1. If α, β and γ are the roots of the equation $x^3 - 8x + 8 = 0$, then $\Sigma \alpha^2$ and $\Sigma \frac{1}{\alpha\beta}$ are respectively

(a) 0 and – 16 (b) 16 and 18

(c) – 16 and 0 (d) 16 and 0

2. $x = 4(1 + \cos\theta)$ and $y = 3(1 + \sin\theta)$ are the parametric equations of

(a) $\frac{(x-3)^2}{9} + \frac{(y-4)^2}{16} = 1$

(b) $\frac{(x+4)^2}{16} + \frac{(y+3)^2}{9} = 1$

(c) $\frac{(x-4)^2}{16} - \frac{(y-3)^2}{9} = 1$

(d) $\frac{(x-4)^2}{16} + \frac{(y-3)^2}{9} = 1$

3. If the distance between the foci and the distance between the directrices of the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ are in the ratio 3 : 2, then $a:b$ is

(a) $\sqrt{2}:1$ (b) $\sqrt{3}:\sqrt{2}$

(c) $1:2$ (d) $2:1$

4. The ellipse $\frac{x^2}{25}+\frac{y^2}{16}=1$ and the hyperbola $\frac{x^2}{25}-\frac{y^2}{16}=1$ have in common

(a) centre only

(b) centre, foci and directrices

(c) centre, foci and vertices

(d) centre and vertices only

5. If $\sec\theta=m$ and $\tan\theta=n$, then $\frac{1}{m}\left[(m+n)+\frac{1}{(m+n)}\right]$ is

(a) 2 (b) $2m$

(c) $2n$ (d) mn

6. The value of $\frac{\sin 85°-\sin 35°}{\cos 65°}$ is

(a) 2 (b) -1

(c) 1 (d) 0

7. If the length of the tangent from any point on the circle $(x-3)^2+(y+2)^2=5r^2$ to the circle $(x-3)^2+(y+2)^2=r^2$ is 16 unit, then the area between the two circles in sq unit is

(a) 32π (b) 4π

(c) 8π (d) 256π

8. The circles $ax^2+ay^2+2g_1x+2f_1y+c_1=0$ and $bx^2+by^2+2g_2x+2f_2y+c_2=0$ ($a\neq 0$ and $b\neq 0$) cut orthogonally if

(a) $g_1g_2+f_1f_2=ac_1+bc_2$

(b) $2(g_1g_2+f_1f_2)=bc_1+ac_2$

(c) $bg_1g_2+af_1f_2=bc_1+ac_2$

(d) $g_1g_2+f_1f_2=c_1+c_2$

9. The equation of the common tangent of the two touching circles, $y^2+x^2-6x-12y+37=0$ and $x^2+y^2-6y+7=0$ is

(a) $x-y-5=0$ (b) $x-y+5=0$

(c) $x-y-5=0$ (d) $x+y+5=0$

10. The equation of the parabola with vertex at $(-1, 1)$ and focus $(2, 1)$ is

(a) $y^2-2y-12x-11=0$

(b) $x^2+2x-12y+13=0$

(c) $y^2-2y+12x+11=0$

(d) $y^2-2y-12x+13=0$

11. The equation of the line which is tangent to both the circle $x^2+y^2=5$ and the parabola $y^2=40x$ is

(a) $2x-y\pm 5=0$ (b) $2x-y+5=0$

(c) $2x-y-5=0$ (d) $2x+y+5=0$

12. If $2A+3B=\begin{bmatrix}2 & -1 & 4\\ 3 & 2 & 5\end{bmatrix}$ and $A+2B=\begin{bmatrix}5 & 0 & 3\\ 1 & 6 & 2\end{bmatrix}$, then B is

(a) $\begin{bmatrix}8 & -1 & 2\\ -1 & 10 & -1\end{bmatrix}$ (b) $\begin{bmatrix}8 & 1 & 2\\ -1 & 10 & -1\end{bmatrix}$

(c) $\begin{bmatrix}8 & 1 & -2\\ -1 & 10 & -1\end{bmatrix}$ (d) $\begin{bmatrix}8 & 1 & 2\\ 1 & 10 & 1\end{bmatrix}$

