Relations and Functions

Question 1.
The function f : A → B defined by f(x) = 4x + 7, x ∈ R is
(a) one-one
(b) Many-one
(c) Odd
(d) Even
Answer:
(a) one-one

Question 2.
The smallest integer function f(x) = [x] is
(a) One-one
(b) Many-one
(c) Both (a) & (b)
(d) None of these
Answer:
(b) Many-one

Question 3.
The function f : R → R defined by f(x) = 3 – 4x is
(a) Onto
(b) Not onto
(c) None one-one
(d) None of these
Answer:
(a) Onto

Question 4.
The number of bijective functions from set A to itself when A contains 106 elements is
(a) 106
(b) $(106)^2$
(c) 106!
(d) 2^{106}

Answer:
(c) 106!

Question 5.
If f(x) = $(ax^2 + b)^3$, then the function g such that f(g(x)) = g(f(x)) is given by
(a) $g(x) = \left(\frac{b-x^{1/3}}{a}\right)$
(b) $g(x) = \frac{1}{(ax^2+b)^3}$
(c) $g(x) = (ax^2 + b)^{1/3}$
(d) $g(x) = \left(\frac{x^{1/3}-b}{a}\right)^{1/2}$
Answer:
(d) $g(x) = \left(\frac{x^{1/3}-b}{a}\right)^{1/2}$

Question 6.
If f : R → R, g : R → R and h : R → R is such that f(x) = x^2, g(x) = tanx and h(x) = logx, then the value of [ho(gof)](x), if x = $\frac{\sqrt{\pi}}{2}$ will be
(a) 0
(b) 1
(c) -1
(d) 10
Answer:
(a) 0

Question 7.
If f : R → R and g : R → R defined by f(x) = 2x + 3 and g(x) = x^2 + 7, then the value of x for which f(g(x)) = 25 is
(a) ±1
(b) ±2
(c) ±3
(d) ±4
Answer:
(b) ±2

Question 8.
Let f : N → R : f(x) = $\frac{(2x-1)}{2}$ and g : Q → R : g(x) = x + 2 be two functions. Then, (gof) ($\frac{3}{2}$) is
(a) 3
(b) 1
(c) $\frac{7}{2}$
(d) None of these

Answer:
(a) 3

Question 9.
Let $f(x) = \frac{x-1}{x+1}$, then f(f(x)) is
(a) $\frac{1}{x}$
(b) $-\frac{1}{x}$
(c) $\frac{1}{x+1}$
(d) $\frac{1}{x-1}$
Answer:
(b) $-\frac{1}{x}$

Question 10.
If f(x) = $1 - \frac{1}{x}$, then f(f($\frac{1}{x}$))
(a) $\frac{1}{x}$
(b) $\frac{1}{1+x}$
(c) $\frac{x}{x-1}$
(d) $\frac{1}{x-1}$
Answer:
(c) $\frac{x}{x-1}$

Question 11.
If f : R → R, g : R → R and h : R → R are such that f(x) = x^2, g(x) = tan x and h(x) = log x, then the value of (go(foh)) (x), if x = 1 will be
(a) 0
(b) 1
(c) -1
(d) π
Answer:
(a) 0

Question 12.
If f(x) = $\frac{3x+2}{5x-3}$ then (fof)(x) is
(a) x
(b) -x
(c) f(x)
(d) -f(x)
Answer:
(a) x

Question 13.
If the binary operation * is defind on the set Q+ of all positive rational numbers by a * b = $\frac{ab}{4}$.
Then, $3 * \left(\frac{1}{5} * \frac{1}{2}\right)$ is equal to
(a) $\frac{3}{160}$
(b) $\frac{5}{160}$
(c) $\frac{3}{10}$
(d) $\frac{3}{40}$
Answer:
(a) $\frac{3}{160}$

