National Testing Agency

Question Paper Name :	Discrete Mathematics 29th August 2021 Shift 2
Subject Name :	Discrete Mathematics
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Discrete Mathematics

Group Number :	1
Group Id :	94091890
Group Maximum Duration :	0
Group Minimum Duration :	120
Show Attended Group? :	No
Edit Attended Group? :	No
Break time :	0
Group Marks :	100
Is this Group for Examiner? :	No

Discrete Mathematics -1

Section Id :	940918128
Section Number :	1
Section type :	Online
Mandatory or Optional :	Mandatory

Number of Questions :	50
Number of Questions to be attempted :	50
Section Marks :	100
Enable Mark as Answered Mark for Review and Clear Response :	Yes
Sub-Section Number :	1
Sub-Section Id :	940918193
Question Shuffling Allowed :	Yes

Question Number : 1 Question Id : 9409186058 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

If $f: z \to z$ defined by, $f(x) = \begin{cases} 3x - 4, x > 0 \\ -3x + 2, \ x \leq 0 \end{cases}$

Then $f^{-1}(2)$ is

1. {0}
2. {2}
3. {0, 2}
4. {}

Options :

94091822817. 1

94091822818. 2

94091822819. 3

94091822820. 4

Question Number : 2 Question Id : 9409186059 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The inverse of the permutation $\begin{pmatrix}1&2&3&4\\3&1&4&2\end{pmatrix}$ is

1. $\begin{pmatrix}1&2&3&4\\1&2&3&4\end{pmatrix}$
2. $\begin{pmatrix}1&2&3&4\\4&3&2&1\end{pmatrix}$
3. $\begin{pmatrix}1&2&3&4\\2&4&1&3\end{pmatrix}$
4. $\begin{pmatrix}1&2&3&4\\4&2&3&1\end{pmatrix}$

Options :

94091822821. 1

94091822822. 2

94091822823. 3

94091822824. 4

Question Number : 3 Question Id : 9409186060 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The solution of the recurrence relation $a_n = 4(a_{n-1} - a_{n-2})$ with the initial conditions $a_0 = a_1 = 1$ is

1. $(1-n)2^n$
2. $\left(1-\frac{1}{2}n\right)2^n$
3. $(1+n)2^n$
4. $\left(1+\frac{1}{2}n\right)2^n$

Options :

94091822825. 1

94091822826. 2

94091822827. 3

94091822828. 4

Question Number : 4 Question Id : 9409186061 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The function $\frac{2}{1-2x}+\frac{1}{1-x}$ generates the sequence $\{a_n\}$ where a_n is

1. $2^{n+1}+1$
2. 2^n+1
3. $2^{n+1}-1$
4. 2^n-1

Options :

94091822829. 1

94091822830. 2

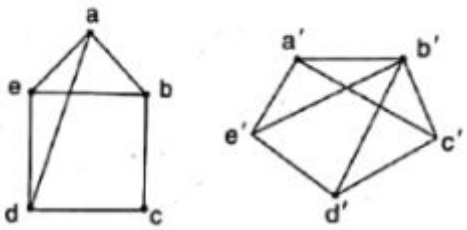
94091822831. 3

94091822832. 4

Question Number : 5 Question Id : 9409186062 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The given graphs are isomorphic.



1. True
2. False
3. Partially true
4. Partially false

Options :

94091822833. 1

94091822834. 2

94091822835. 3

94091822836. 4

Question Number : 6 Question Id : 9409186063 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The complexity of Fibonacci series is

1. $O(2^n)$
2. $O(\log n)$
3. $O(n^2)$
4. $O(\mathrm{n}\log n)$

Options :

94091822837. 1

94091822838. 2

94091822839. 3

94091822840. 4

Question Number : 7 Question Id : 9409186064 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The type of grammar which consists of the following productions is
$S \to aA, A \to AB, B \to b, A \to a.$

1. Type 0
2. Type 1
3. Type 2
4. Type 3

Options :

94091822841. 1

94091822842. 2

94091822843. 3

94091822844. 4

Question Number : 8 Question Id : 9409186065 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

How many different numbers lying between 100 and 1000 can be formed with the digits 1, 2, 3, 4 and 5, no number being repeated?

