SECTION-A

UNIT-I

1. If A = {1, 2, 3, 5, 7} and B = {2, 4, 5, 9} then A – B will be :
   (A) {4, 9} (B) {1, 3, 7}
   (C) {2, 5} (D) none of these
2. If A = {1, 2, 3, 4}, B = {3, 4, 5, 6} and C = {4, 5, 6, 7} then (A ∪ B) ∩ C is equal to :
   (A) {4, 5, 6} (B) {3, 4, 5, 6, 7}
   (C) {5, 6, 7} (D) ϕ
3. In above question (A ∩ B) ∪ C will be :
   (A) {5, 6, 7} (B) {2, 4, 5, 6}
   (C) {3, 4, 5, 6, 7} (D) (1, 2, 3, 4, 5, 6, 7)
4. If A = {1, 3, 5, 7, 9, 11} and B = {3, 5, 7, 8} then complement of A in B will be :
   (A) {1, 9, 11} (B) {3, 5, 7}
   (C) {3, 5, 7, 8} (D) {8}
5. If A be a finite set consisting of n elements then the power set P(A) contains :
   (A) 2^n elements (B) 2^{n-1} elements
   (C) 2^{n+1} elements (D) none of these
6. Let A = {1, 2, 3} and B = {3, 4, 5} then the symmetric difference of A and B is :
   (A) {1, 2} (B) {4, 5}
   (C) {1, 2, 4, 5} (D) {3}
7. If A = {0, 1} and B = {0, –1} then A × B will be :
   (A) {(0, 0), (0, 1), (–1, 0), (–1, 1)} (B) {(0, 0), (0, –1), (1, 0), (1, –1)}
   (C) {(–1, 1), (1, –1)} (D) none of these
8. If A has 32 elements, B has 42 elements and A ∪ B has 62 elements then the number of elements in A ∩ B will be :
   (A) 12 (B) 20
   (C) 10 (D) 30
9. Let S be the set of all straight lines in a plane. The relation R in S defined by "x is parallel y" is :
   (A) Reflexive (B) Symmetric
   (C) Transitive (D) All above

UNIT-II

10. If (x) = cos x + $\sqrt{3}$ sin x then $f(\pi/3)$ will be equal to :
    (A) 1 (B) 2
    (C) $2\sqrt{2}$ (D) 3

(C) $2x^2-1$ (D) none of these

12. If $\sin x = \frac{3}{5}$ then cot x will be equal to :

(A) $\frac{3}{4}$ (B) $\frac{4}{3}$

(C) $\frac{4}{5}$ (D) none of these

13. If $f(x)=\sqrt{x}$ then $\frac{f(25)}{f(9)+f(16)}$ is equal to :

(A) $\frac{5}{7}$ (B) $\frac{7}{5}$

(C) 1 (D) none of these

14. $\lim_{x\to 1}\frac{x^2-1}{x+2}$ will be equal to :

(A) 2 (B) –2

(C) 1 (D) 0

15. $\lim_{x\to\infty}\frac{ax^2+bx+c}{dx^2+ex+f}$ is equal to :

(A) $\frac{c}{f}$ (B) ∞

(C) $\frac{a}{d}$ (D) 0

16. $\lim_{x\to 0}(1+x)^{1/x}$ is equal to :

(A) e (B) $1/e$

(C) 1 (D) none of these

17. If $f(x)=\begin{cases} x+\lambda & , \ x<3 \\ 4 & , \ x=3 \\ 3x-5 & , \ x>3 \end{cases}$ is continuous at x = 3 then the value of the λ is :

(A) 4 (B) 3

(C) 1 (D) 2

11. If $f : R \to R$ s.t $f(x) = 2x - 1$ and $g : R \to R$ s.t. $g(x) = x^2$ then (fog) (x) is :

(A) $2(x^2-1)$ (B) $2(x-1)^2$

(C) $2x^2-1$ (D) none of these

12. If $\sin x = \frac{3}{5}$ then cot x will be equal to :

(A) $\frac{3}{4}$ (B) $\frac{4}{3}$

(C) $\frac{4}{5}$ (D) none of these

13. If $f(x) = \sqrt{x}$ then $\frac{f(25)}{f(9)+f(16)}$ is equal to :

(A) $\frac{5}{7}$ (B) $\frac{7}{5}$

(C) 1 (D) none of these

14. $\lim_{x \to 1} \frac{x^2-1}{x+2}$ will be equal to :

(A) 2 (B) –2

(C) 1 (D) 0

15. $\lim_{x \to \infty} \frac{ax^2+bx+c}{dx^2+ex+f}$ is equal to :

(A) $\frac{c}{f}$ (B) ∞

(C) $\frac{a}{d}$ (D) 0

16. $\lim_{x \to 0} (1+x)^{1/x}$ is equal to :

