the set $A = \{x \in Z : 0 \le x \le 12\}$ given by

$R = \{a, b) : |a - b|$ is a multiple of 4} is an equivalence relation.

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6. Let R be relation on the set $A = \{1, 2, 3, \ldots .. , 14\}$ by

$R = \{(x, y) : 3x - y = 0\}$. Verify R is reflexive symmetric and transitive.

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7. Relation R on Z defined as $R = \{(x, y) : x - y \text{is an integer}\}$. Show that R is an equivalence relation.

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8. Show that the relation R in R defined $R = \{(a, b) : a \leq b\}$ is reflexive and transitive but not symmetric.

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9. Show that if $f : R - \left\{\frac{7}{5}\right\} \rightarrow R - \left\{\frac{3}{5}\right\}$ is defined by $f(x) = \frac{3x + 4}{5x - 7}$ and $g : R - \left\{\frac{3}{5}\right\} \rightarrow R - \left\{\frac{7}{5}\right\}$ is defined by $g(x) = \frac{7x + 4}{5x - 3}$, then fog = I_A and $gof = I_n$, where $A = R - \left\{\frac{3}{5}\right\}, B = R - \left\{\frac{7}{5}\right\}, I_A(x) = x, \forall x \in A, I_B(x) = x, \forall x \in I$ are called identify function on sets A and B, respectively.

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10. Show that if $f: A \rightarrow B$ and $g: B \rightarrow C$ are one-one, then gof: $A \rightarrow C$ is also one-one.

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11. Show that if $f: A \rightarrow B$ and $g: B \rightarrow C$ are onto, then gof : $A \rightarrow C$ is also onto.

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12. Consider $f: N \rightarrow N, g: N \rightarrow N$ and $h: N \rightarrow R$ defined as $f(x) = 2x, g(y) = 3y + 4$ and $h(z) = \sin z, \forall x, y$ and z in N. Show that $ho(gof) = (hog)of.$

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13. If $f: X \rightarrow Y, g: Y \rightarrow Z$ and $h: Z \rightarrow S$ are functions, then $ho(gof) = (hog)of.$

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14. Let $f: X \rightarrow Y$ and $g: Y \rightarrow Z$ be two invertible functions. Then gof is also invertible with $(gof)^{-1} = f^{-1}og^{-1}$.

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15. If R_1 and R_2 are equivalence relations in a set A, show that $R_1 \cap R_2$ is also an equivalence relation.

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16. Prove that the relation R defined on the set of real numbers R as $R = \{(a, b) : a \leq b^2 \forall a, b \in R\}$ is neither reflexive nor symmetric nor transitive.

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Six Marks Questions With Answers

1. Prove that the function $f: N \to Y$ defined by $f(x) = x^2$, where $y = \{y: y = x^2, x \in N\}$ is invertible. Also write the inverse of f(x).

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2. Let $f: N \to R$ be defined by $f(x) = 4x^2 + 12x + 15$, show that $f: N \to S$, where S is the function, is invertible. Also find the inverse.

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3. Verify whether the function $f: N \to Y$ defined by $f(x) = 4x + 3$, where $Y = \{y: y = 4x + 3, x \in N\}$ is invertible or not. Write the inverse of f(x) if exists.

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4. Let R+ be the set of all non-negative real number. Show that the faction $f: R, \rightarrow [4, \infty)$ defined $f(x) = x^2 + 4$ is invertible. Also write the inverse of f.

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5. If R, is the set of all non-negative real numbers prove that the $f: R, \rightarrow [-5, \infty)$ defined by $f(x) = 9x^2 + 6x - 5$ is invertible. Write also $f^{-1}(x)$.

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6. If $A \rightarrow A$ where $A - R - \left\{\frac{2}{3}\right\}$ defined by $f(x) = \frac{4x+3}{6x-4}$ is invertible. Prove that $f^{-1} = f$.

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7. $f:R \rightarrow R$ be defined as $f(x)=4x+5 \forall x \in R$ show that f is invertible and find f^{-1}.

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Try Yourself Exercise One Mark Questions

1. On Z defined * by $a*b=a-b$ show that * is a binary operation of Z.

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2. On Q defined * by $a*b=ab+1$ show that * commutative.

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3. Let * be a Binary operation defined on N by $a*b=2^{ab}$. Prove that * is commutative.

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4. On Q define * by $a * b = \frac{ab}{3}$. Show that * is associative.

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5. On Q - {0} define * by $a * b = \frac{ab}{5}$. Find the identity element.

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Try Yourself Exercise Two Marks Questions

1. Define an equivalence relation.

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2. On Q, define * by $a * b = \frac{ab}{4}$. Show that * is both commutative and associative.

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3. On Q, define * by $a * b = \frac{2ab}{3}$. Show that * is both cummutative and associative.

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4. Let * be a binary operation on N defined by $a * b = HCF$ of a and b. Show that * is both commutative and associative.

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5. Let * be a binary operation on the set R defined by $a * b = \frac{a+b}{2}$. Show that * is commulative but not associative.

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Try Yourself Exercise Three Marks Questions

1. Find gof and fog given $f(x) = |x|$ and $g(x) = |5x - 2|$.

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2. Find gof and fog given $f(x) = 8x^3$ and $g(x) = x^{1/3}$.

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3. If $f: R \rightarrow R$ given by $f(x) = (3 - x^3)^{1/3}$. Find fof(x).

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4. Consider $f: N \to N, g: N \to N$ and $h: N \to R$ defined as $f(x) = 2x, g(y) = 3y + 4$ and $h(z) = \sin z, \forall x, y$ and z in N. Show that $ho(gof) = (hog)of$.

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Try Yourself Exercise Five Marks Questions

1. Show that $f: [-1, 1] \to R$ given by $f(x) = \frac{x}{x+2}$ is one-one. Find the inverse of the function $f: [-1, 1] \to S$, where S is the range of f.

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