1. 240
2. 24
3. 120
4. 60

Options :

94091822845. 1

94091822846. 2

94091822847. 3

94091822848. 4

Question Number : 9 Question Id : 9409186066 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Let $A = \{a, b, c, d\}$ and R is a relation on A whose matrix is $M_R = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ Then R is

1. reflexive but not symmetric
2. reflexive and symmetric
3. symmetric but not reflexive
4. neither reflexive nor symmetric

Options :

94091822849. 1

94091822850. 2

94091822851. 3

94091822852. 4

Question Number : 10 Question Id : 9409186067 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Every tree with two or more vertices is

1. 0-chromatic
2. 1-chromatic
3. 2-chromatic
4. 3-chromatic

Options :

94091822853. 1

94091822854. 2

94091822855. 3

94091822856. 4

Question Number : 11 Question Id : 9409186068 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

If a cyclic group G contains 11 distinct elements, then it has how many generators?

1. 2
2. 7
3. 9
4. 10

Options :

94091822857. 1

94091822858. 2

94091822859. 3

94091822860. 4

Question Number : 12 Question Id : 9409186069 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Index of a subgroup is 5 and its order is 3. The order of the group is

1. 3
2. 5
3. 15
4. 8

Options :

94091822861. 1

94091822862. 2

94091822863. 3

94091822864. 4

Question Number : 13 Question Id : 9409186070 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Let $(G,*)$ is a group where the binary operation * is defined as $a * b = a + b + 3, \forall a, b \in$ G. Then the inverse of $a \in$ G is given by

1. $-3 - a$
2. $3 - a$
3. $6 - a$
4. $-6 - a$

Options :

94091822865. 1

94091822866. 2

94091822867. 3

94091822868. 4

Question Number : 14 Question Id : 9409186071 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

There are four candidates A, B, C, D for president. Suppose A is twice as likely to be elected as B, B is three times as likely as C, and C and D are equally likely to be elected. What is the probability that the candidate C is elected?

1. $\frac{1}{11}$
2. $\frac{6}{11}$
3. $\frac{3}{11}$
4. $\frac{2}{11}$

Options :

94091822869. 1

94091822870. 2

94091822871. 3

94091822872. 4

Question Number : 15 Question Id : 9409186072 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Which of the following sets under the relation 'divisibility' is a Boolean algebra?

1. D_{40}
2. D_{385}
3. D_{75}
4. D_{60}

Options :

94091822873. 1

94091822874. 2

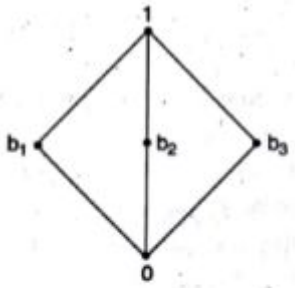
94091822875. 3

94091822876. 4

Question Number : 16 Question Id : 9409186073 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The lattice given below is



1. modular and distributive
2. distributive but not modular
3. modular but not distributive
4. neither distributive nor modular

Options :

94091822877. 1

94091822878. 2

94091822879. 3

94091822880. 4

Question Number : 17 Question Id : 9409186074 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

What logic function is produced by adding an inverter to the output of an AND gate?

1. NOR
2. NAND
3. XOR
4. OR

Options :

94091822881. 1

94091822882. 2

94091822883. 3

94091822884. 4

Question Number : 18 Question Id : 9409186075 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The number of two-input NAND gate required to produce two-input OR function is

1. 1
2. 2
3. 3
4. 4

Options :

94091822885. 1

94091822886. 2

94091822887. 3

94091822888. 4

Question Number : 19 Question Id : 9409186076 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The sum of products form of the Boolean expression $ab + bc'$ is

1. $abc + abc' + a'bc'$
2. $abc' + a'bc' + a'b'c'$
3. $abc + abc' + a'b'c'$
4. $abc' + a'bc' + a'b'c$

Options :