13. If $O(A)=2\times 3$, $O(B)=3\times 2$, and $O(C)=3\times 3$, which one of the following is not defined ?

(a) $CB+A'$ (b) BAC

(c) $C(A+B')'$ (d) $C(A+B')$

14. If $A=\begin{bmatrix}1 & -3\\ 2 & k\end{bmatrix}$ and $A^2-4A+10I=A$, then k is equal to

(a) 0 (b) -4

(c) 4 and not 1 (d) 1 or 4

15. The value of $\begin{vmatrix}x+y & y+z & z+x\\ x & y & z\\ x-y & y-z & z-x\end{vmatrix}$ is equal to

(a) $2(x+y+z)^2$ (b) $2(x+y+z)^3$

(c) $(x+y+z)^3$ (d) 0

16. From an aeroplane flying, vertically above a horizontal road, the angles of depression of two consecutive stones on the same side of the aeroplane are observed to be 30° and 60° respectively. The height at which the aeroplane is flying in km is

(a) $\frac{4}{\sqrt{3}}$ (b) $\frac{\sqrt{3}}{2}$

(c) $\frac{2}{\sqrt{3}}$ (d) 2

17. If the angles of a triangle are in the ratio 3 : 4 : 5, then the sides are in the ratio

(a) $2 : \sqrt{6} : \sqrt{3} + 1$ (b) $\sqrt{2} : \sqrt{6} : \sqrt{3} + 1$

(c) $2 : \sqrt{3} : \sqrt{3} + 1$ (d) $3 : 4 : 5$

18. If $\cos^{-1} x = \alpha, (0 < x < 1)$ and $\sin^{-1}(2x\sqrt{1-x^2}) + \sec^{-1}\left(\frac{1}{2x^2-1}\right) = \frac{2\pi}{3}$, then $\tan^{-1}(2x)$ equals

(a) $\pi/6$ (b) $\pi/4$

(c) $\pi/3$ (d) $\pi/2$

19. If $a > b > 0$, then the value of $\tan^{-1}\left(\frac{a}{b}\right) + \tan^{-1}\left(\frac{a+b}{a-b}\right)$ depends on

(a) both a and b (b) b and not a

(c) a and not b (d) neither a nor b

20. Which one of the following equations has no solution ?

(a) $\operatorname{cosec} \theta - \sec \theta = \operatorname{cosec} \theta \cdot \sec \theta$

(b) $\operatorname{cosec} \theta \cdot \sec \theta = 1$

(c) $\cos \theta + \sin \theta = \sqrt{2}$

(d) $\sqrt{3} \sin \theta - \cos \theta = 2$

21. If $A = \{a, b, c\}, B = \{b, c, d\}$ and $C = \{a, d, c\}$, then $(A - B) \times (B \cap C)$ is equal to

(a) $\{(a, c), (a, d)\}$

(b) $\{(a, b), (c, d)\}$

(c) $\{(c, a), (d, a)\}$

(d) $\{(a, c), (a, d), (b, d)\}$

22. The function $f : X \to Y$ defined by $f(x) = \sin x$ is one-one but not onto, if X and Y are respectively equal to

(a) R and R

(b) $[0, \pi]$ and $[0, 1]$

(c) $\left[0, \frac{\pi}{2}\right]$ and $[-1, 1]$

(d) $\left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$ and $[-1, 1]$

23. If $\log_4 2 + \log_4 4 + \log_4 x + \log_4 16 = 6$, then value of x is

(a) 64 (b) 4

(c) 8 (d) 32

24. If $S_n = \frac{1}{6 \cdot 11} + \frac{1}{11 \cdot 16} + \frac{1}{16 \cdot 21} + \ldots$ to n terms, then $6S_n$ equals

(a) $\frac{5n-4}{5n+6}$ (b) $\frac{n}{(5n+6)}$

(c) $\frac{2n-1}{5n+6}$ (d) $\frac{1}{(5n+6)}$

25. If $\vec{\mathbf{p}} = \hat{\mathbf{i}} + \hat{\mathbf{j}}, \vec{\mathbf{q}} = 4\hat{\mathbf{k}} - \hat{\mathbf{j}}$ and $\vec{\mathbf{r}} = \hat{\mathbf{i}} + \hat{\mathbf{k}}$ then the unit vector in the direction of $3\vec{\mathbf{p}} + \vec{\mathbf{q}} - 2\vec{\mathbf{r}}$ is

