**Continuity and Differentiability**

**Choose the most appropriate option (a, b, c or d).**

Q 1. Let f(x) = log |x – 1|, x ≠ 1. The value of 

(a) is -2 (b) is 2 (c) does not exist (d) none of these

Q 2. Let . Then at 

(a) is 1 (b) is -1 (c) does not exist (d) none of these

Q 3. Let y = |x| + |x – 2|. Then at x = 2

(a) is 2 (b) is 0 (c) does not exist (d) none of these

Q 4. Let f(x) = λ + μ |x| + ν|x|2, where λ, μ, ν are real constants. The f'(0) exists if

(a) μ = 0 (b) ν = 0 (c) λ = 0 (d) μ = ν

Q 5. If f(x) = ¸x ≠ 0 where [.] denotes the greatest integer function, then f'(1) is

(a) -1 (b) ∞ (c) nonexistent (d) none of these

Q 6. If f(x) = |cos 2x| then is equal to

(a) 2 (b) 0 (c) -2 (d) none of these

Q 7. If (x) = sin π[x] then f'(1 – 0) is equal to

(a) -1 (b) 0 (c) 1 (d) none of these

Q 8. Let f(x) = [x2] – [x]2, where [.] denotes the greatest integer function. Then

(a) f(x) is discontinuous for all integral values of x

(b) f(x) is discontinuous only at x = 0, 1

(c) f(x) is continuous only at x = 1 (d) none of these

Q 9. Let f(x) = [cos x + sin x], 0 < x < 2π where [x] denotes the greatest integer less than or equal to x. The number of points of discontinuity of f(x) is

(a) 6 (b) 5 (c) 4 (d) 3

Q 10. Let f(x) = x – |x – x2|, x ∈ [-1, 1] . Then the number of points at which f(x) is discontinuous is

(a) 1 (b) 2 (c) 0 (d) none of these

Q 11. Let 



[x], 4 ≤ x < 5, where [x] is the greatest integer ≤ x

|1 – x|, x ≥ 5

The number of points of discontinuity of f(x) in R is

(a) 3 (b) 0 (c) infinite (d) none of these

Q 12. Let f(x) = . Then the number of points of discontinuity of the function f(x) in the open interval (0, π) is

(a) 0 (b) 1 (c) 2 (d) infinite

Q 13. Let f : [0, 1] → [0, 1] be a continuous function. Then

(a) f(x) = x for all least one 0 ≤ x ≤ 1 (b) f(x) will be differentiable in [0, 1]

(c) f(x) + x = 0 for at least one x such that 0 ≤ x ≤ 1 (d) none of these

Q 14. Let f(x) be a continuous function defined for 1 ≤ x ≤ 3. If f(x) takes rational values for all x and f(2) = 10 then the value of f(1.5) is

(a) 7.5 (b) 10 (c) 5 (d) none of these

Q 15. If f(x) =, x ≠ 0, and f(0) = 0 then f'(0) is

(a) 0 (b) 1 (c) e (d) nonexistent

Q 16. Let f(x) = sin x, g(x) = [x + 1] and g{f(x)} = h(x), where [.] is the greatest integer function. Then is

(a) nonexistent (b) 1 (c) -1 (d) none of these

Q 17. Let f(x)= [x], g(x) = |x| and f{g(x)} = h(x), where [.] is the greatest integer function. Then h'(-1) is

(a) 0 (b) -∞ (c) nonexistent (d) none of these

Q 18. The number of values of x ∈ [0, 2] at which the real function + |x – 1| + tan x is not finitely differentiable is

(a) 2 (b) 3 (c) 1 (d) 0

Q 19. Let f(x) = [n + p sin x], x ∈ (0, π), n ∈ , p is a prime number and [x] = the greatest integer less than or equal to x. The number of points at which g(x) is not differentiable is

(a) p (b) p – 1 (c) 2p + 1 (d) 2p – 1

Q 20. Let f(x) = (x – 1)2 cos - |x|, x ≠ 1

-1, x = 1

The set of points where f(x) is not differentiable is

(a) {1} (b) {0, 1} (c) {0} (d) none of these

Q 21. Let . If f(x) is continuous at then should be

(a) 1 (b) 0 (c)  (d) none of these

Q 22. A function f(x) is defined as below

.

f(x) is continuous at x = 0 if a equals

(a) 0 (b) 4 (c) 5 (d) 6

Q 23. Let , and x ∈ 

λ, 

If f(x) is continuous in then λ is

(a) 1 (b)  (c)  (d) none of these

Q 24. Let f(x) = .

If f(x) is continuous at is

(a) e (b) 1 (c) 0 (d) none of these

Q 25. Let , x ≠ 0. Then f(x) can be continuous at x = 0

(a) if f(0) = 1 (b) if f(0) = 0 (c) if f(0) = -1 (d) for no value of f(0)

Q 26. If f(x) = px2 – q, x ∈ [0, 1)

x + 1, x ∈ (1, 2]

and f(1) = 2 then the value of the pair (p, q) for which f(x) cannot be continuous at x = 1 is

(a) (2, 0) (b) (1, -1) (c) (4, 2) (d) (1, 1)

Q 27. If f(x) = x, x ≤ 1, and f(x) = x2 + bx + c, x > 1, and f'(x) exists finitely for all x ∈ R then