94091822889. 1

94091822890. 2

94091822891. 3

94091822892. 4

Question Number : 20 Question Id : 9409186077 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Consider the set $A = \{2,3,6,12,24,26\}$ with the relation 'divisibility'. The greatest and least element of this poset are respectively

1. 2, 36
2. 3, 24
3. 2, 3
4. does not exist

Options :

94091822893. 1

94091822894. 2

94091822895. 3

94091822896. 4

Question Number : 21 Question Id : 9409186078 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

For any two real numbers θ and $\emptyset$, we define $\theta\ R\ \emptyset$ if and only if $sec^2\theta - ten^2\emptyset = 1$. Then R is

1. reflexive
2. transitive
3. symmetric
4. equivalence

Options :

94091822897. 1

94091822898. 2

94091822899. 3

94091822900. 4

Question Number : 22 Question Id : 9409186079 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

There exists a simple graph with 7 vertices having the degree sequence (1, 3, 3, 4, 5, 6, 6).

1. True
2. False
3. Partially True
4. Partially False

Options :

94091822901. 1

94091822902. 2

94091822903. 3

94091822904. 4

Question Number : 23 Question Id : 9409186080 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

A connected planar graph with 10 edges and 5 regions has _____ no. of vertices.

1. 7
2. 8
3. 10
4. 5

Options :

94091822905. 1

94091822906. 2

94091822907. 3

94091822908. 4

Question Number : 24 Question Id : 9409186081 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The number of pendant vertices in a binary tree with n vertices is

1. $\frac{n+1}{2}$
2. $\frac{n-1}{2}$
3. $\frac{n(n+1)}{2}$
4. $\frac{n}{2}$

Options :

94091822909. 1

94091822910. 2

94091822911. 3

94091822912. 4

Question Number : 25 Question Id : 9409186082 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The number of internal vertices of a complete binary tree *T* is 12. Then the number of pedant vertices of *T* is

1. 11
2. 12
3. 13
4. 14

Options :

94091822913. 1

94091822914. 2

94091822915. 3

94091822916. 4

Question Number : 26 Question Id : 9409186083 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The particular solution of the recurrence relation $a_{n+2} - 5a_{n+1} + 6a_n = 5^n$ is

1. $\frac{5^n}{6}$
2. $\frac{5^n}{2}$
3. $\frac{5^{-n}}{6}$
4. 6.5^n

Options :

94091822917. 1

94091822918. 2

94091822919. 3

94091822920. 4

Question Number : 27 Question Id : 9409186084 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The solution of the recurrence relation $a_{n+1} - 2a_n = 5, n \geq 0, a_0 = 1$ is

1. $6.2^n - 5$
2. $5 - 6.2^n$
3. $2^{n+1} - 1$
4. $1 - 2^{n+1}$

Options :

94091822921. 1

94091822922. 2

94091822923. 3

94091822924. 4

Question Number : 28 Question Id : 9409186085 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

If G(x) is the generating function for the sequence $a_0, a_1, a_2, \ldots\ldots$ then $xG(x)$ is the generating function of

1. $a_1, a_2, a_3 \ldots\ldots$
2. $a_2, a_3, a_4 \ldots\ldots$
3. $0, a_0, a_1 \ldots\ldots$
4. $0, a_1, a_2 \ldots\ldots$

Options :

94091822925. 1

94091822926. 2

94091822927. 3

94091822928. 4

Question Number : 29 Question Id : 9409186086 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The sequence corresponding to the generating function $(3 + x)^3$ is

1. (9, 18, 18, 1, 0, 0, 0, ...)
2. (27, 27, 9, 1, 0, 0, 0, ...)
3. (0, 0, 0, 27, 27, 9, ...)
4. (1, 9, 27, 27, 0, 0, 0, ...)