(A) e (B) $1/e$

(C) 1 (D) none of these

17. If $f(x) = \begin{cases} x+\lambda & , \ x<3 \\ 4 & , \ x=3 \\ 3x-5 & , \ x>3 \end{cases}$ is continuous at x = 3 then the value of the λ is :

(A) 4 (B) 3

(C) 1 (D) 2

18. If $f(x)=\begin{cases} x^2+1 & , \quad x \le 2 \\ 2x & \quad x>2 \end{cases}$ then f(x) is :

(A) Continuous at x = 2
(B) not continuous at x = 2
(C) not defined at x = 2
(D) none of these

UNIT-III

19. The roots of the quadratic equation $2x^2 - 13x + 15 = 0$ are :

(A) $5, \frac{5}{2}$
(B) $3, \frac{5}{2}$
(C) $3, \frac{3}{2}$
(D) $5, \frac{3}{2}$

20. If α, β are roots of the equation $x^2 - 2x + 3 = 0$ then $\frac{\alpha}{\beta}+\frac{\beta}{\alpha}$ will be equal to :

(A) $\frac{2}{3}$
(B) $\frac{-2}{3}$
(C) $\frac{-1}{3}$
(D) $\frac{1}{3}$

21. If $\left(-1, \sqrt{3}\right)$ be the cartesion coordinates of a point, then its polar coordinates are :

(A) $\left(2, \frac{2\pi}{3}\right)$
(B) $\left(1, \frac{\pi}{3}\right)$
(C) $\left(2, \frac{\pi}{3}\right)$
(D) none of these

22. If (–4, –1), (1, 2) and (4, –3) are vertices of a triangle then the area of this triangle will be :

(A) 12 units
(B) 15 units
(C) 16 units
(D) 17 units

23. The locus of the point whose distance from the origin is 4 will be :

(A) $x^2 - y^2 = 16$
(B) $x + y = 4$
(C) $x^2 + y^2 = 16$
(D) none of these

24. The equation of the line passing through the points (1, 2) and (–1, 4) is given by :

(A) $x + y - 3 = 0$
(B) $x - y - 3 = 0$
(C) $x - y + 3 = 0$
(D) $x - 2y + 5 = 0$

25. If $A=\begin{bmatrix} 3 & -1 & 2 \\ -2 & 0 & 1 \end{bmatrix}$ and $B=\begin{bmatrix} 0 & 1 & -2 \\ 2 & 1 & 0 \end{bmatrix}$ then A – B is :

(A) $\begin{bmatrix} 3 & 2 & -4 \\ 4 & -1 & 1 \end{bmatrix}$

(B) $\begin{bmatrix} 3 & -2 & 4 \\ -4 & -1 & 1 \end{bmatrix}$

(C) $\begin{bmatrix} -3 & 2 & -4 \\ -4 & 1 & -1 \end{bmatrix}$

(D) none of these

26. If $A=\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \end{bmatrix}$ and $B=\begin{bmatrix} 4 & 2 \\ 2 & 1 \\ 1 & 3 \end{bmatrix}$ then AB is :

(A) $\begin{bmatrix} 11 & 10 \\ 15 & 13 \end{bmatrix}$

(B) $\begin{bmatrix} 13 & 11 \\ 15 & 10 \end{bmatrix}$

(C) $\begin{bmatrix} 11 & 13 \\ 15 & 10 \end{bmatrix}$

(D) none of these

27. Inverse of the matrix $\begin{bmatrix} 4 & 1 \\ 2 & 3 \end{bmatrix}$ is :

(A) $\frac{1}{10}\begin{bmatrix} -1 & 3 \\ 4 & -2 \end{bmatrix}$

(B) $\frac{1}{10}\begin{bmatrix} 3 & -1 \\ -2 & 4 \end{bmatrix}$

(C) $\frac{1}{10}\begin{bmatrix} 3 & -1 \\ -4 & 2 \end{bmatrix}$

(D) $\frac{1}{10}\begin{bmatrix} -1 & 3 \\ -2 & 4 \end{bmatrix}$

UNIT-IV

28. $\frac{d}{dx}\left[\frac{1-\tan x}{\sec x}\right]$ is :

(A) –(sin x + cos x)

(B) cos x – sin x

(C) sin x – cos x

(D) sin x + cos x

29. $\frac{d}{dx}(a^{2x})$ is :

(A) $2a^x$

(B) a^{2x}

(C) $\frac{a^{2x}}{2}$

(D) $2a^{2x}$

30. $\frac{d}{dx}(\log \sin x) =$

(A) tan x
(B) cot x
(C) cosec x
(D) none of these

31. If $f(x) = \frac{1-x}{1+x}$ then f'(2) will be equal to :

(A) $-2/9$
(B) $\frac{2}{9}$
(C) $\frac{4}{9}$
(D) none of these

32. If y = sec x + tan x then $\frac{dy}{dx}$ will be :

(A) sec x (sec x – tan x)
(B) tan x (tan x – sec x)
(C) sec x (sec x + tan x)
(D) none of these