Question 14.
The number of binary operations that can be defined on a set of 2 elements is
(a) 8
(b) 4
(c) 16
(d) 64
Answer:
(c) 16

Question 15.
Let * be a binary operation on Q, defined by a * b = $\frac{3ab}{5}$ is
(a) Commutative
(b) Associative
(c) Both (a) and (b)
(d) None of these
Answer:
(c) Both (a) and (b)

Question 16.
Let * be a binary operation on set Q of rational numbers defined as a * b = $\frac{ab}{5}$. Write the identity for *.
(a) 5
(b) 3
(c) 1
(d) 6
Answer:
(a) 5

Question 17.
For binary operation * defind on R – {1} such that a * b = $\frac{a}{b+1}$ is

(a) not associative
(b) not commutative
(c) commutative
(d) both (a) and (b)
Answer:
(d) both (a) and (b)

Question 18.
The binary operation * defind on set R, given by a * b = $\frac{a+b}{2}$ for all a,b ∈ R is
(a) commutative
(b) associative
(c) Both (a) and (b)
(d) None of these
Answer:
(a) commutative

Question 19.
Let A = N × N and * be the binary operation on A defined by (a, b) * (c, d) = (a + c, b + d). Then * is
(a) commutative
(b) associative
(c) Both (a) and (b)
(d) None of these
Answer:
(c) Both (a) and (b)

Question 20.
Find the identity element in the set I^+ of all positive integers defined by a * b = a + b for all a, b ∈ I^+.
(a) 1
(b) 2
(c) 3
(d) 0
Answer:
(d) 0

Question 21.
Let * be a binary operation on set Q – {1} defind by a * b = a + b – ab : a, b ∈ Q – {1}. Then * is
(a) Commutative
(b) Associative
(c) Both (a) and (b)
(d) None of these

Answer:
(c) Both (a) and (b)

Question 22.
The binary operation * defined on N by a * b = a + b + ab for all a, b ∈ N is
(a) commutative only
(b) associative only
(c) both commutative and associative
(d) none of these
Answer:
(c) both commutative and associative

Question 23.
The number of commutative binary operation that can be defined on a set of 2 elements is
(a) 8
(b) 6
(c) 4
(d) 2
Answer:
(d) 2

Question 24.
Let T be the set of all triangles in the Euclidean plane, and let a relation R on T be defined as aRb if a is congruent to b ∀ a, b ∈ T. Then R is
(a) reflexive but not transitive
(b) transitive but not symmetric
(c) equivalence
(d) None of these
Answer:
(c) equivalence

Question 25.
The maximum number of equivalence relations on the set A = {1, 2, 3} are
(a) 1
(b) 2
(c) 3
(d) 5
Answer:
(d) 5

Question 26.
Let us define a relation R in R as aRb if a ≥ b. Then R is
(a) an equivalence relation

(b) reflexive, transitive but not symmetric
(c) symmetric, transitive but not reflexive
(d) neither transitive nor reflexive but symmetric
Answer:
(b) reflexive, transitive but not symmetric

Question 27.
Let A = {1, 2, 3} and consider the relation R = {(1, 1), (2, 2), (3, 3), (1, 2), (2, 3), (1, 3)}. Then R is
(a) reflexive but not symmetric
(b) reflexive but not transitive
(c) symmetric and transitive
(d) neither symmetric, nor transitive
Answer:
(a) reflexive but not symmetric

Question 28.
The identity element for the binary operation * defined on Q – {0} as a * b = $\frac{ab}{2}$ ∀ a, b ∈ Q – {0) is
(a) 1
(b) 0
(c) 2
(d) None of these
Answer:
(c) 2

Question 29.
Let A = {1, 2, 3, …. n} and B = {a, b}. Then the number of surjections from A into B is
(a) ${}^{n}P_{2}$
(b) $2^n - 2$
(c) $2^n - 1$
(d) none of these
Answer:
(b) $2^n - 2$