Options :

94091822929. 1

94091822930. 2

94091822931. 3

94091822932. 4

Question Number : 30 Question Id : 9409186087 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The closed form of the generating function of the sequence (0, 1, 0, 0, 1, 0, 0, 1, ...) is

1. $\frac{x^3}{(1-x)}$
2. $\frac{x}{(1-x)^3}$
3. $\frac{1}{(1-x)^3}$
4. $\frac{(1-x)^3}{x}$

Options :

94091822933. 1

94091822934. 2

94091822935. 3

94091822936. 4

Question Number : 31 Question Id : 9409186088 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

If L_1 and L_2 are context free languages and R is a regular set, which one of the following languages are not necessarily a context free language?

1. L_1L_2
2. $L_1 \cap L_2$
3. $L_1 \cup R$
4. $L_1 \cup L_2$

Options :

94091822937. 1

94091822938. 2

94091822939. 3

94091822940. 4

Question Number : 32 Question Id : 9409186089 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

If $L = \{a^n b^n : n \geq 0\}$ then L^2 is

1. $\{a^n b^n a^n b^n : n \geq 0\}$
2. $\{a^{2n} b^{2n} : n \geq 0\}$
3. $\{a^n b^n a^m b^m : n, m \geq 0\}$
4. $\{a^n b^n : n \geq 0\}$

Options :

94091822941. 1

94091822942. 2

94091822943. 3

94091822944. 4

Question Number : 33 Question Id : 9409186090 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Let L denote the language generated by the grammar $S \rightarrow 0S0100$, then

1. $L = 0^*$
2. L is context free but not regular
3. L is regular but not 0^*
4. L is not context free

Options :

94091822945. 1

94091822946. 2

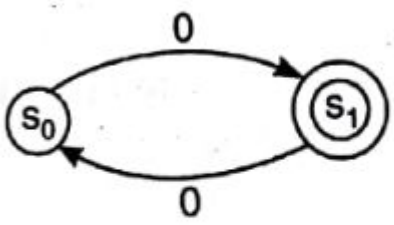
94091822947. 3

94091822948. 4

Question Number : 34 Question Id : 9409186091 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The given transition diagram of a Finite Automata recognizes the language



1. $L = \{0^n : n \text{ is even}\}$
2. $L = \{0^{n+1} : n \geq 0\}$
3. $L = \{0^n : n \text{ is odd}\}$
4. $L = \{0\}^*$

Options :

94091822949. 1

94091822950. 2

94091822951. 3

94091822952. 4

Question Number : 35 Question Id : 9409186092 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Let $L \subseteq \sum^*$ where $\sum = \{a, b\}$. Which of the following is true?

1. $L = \{x : x \text{ has equal no. of } a\text{'s and } b\text{'s}\}$ is regular
2. $L = \{x : x \text{ has more no. of } a\text{'s than } b\text{'s}\}$ is regular
3. $L = \{a^n b^n : n > 1\}$ is regular
4. $L = \{a^m b^n : m \geq 1, n \geq 1\}$ is regular

Options :

94091822953. 1

94091822954. 2

94091822955. 3

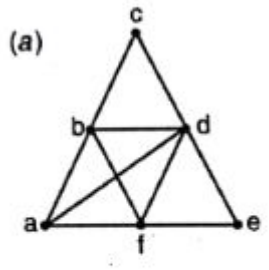
94091822956. 4

Question Number : 36 Question Id : 9409186093 Question Type : MCQ Option Shuffling : No Is

Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The given graph a is



1. Eulerian and Hamiltonian
2. Eulerian but not Hamiltonian
3. Not Eulerian but Hamiltonian
4. Neither Eulerian nor Hamiltonian

Options :

94091822957. 1

94091822958. 2

94091822959. 3

94091822960. 4

Question Number : 37 Question Id : 9409186094 Question Type : MCQ Option Shuffling : No Is

Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

If a ring $(R,+,X)$ is such that $a^2 = a, \forall a \in R$ then R is called a

1. Integral domain
2. Division ring
3. Boolean ring
4. Field

Options :

94091822961. 1

94091822962. 2

94091822963. 3

94091822964. 4

Question Number : 38 Question Id : 9409186095 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

In a ring (Z8,+8, X8) the number of zero divisors are

1. 3
2. 4
3. 5
4. 6

Options :

94091822965. 1

94091822966. 2

94091822967. 3

94091822968. 4

Question Number : 39 Question Id : 9409186096 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Which of the following statements are true?
(i) Every field is an integral domain

(ii) In a finite field F,
$a^2 + b^2 = 0 \Rightarrow a = 0, b = 0, \forall a, b \in F$

(iii)The characteristic of an infinite ring is always zero.