33. If $y = e^{3x}$ then $\frac{d^2y}{dx^2}$ will be equal to :

(A) $9\ e^{3x}$
(B) $3e^{3x}$
(C) $6\ e^{3x}$
(D) $9\ e^{2x}$

34. If $x^2 + y^2 = 6x - 2y$ then $\frac{dy}{dx} =$

(A) $\frac{x-3}{y+1}$
(B) $\frac{3-x}{y-1}$
(C) $\frac{x+3}{y+1}$
(D) $\frac{3-x}{y+1}$

35. A function y = f(x) will be maximum if :

(A) $\frac{d^2y}{dx^2} > 0$
(B) $\frac{d^2y}{dx^2} < 0$
(C) $\frac{d^2y}{dx^2} = 0$
(D) none of these

36. Function $f(x) = x^3 - 3x + 4$ has minimum value at :

(A) x = – 1
(B) x = 2
(C) x = 1
(D) x = –2

UNIT-V

37. $\int \frac{x^2+1}{x} dx =$

(A) $\frac{x^2}{2} + \log x + c$

(B) x log x + c

(C) $\log x - \frac{x^2}{2} + c$

(D) none of these

38. $\int \frac{dx}{1+x^2} =$

(A) $\sec^{-1} x + c$

(B) $\tan^{-1} x + c$

(C) $\text{cosec}^{-1} x$

(D) none of these

39. $\int e^{4x} dx =$

(A) $e^{4x} + c$

(B) $4e^{4x} + c$

(C) $2e^{2x} + c$

(D) $\frac{e^{4x}}{4} + c$

40. $\int \tan x \, dx =$

(A) log sin x + c

(B) log cos x + c

(C) log sec x + c

(D) none of these

41. $\int \frac{1}{3-2x} dx =$

(A) $-\frac{1}{2}\log(3-2x) + c$

(B) 2 log (3 – 2x) + c

(C) – log (3 – 2x) + c

(D) none of these

42. $\int \frac{dx}{x^2-16} =$

(A) $\frac{1}{2}\log\left(\frac{x-4}{x+4}\right) + c$

(B) $\frac{1}{8}\log\left(\frac{x-4}{x+4}\right) + c$

(C) $\frac{1}{8}\log\left(\frac{x+4}{x-4}\right) + c$

(D) none of these

43. $\int \frac{1-\tan x}{1+\tan x} dx =$

(A) log (cos x – sin x) + c

(B) log (sin x – cos x) + c

(C) log (sin x + cos x) + c

(D) none of these

44. $\int_1^2 x^2 dx =$

(A) $\frac{5}{3}$ (B) $\frac{7}{3}$

(C) $-\frac{2}{3}$ (D) none of these

45. The value of the integral $\int_{-4}^{4} (ax^3 + bx + c)\, dx$ depends on :

(A) c only (B) b and c

(C) a, b and c (D) a and c

SECTION-B

1. (a) Let R be the relation on N × N defined by (a, b) R (c, d), iff ad = bc ∀ (a, b) ∈ N × N, show that R is an equivalence relation.

(b) If A = {a, b, c, d}, B = {a, e, g} and c = {e, g, m, n, p} then find

(i) A ∪ C (B ∩ C) (ii) (A ∪ B) ∩ C (iii) (A ∩ B) ∪ C

2. (a) Evaluate $\lim_{x \to \infty} \left[\sqrt{x^2+1} - x\right]$.

(b) Test the continuity of the following function at x = 0,

$$f(x) = \begin{cases} \dfrac{1+e^{-1/x}}{1-e^{-1/x}} & , \ x \neq 0 \\ 0 & , \ x = 0 \end{cases}$$

3. (a) Find the roots of the following quadratic equation

$$\frac{2x+31}{9} + \frac{x^2+7}{x^2-7} = \frac{2x+47}{9}$$

(b) If $A = \begin{bmatrix} 1 & -2 & 3 \\ 2 & 3 & -1 \\ -3 & 1 & 2 \end{bmatrix}$ then show that $A^3 - 6A^2 + 25A - 42\, I = 0$.

4. (a) Find the differential coefficient of $\left(1 + \frac{1}{x}\right)^x$ with respect to x.

(b) Find the maxima and minima of the following function $2x^3 - 21x^2 + 36x - 20$.

5. (a) Evaluate $\int \frac{2x}{x^2+3x+2}$.

(b) Evaluate $\int_0^{\pi} \frac{x \sin x}{1+\cos^2 x} dx$.