Question 30.
Let f : R → R be defind by f(x) = $\frac{1}{x}$ ∀ x ∈ R. Then f is
(a) one-one
(b) onto
(c) bijective
(d) f is not defined

Answer:
(d) f is not defined

Question 31.
Which of the following functions from Z into Z are bijective?
(a) $f(x) = x^3$
(b) $f(x) = x + 2$
(c) $f(x) = 2x + 1$
(d) $f(x) = x^2 + 1$
Answer:
(b) $f(x) = x + 2$

Question 32.
Let $f : R \to R$ be the functions defined by $f(x) = x^3 + 5$. Then $f^{-1}(x)$ is
(a) $(x + 5)^{\frac{1}{3}}$
(b) $(x - 5)^{\frac{1}{3}}$
(c) $(5 - x)^{\frac{1}{3}}$
(d) 5 – x
Answer:
(b) $(x - 5)^{\frac{1}{3}}$

Question 33.
Let $f : R - \{\frac{3}{5}\} \to R$ be defined by $f(x) = \frac{3x+2}{5x-3}$. Then
(a) $f^{-1}(x) = f(x)$
(b) $f^{-1}(x) = -f(x)$
(c) (fof) x = -x
(d) $f^{-1}(x) = \frac{1}{19}$ f(x)
Answer:
(a) $f^{-1}(x) = f(x)$

Question 34.
Let $f : R \to R$ be given by $f(x) = \tan x$. Then $f^{-1}(1)$ is
(a) $\frac{\pi}{4}$
(b) $\{n\pi + \frac{\pi}{4} ; n \in Z\}$
(c) Does not exist
(d) None of these
Answer:
(b) $\{n\pi + \frac{\pi}{4} ; n \in Z\}$

Question 35.
Let R be a relation on the set N of natural numbers denoted by nRm ⇔ n is a factor of m (i.e. n | m). Then, R is
(a) Reflexive and symmetric
(b) Transitive and symmetric
(c) Equivalence
(d) Reflexive, transitive but not symmetric
Answer:
(d) Reflexive, transitive but not symmetric

Question 36.
Let S = {1, 2, 3, 4, 5} and let A = S × S. Define the relation R on A as follows:
(a, b) R (c, d) iff ad = cb. Then, R is
(a) reflexive only
(b) Symmetric only
(c) Transitive only
(d) Equivalence relation
Answer:
(d) Equivalence relation

Question 37.
Let R be the relation "is congruent to" on the set of all triangles in a plane is
(a) reflexive
(b) symmetric
(c) symmetric and reflexive
(d) equivalence
Answer:
(d) equivalence

Question 38.
Total number of equivalence relations defined in the set S = {a, b, c} is
(a) 5
(b) 3!
(c) 23
(d) 33
Answer:
(a) 5

Question 39.
The relation R is defined on the set of natural numbers as {(a, b) : a = 2b}. Then, R^{-1} is given by
(a) {(2, 1), (4, 2), (6, 3),….}
(b) {(1, 2), (2, 4), (3, 6), ……..}
(c) R^{-1} is not defiend

(d) None of these
Answer:
(b) {(1, 2), (2, 4), (3, 6), ……..}

Question 40.
Let X = {-1, 0, 1}, Y = {0, 2} and a function f : X → Y defiend by $y = 2x^4$, is
(a) one-one onto
(b) one-one into
(c) many-one onto
(d) many-one into
Answer:
(c) many-one onto

Question 41.
Let f : R → R be a function defined by $f(x) = \frac{e^{|x|} - e^{-x}}{e^x + e^{-x}}$ then f(x) is
(a) one-one onto
(b) one-one but not onto
(c) onto but not one-one
(d) None of these
Answer:
(d) None of these

Question 42.
Let $g(x) = x^2 - 4x - 5$, then
(a) g is one-one on R
(b) g is not one-one on R
(c) g is bijective on R
(d) None of these
Answer:
(b) g is not one-one on R