(iv) Every field is a division ring

1. (i) and (ii)
2. (ii) and (iii)
3. (i) and (iv)
4. (iii) and (iv)

Options :

94091822969. 1

94091822970. 2

94091822971. 3

94091822972. 4

Question Number : 40 Question Id : 9409186097 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Which of the algebraic structures is a semi-group but not a group

1. $(N, +)$
2. $(\mathrm{R}, +)$
3. $(\mathrm{Z}, +)$
4. (Z, X)

Options :

94091822973. 1

94091822974. 2

94091822975. 3

94091822976. 4

Question Number : 41 Question Id : 9409186098 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

If A is any statement and p is a proposition,
$\sim(\mathrm{A} \vee \mathrm{P}) \wedge (\mathrm{A} \wedge \mathrm{P})$ is a

1. tautology
2. contingency
3. contradiction
4. all of these

Options :

94091822977. 1

94091822978. 2

94091822979. 3

94091822980. 4

Question Number : 42 Question Id : 9409186099 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Among the integers from 1 to 300, how many are divisible by 3, but not by 5 nor by 7?

1. 100
2. 14
3. 68
4. 138

Options :

94091822981. 1

94091822982. 2

94091822983. 3

94091822984. 4

Question Number : 43 Question Id : 9409186100 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The question paper of Discrete Mathematics contains ten questions divided into two groups of five questions each. In how many ways can a candidate answer six questions taking at least two questions from each group.

1. 50
2. 100
3. 150
4. 200

Options :

94091822985. 1

94091822986. 2

94091822987. 3

94091822988. 4

Question Number : 44 Question Id : 9409186101 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

In how many ways can a group of 4 boys and 4 girls be seated in a circular table so that no 2 boys are adjacent?

1. 6
2. 24
3. 144
4. 36

Options :

94091822989. 1

94091822990. 2

94091822991. 3

94091822992. 4

Question Number : 45 Question Id : 9409186102 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

How many students must be there in a class to guarantee that at least 5 them receive the same score in an exam which is graded on the scale from 0 to 25 points?

1. 105
2. 101
3. 125
4. 126

Options :

94091822993. 1

94091822994. 2

94091822995. 3

94091822996. 4

Question Number : 46 Question Id : 9409186103 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

In the poset $(P(\{a, b, c\}), \subseteq)$, the number of subsets non comparable to {a} s

1. 4
2. 3
3. 2
4. 1

Options :

94091822997. 1

94091822998. 2

94091822999. 3

94091823000. 4

Question Number : 47 Question Id : 9409186104 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Among the relations 'not equal to' and 'less than' defined on the set Z of integers

1. Both are partially ordered
2. only the second is partially ordered
3. only the first one is partially ordered
4. both are not partially ordered

Options :

94091823001. 1

94091823002. 2

94091823003. 3

94091823004. 4

Question Number : 48 Question Id : 9409186105 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

In the lattice {1, 2, 4, 5, 10, 20}with the relation 'divisibility', the complement of 10 is

1. 2
2. 4
3. 5
4. does not exist

Options :

94091823005. 1

94091823006. 2

94091823007. 3

94091823008. 4

Question Number : 49 Question Id : 9409186106 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

If the function $f : Z_5 \to Z_5$ is defined by $f(x) = 2x$ then $f^{-1}(3)$ is

1. 1
2. 2
3. 3
4. 4

Options :

94091823009. 1

94091823010. 2

94091823011. 3

94091823012. 4

Question Number : 50 Question Id : 9409186107 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The relation R on the set of integers Z defined by $R = \{(x, y) : x \leq y + 1\}$ is

1. symmetric
2. transitive
3. reflexive and transitive
4. reflexive

Options :

94091823013. 1

94091823014. 2

94091823015. 3

94091823016. 4