(a) b = -1, c ∈ R (b) c = 1, b ∈ R (c) b = 1, c = -1 (d) b = -1, c = 1

**Choose the correct options. One or more options may be correct.**

Q 28. If f(x) = ex, x < 2

a + bx, x ≥ 2

is differentiable for all x ∈ R then

(a) a + b = 0 (b) a + 2b = e2 (c) b = e2 (d) none of these

Q 29. If f(x) = cos-1(cos x) then f(x) is

(a) continuous at x = π (b) discontinuous x = -π

(c) differentiable at x = 0 (d) nondifferentiable at x = π

Q 30. Let f(x) = x - |x|. Then

(a) f(x) is continuous everywhere (b) f(x) is differentiable everywhere

(c) f(x) is discontinuous at x = 0 (d) f(x) is not differentiable at x = 0

Q 31. If f(x) = [x] + , where [.] denotes the greatest integer function, then

(a) f(x) is continuous at x =  (b) 

(c) f(x) is discontinuous at x =  (d) 

Q 32. If f(x) = |2 – x| + (2 + x), where (x) = the least integer greater than or equal to x, then

(a) f(2 – 0) = f(2) = 4 (b) f(x) is continuous at x = 2

(c) f(x) is nondifferentiable at x= 2 (d) f(x) is differentiable but not continuous at x = 2

Q 33. Let h(x) = min {x, x2} for every real number x. Then

(a) h is continuous for all x (b) h is differentiable for all x

(c) h'(x) = 1 for all x > 1 (d) h is not differentiable at two values of x

Q 34. At x = 0, the function y = e-|x| is

(a) continuous (b) continuous and differentiable

(c) differentiable with derivative = 1 (d) differentiable with derivative = -1

Q 35. A function f(x) is defined as follows :

f(x) = -x2, x ≤ 0 f(x) = 5x – 4, 0 < x ≤ 1

f(x) = 4x2 – 3x, 1 < x ≤ 2 f(x) = 3x + 4, x > 2

(a) f(x) is not continuous at x = 0, but differentiable there

(b) f(x) is continuous at x = 1, but not differentiable there

(c) f(x) is continuous at x = 2, but not differentiable there

(d) none of the above

Q 36. The function , x ≠ 0, is continuous at x = 0. Then

(a) f(0) = 1 (b) f(x) is differentiable at x = 0

(c) f(x) is not differentiable at x = 0 (d) 

Q 37. The function f(x) = |x2 – 3x + 2| + cos |x| is not differentiable at x =

(a) -1 (b) 0 (c) 1 (d) 2

Q 38. Let f(x) be defined as follows :

f(x) = x6, x2 > 1

x3, x2 ≤ 1

Then f(x) is

(a) continuous everywhere (b) differentiable everywhere

(c) discontinuous at x = -1 (d) not differentiable at x = 1

Q 39. Let f(x) = sin x, x ≥ 0

-sin x, x < 0

The f(x) is

(a) continuous at x = 0 (b) differentiable at x = 0

(c) discontinuous at x = 0 (d) not differentiable at x = 0

Q 40. If , where ai’s real constants, then f(x) is

(a) continuous at x = 0 for all ai (b) differentiable at x = 0 for all ai ∈ R

(c) differentiable at x = 0 for a2k+1 = 0 (d) none of these

Q 41. Let [x] denote the greatest integer less than or equal to x. Now g(x) is defined as below :

g(x) = [f(x)], x ∈ 



where , n ∈ R. Then

(a) g(x) is continuous and differentiable at when n > 1

(b) g(x) is continuous and differentiable at when 0 < n < 1

(c) g(x) is continuous but not differentiable at when n > 1

(d) g(x) is continuous but differentiable at when 0 < n < 1

Q 42. Let f(x) = φ(x) + ψ(x) and φ'(a), ψ'(a) are finite and definite. Then

(a) f(x) is continuous at x = a (b) f(x) is differentiable at x = a

(c) f(x) is continuous at x = a (d) f'(x) is differentiable at x = a

Q 43. Let f(x) = x + |x|. Then f(x) is

(a) differentiable at all x (b) continuous at all x

(c) differentiable everywhere except at x = 0 (d) continuous everywhere except at x = 0

Q 44. Let . Then

(a) f(x) is a constant in 0 < x < 1 (b) f(x) is continuous at x = 1

(c) f(x) is not differentiable at x = 1 (d) none of these

Q 45. Let f(x) = 1 - |cos x| for all x ∈ R. Then

(a) does not exist (b) f(x) is continuous everywhere

(c) f(x) is not differentiable anywhere (d) f(x) = 1

Q 46. Let f(x) = [tan2 x], where [,] denotes the greatest integer function. Then

(a) f(x) does not exist (b) f(x) is continuous at x = 0

(c) f'(0) = 1 (d) f(x) is not differentiable at = 0

Q 47. If be a real-valued function then

(a) f(x) is continuous, but f'(0) does not exist (b) f(x) is differentiable at x = 0

(c) f(x) is not continuous at x = 0 (d) f(x) is not differentiable at x = 0

Q 48. A function f(x) is defined in the interval [1, 4) as follows :

f(x) = loge[x], 1 ≤ x < 3

|loge x|, 3 ≤ x < 4

The graph of the function f(x)

(a) is broken at two points (b) is broken at exactly one point

(c) does not have a definite tangent at two points

(d) does not have a definite tangent at more than two points

**1a 2c 3c 4a 5c 6a 7b 8c 9c 10c**

**11d 12a 13a 14b 15c 16a 17c 18b 19d 20c**

**21b 22a 23c 24b 25d 26d 27d 28abc 29ad 30ad**

**31ab 32ac 33acd 34a 35c 36ab 37cd 38cd 39ad 40ac**

**41b 42ab 43bc 44ac 45bd 46b 47b 48ac**