Question 43.
Let A = R – {3}, B = R – {1}. Let f : A → B be defined by $f(x) = \frac{x-2}{x-3}$. Then,
(a) f is bijective
(b) f is one-one but not onto
(c) f is onto but not one-one
(d) None of these
Answer:
(a) f is bijective

Question 44.
The mapping f : N → N is given by $f(n) = 1 + n^2$, n ∈ N when N is the set of natural numbers is

(a) one-one and onto
(b) onto but not one-one
(c) one-one but not onto
(d) neither one-one nor onto
Answer:
(c) one-one but not onto

Question 45.
The function f : R → R given by $f(x) = x^3 - 1$ is
(a) a one-one function
(b) an onto function
(c) a bijection
(d) neither one-one nor onto
Answer:
(c) a bijection

Question 46.
Let f : [0, ∞) → [0, 2] be defined by $f(x) = \frac{2x}{1+x}$, then f is
(a) one-one but not onto
(b) onto but not one-one
(c) both one-one and onto
(d) neither one-one nor onto
Answer:
(a) one-one but not onto

Question 47.
If N be the set of all-natural numbers, consider f : N → N such that f(x) = 2x, ∀ x ∈ N, then f is
(a) one-one onto
(b) one-one into
(c) many-one onto
(d) None of these
Answer:
(b) one-one into

Question 48.
Let A = {x : $-1 \leq x \leq 1$} and f : A → A is a function defined by f(x) = x |x| then f is
(a) a bijection
(b) injection but not surjection
(c) surjection but not injection
(d) neither injection nor surjection
Answer:
(a) a bijection

Question 49.
Let f : R → R be a function defined by f(x) = x^3 + 4, then f is
(a) injective
(b) surjective
(c) bijective
(d) none of these
Answer:
(c) bijective

Question 50.
If f(x) = $(ax^2 - b)^3$, then the function g such that f{g(x)} = g{f(x)} is given by
(a) $g(x) = \left(\frac{b-x^{1/3}}{a}\right)^{1/2}$
(b) $g(x) = \frac{1}{(ax^2+b)^3}$
(c) $g(x) = (ax^2 + b)^{1/3}$
(d) $g(x) = \left(\frac{x^{1/3}+b}{a}\right)^{1/2}$
Answer:
(d) $g(x) = \left(\frac{x^{1/3}+b}{a}\right)^{1/2}$

Question 51.
If f : [1, ∞) → [2, ∞) is given by f(x) = x + $\frac{1}{x}$, then f^{-1} equals to
(a) $\frac{x+\sqrt{x^2-4}}{2}$
(b) $\frac{x}{1+x^2}$
(c) $\frac{x-\sqrt{x^2-4}}{2}$
(d) $1 + \sqrt{x^2 - 4}$
Answer:
(a) $\frac{x+\sqrt{x^2-4}}{2}$

Question 52.
Let f(x) = x^2 – x + 1, x ≥ $\frac{1}{2}$, then the solution of the equation f(x) = f^{-1}(x) is
(a) x = 1
(b) x = 2
(c) x = $\frac{1}{2}$
(d) None of these
Answer:
(a) x = 1

Question 53.
Which one of the following function is not invertible?
(a) f : R → R, f(x) = 3x + 1
(b) f : R → [0, ∞), f(x) = x^2
(c) f : R^+ → R^+, f(x) = $\frac{1}{x^3}$
(d) None of these
Answer:
(d) None of these

Question 54.
The inverse of the function $y = \frac{10^x - 10^{-x}}{10^x + 10^{-x}}$ is
(a) $\log_{10}(2 - x)$
(b) $\frac{1}{2}\log_{10}\left(\frac{1+x}{1-x}\right)$
(c) $\frac{1}{2}\log_{10}(2x - 1)$
(d) $\frac{1}{4}\log\left(\frac{2x}{2-x}\right)$
Answer:
(b) $\frac{1}{2}\log_{10}\left(\frac{1+x}{1-x}\right)$