(a) $\frac{1}{3}(\hat{\mathbf{i}} + 2\hat{\mathbf{j}} + 2\hat{\mathbf{k}})$ (b) $\frac{1}{3}(\hat{\mathbf{i}} - 2\hat{\mathbf{j}} - 2\hat{\mathbf{k}})$

(c) $\frac{1}{3}(\hat{\mathbf{i}} - 2\hat{\mathbf{j}} + 2\hat{\mathbf{k}})$ (d) $\hat{\mathbf{i}} + 2\hat{\mathbf{j}} + 2\hat{\mathbf{k}}$

26. If $\vec{\mathbf{a}}$ and $\vec{\mathbf{b}}$ are the two vectors such that $|\vec{\mathbf{a}}| = 3\sqrt{3}, |\vec{\mathbf{b}}| = 4$ and $|\vec{\mathbf{a}} + \vec{\mathbf{b}}| = \sqrt{7}$, then the angle between $\vec{\mathbf{a}}$ and $\vec{\mathbf{b}}$ is

(a) 120° (b) 60°

(c) 30° (d) 150°

27. If the area of the parallelogram with $\vec{\mathbf{a}}$ and $\vec{\mathbf{b}}$ as two adjacent sides is 15 sq unit, then the area of the parallelogram having, $3\vec{\mathbf{a}} + 2\vec{\mathbf{b}}$ and $\vec{\mathbf{a}} + 3\vec{\mathbf{b}}$ as two adjacent sides in sq unit is

(a) 120 (b) 105

(c) 75 (d) 45

28. The locus of the point which moves such that the ratio of its distance from two fixed point in the plane is always a constant k (< 1) is

(a) hyperbola (b) ellipse

(c) straight line (d) circle

29. If the lines $x + 3y - 9 = 0$, $4x + by - 2 = 0$ and $2x - y - 4 = 0$ are concurrent, then b equals

(a) -5 (b) 5

(c) 1 (d) 0

30. The lines represented by $ax^2 + 2hxy + by^2 = 0$ are perpendicular to each other, if

(a) $h^2 = a + b$ (b) $a + b = 0$

(c) $h^2 = ab$ (d) $h = 0$

31. The equation of the circle having $x - y - 2 = 0$ and $x - y + 2 = 0$ as two tangents and $x - y = 0$ as a diameter is

(a) $x^2 + y^2 + 2x - 2y + 1 = 0$

(b) $x^2 + y^2 - 2x + 2y - 1 = 0$

(c) $x^2 + y^2 = 2$

(d) $x^2 + y^2 = 1$

32. If the curve $y = 2x^3 + ax^2 + bx + c$ passes through the origin and the tangents drawn to it at $x = -1$ and $x = 2$ are parallel to the x-axis, then the values of a, b and c are respectively

(a) 12, – 3 and 0 (b) – 3, – 12 and 0

(c) – 3, 12 and 0 (d) 3, – 12 and 0

33. A circular sector of perimeter 60 m with maximum area is to be constructed. The radius of the circular arc in metre must be

(a) 20 (b) 5

(c) 15 (d) 10

34. The tangent and the normal drawn to the curve $y = x^2 - x + 4$ at $P(1, 4)$ cut the x-axis at A and B respectively. If the length of the subtangent drawn to the curve at P is equal to the length of the subnormal, then the area of the triangle PAB in sq unit is

(a) 4 (b) 32

(c) 8 (d) 16

35. $\int \frac{(x^3 + 3x^2 + 3x + 1)}{(x+1)^5} dx$ is equal to

(a) $-\frac{1}{(x+1)} + c$ (b) $\frac{1}{5} \log (x+1) + c$

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

36. $\int \frac{\operatorname{cosec} x}{\cos^2 \left(1 + \log \tan \frac{x}{2}\right)} dx$ is equal to

(a) $\sin^2 \left[1 + \log \tan \frac{x}{2}\right] + c$

(b) $\tan \left[1 + \log \tan \frac{x}{2}\right] + c$

(c) $\sec^2 \left[1 + \log \tan \frac{x}{2}\right] + c$

(d) $-\tan \left[1 + \log \tan \frac{x}{2}\right] + c$

37. The complex number $\frac{(-\sqrt{3} + 3i)(1 - i)}{(3 + \sqrt{3}i)(i)(\sqrt{3} + \sqrt{3}i)}$ when represented in the Argand diagram is

(a) in the second quadrant

(b) in the first quadrant

(c) on the y-axis (imaginary axis)

(d) on the x-axis (real axis).