Question 55.
If f : R → R defind by f(x) = $\frac{2x-7}{4}$ is an invertible function, then find f^{-1}.
(a) $\frac{4x+5}{2}$
(b) $\frac{4x+7}{2}$
(c) $\frac{3x+2}{2}$
(d) $\frac{9x+3}{5}$
Answer:
(b) $\frac{4x+7}{2}$

Question 56.
Consider the function f in A = R – $\{\frac{2}{3}\}$ defiend as $f(x) = \frac{4x+3}{6x-4}$. Find f^{-1}.
(a) $\frac{3+4x}{6x-4}$
(b) $\frac{6x-4}{3+4x}$
(c) $\frac{3-4x}{6x-4}$
(d) $\frac{9+2x}{6x-4}$
Answer:
(a) $\frac{3+4x}{6x-4}$

Question 57.
If f is an invertible function defined as $f(x) = \frac{3x-4}{5}$, then $f^{-1}(x)$ is
(a) 5x + 3
(b) 5x + 4
(c) $\frac{5x+4}{3}$
(d) $\frac{3x+2}{3}$
Answer:
(c) $\frac{5x+4}{3}$

Question 58.
If $f : R \to R$ defined by $f(x) = \frac{3x+5}{2}$ is an invertible function, then find f^{-1}.
(a) $\frac{2x-5}{3}$
(b) $\frac{x-5}{3}$
(c) $\frac{5x-2}{3}$
(d) $\frac{x-2}{3}$
Answer:
(a) $\frac{2x-5}{3}$

Question 59.
Let $f : R \to R$, $g : R \to R$ be two functions such that $f(x) = 2x - 3$, $g(x) = x^3 + 5$. The function $(fog)^{-1}(x)$ is equal to
(a) $\left(\frac{x+7}{2}\right)^{1/3}$
(b) $\left(x - \frac{7}{2}\right)^{1/3}$
(c) $\left(\frac{x-2}{7}\right)^{1/3}$
(d) $\left(\frac{x-7}{2}\right)^{1/3}$
Answer:
(d) $\left(\frac{x-7}{2}\right)^{1/3}$

Question 60.
Let * be a binary operation on set of integers I, defined by a * b = a + b – 3, then find the value of 3 * 4.
(a) 2
(b) 4
(c) 7

(d) 6
Answer:
(c) 7

Question 61.
If * is a binary operation on set of integers I defined by a * b = 3a + 4b – 2, then find the value of 4 * 5.
(a) 35
(b) 30
(c) 25
(d) 29
Answer:
(b) 30

Question 62.
Let * be the binary operation on N given by a * b = HCF (a, b) where, a, b ∈ N. Find the value of 22 * 4.
(a) 1
(b) 2
(c) 3
(d) 4
Answer:
(b) 2

Question 63.
Consider the binary operation * on Q defind by a * b = a + 12b + ab for a, b ∈ Q. Find $2 * \frac{1}{3}$
(a) $\frac{20}{3}$
(b) 4
(c) 18
(d) $\frac{16}{3}$
Answer:
(a) $\frac{20}{3}$

Question 64.
The domain of the function $f(x) = \frac{1}{\sqrt{\{\sin x\}+\{\sin(\pi+x)\}}}$ where {.} denotes fractional part, is
(a) [0, π]
(b) (2n + 1) π/2, n ∈ Z
(c) (0, π)
(d) None of these
Answer:
(d) None of these

Question 65.

Range of $f(x) = \sqrt{(1-\cos x)\sqrt{(1-\cos x)\sqrt{(1-\cos x)\ldots\ldots\infty}}}$

(a) [0, 1]
(b) (0, 1)
(c) [0, 2]
(d) (0, 2)
Answer:
(c) [0, 2]