38. If $2x = -1 + \sqrt{3}i$, then the value of $(1 - x^2 + x)^6 - (1 - x + x^2)^6$ is equal to

(a) 32 (b) – 64

(c) 64 (d) 0

39. The modulus and amplitude of $(1 + i\sqrt{3})^8$ are respectively

(a) 256 and $\frac{\pi}{3}$ (b) 256 and $\frac{2\pi}{3}$

(c) 2 and $\frac{2\pi}{3}$ (d) 256 and $\frac{8\pi}{3}$

40. The value of $\lim_{x \to 0} \frac{5^x - 5^{-x}}{2x}$ is

(a) log 5 (b) 0

(c) 1 (d) 2 log 5

41. Which one of the following is not true always ?

(a) If $f(x)$ is not continuous at $x = a$, then it is not differentiable at $x = a$

(b) If $f(x)$ is continuous at $x = a$, then it is differentiable at $x = a$

(c) If $f(x)$ and $g(x)$ are differentiable at $x = a$, then $f(x) + g(x)$ is also differentiable at $x = a$

(d) If a function $f(x)$ is continuous at $x = a$, then $\lim_{x \to a} f(x)$ exists

42. $\int \frac{dx}{x\sqrt{x^6 - 16}}$ is equal to

(a) $\frac{1}{3} \sec^{-1}\left(\frac{x^3}{4}\right) + c$ (b) $\cos^{-1}\left(\frac{x^3}{4}\right) + c$

(c) $\frac{1}{12} \sec^{-1}\left(\frac{x^3}{4}\right) + c$ (d) $\sec^{-1}\left(\frac{x^3}{4}\right) + c$

43. If $I_1 = \int_0^{\pi/2} x \sin x \, dx$ and $I_2 = \int_0^{\pi/2} x \cos x \, dx$, then which one of the following is true ?

(a) $I_1 + I_2 = \frac{\pi}{2}$

(b) $I_2 - I_1 = \frac{\pi}{2}$

(c) $I_1 + I_2 = 0$

(d) $I_1 = I_2$

44. If $f(x)$ is defined $[-2, 2]$ by $f(x) = 4x^2 - 3x + 1$ and

$$g(x) = \frac{f(-x) - f(x)}{x^2 + 3},$$

then $\int_{-2}^{2} g(x)\, dx$ is equal to

(a) 64 (b) -48

(c) 0 (d) 24

45. The area enclosed between the parabola $y = x^2 - x + 2$ and the line $y = x + 2$ in sq unit equals

(a) 8/3 (b) 1/3

(c) 2/3 (d) 4/3

46. The solution of the differential equation $e^{-x}(y+1)\, dy + (\cos^2 x + \sin 2x) y \, dx = 0$ subjected to the condition that $y = 1$ when $x = 0$ is

(a) $y + \log y + e^x \cos^2 x = 2$

(b) $\log(y+1) + e^x \cos^2 x = 1$

(c) $y + \log y = e^x \cos^2 x$

(d) $(y+1) + e^x \cos^2 x = 2$

47. If $y = 1 + \frac{1}{x} + \frac{1}{x^2} + \frac{1}{x^3} + \ldots$ to ∞ with $|x| > 1$, then $\frac{dy}{dx}$ is

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

(b) $x^2 y^2$

(c) $\frac{y^2}{x^2}$

(d) $\frac{-y^2}{x^2}$

48. If $f(x)$ and $g(x)$ are two functions with $g(x) = x - \frac{1}{x}$ and $fog(x) = x^3 - \frac{1}{x^3}$, then $f'(x)$ is

(a) $3x^2 + 3$ (b) $x^2 - \frac{1}{x^2}$

(c) $1 + \frac{1}{x^2}$ (d) $3x^2 + \frac{3}{x^4}$

49. The derivative of $a^{\sec x}$ w.r.t. $a^{\tan x}$ $(a > 0)$ is

(a) $\sec x \, a^{\sec x - \tan x}$ (b) $\sin x \, a^{\tan x - \sec x}$

(c) $\sin x \, a^{\sec x - \tan x}$ (d) $a^{\sec x - \tan x}$

50. For the given data, the calculation corresponding to all values of varis (x, y) is following

$\Sigma(x - \bar{x})^2 = 36$, $\Sigma(y - \bar{y})^2 = 25$,

$\Sigma(x - \bar{x})(y - \bar{y}) = 20$

The Karl pearson's correlation coefficient is

(a) 0.2 (b) 0.5

(c) 0.66 (d) 0.33

51. If the variance of $x = 9$ and regression equations are $4x - 5y + 33 = 0$ and $20x - 9y - 10 = 0$, then the coefficient of correlation between x and y and the variance of y respectively are

(a) 0.6; 16 (b) 0.16; 16

(c) 0.3; 4 (d) 0.6; 4

52. The value of mean, median and made coincides, then the distribution is

(a) positive skewness

(b) symmetrical distribution

(c) negative skewness

(d) all of the above

53. The volume of the solid generated by revolving the region bounded by $y = x^2 + 1$ and $y = 2x + 1$ about x-axis is

(a) $\frac{104}{15} \pi$ cu unit (b) $\frac{42\pi}{15}$ cu unit

(c) $\frac{52\pi}{15}$ cu unit (d) None of these

54. The function $x\sqrt{1 - x^2}$, $(x > 0)$ has

(a) a local maxima

(b) a local minima

(c) neither a local maxima nor a local minima

(d) None of the above

55. For the curve $xy = c^2$, the subnormal at any point varies as

(a) $\frac{x^2}{c^2}$ (b) $\frac{x^3}{c}$

(c) $\frac{y^2}{c^2}$ (d) $\frac{-y^3}{c^2}$

56. The acute angle between the line joining the points $(2, 1, -3)$, $(-3, 1, 7)$ and a line parallel to $\frac{x-1}{3} = \frac{y}{4} = \frac{z+3}{5}$ through the point $(-1, 0, 4)$ is

(a) $\cos^{-1}\left(\frac{1}{\sqrt{10}}\right)$

(b) $\cos^{-1}\left(\frac{1}{5\sqrt{10}}\right)$

(c) $\cos^{-1}\left(\frac{7}{5\sqrt{10}}\right)$

(d) $\cos^{-1}\left(\frac{3}{5\sqrt{10}}\right)$

57. The centre of sphere passes through four points $(0, 0, 0)$, $(0, 2, 2)$, $(1, 0, 0)$ and $(0, 0, 4)$ is

(a) $\left(-\frac{1}{2}, 1, 2\right)$

(b) $\left(1, \frac{1}{2}, 2\right)$

(c) $\left(\frac{1}{2}, 1, 2\right)$

(d) $\left(\frac{1}{2}, 1, -2\right)$

58. If $f(x)$ is an odd periodic function with period 2, then $f(4)$ equals

(a) 0 (b) 2

(c) 4 (d) -4

59. If $A = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$, then which of the following statement is not correct?

(a) A is orthogonal matrix

(b) A' is orthogonal matrix

(c) Determinant $A = 1$

(d) A is not invertible

60. R is a relation from $\{11, 12, 13\}$ to $\{8, 10, 12\}$ defined by $y = x - 3$. Then R^{-1} is

(a) $\{(8, 11), (10, 13)\}$

(b) $\{(11, 18), (13, 10)\}$

(c) $\{(10, 13), (8, 11)\}$

(d) None of the above

Answer – Key

1. d	2. d	3. a	4. d	5. a	6. c	7. d	8. b	9. c	10. a
11. a	12. b	13. d	14. c	15. d	16. b	17. a	18. c	19. d	20. b
21. a	22. c	23. d	24. b	25. a	26. d	27. b	28. b	29. a	30. d
31. c	32. b	33. c	34. d	35. a	36. b	37. c	38. d	39. b	40. a
41. b	42. c	43. b	44. c	45. d	46. a	47. d	48. a	49. c	50. c
51. a	52. b	53. a	54. a	55. d	56. c	57. c	58. a	59. d	60. a