1. Of a total of 600 bolts, 20% are too large and 10% are too small. The remainder are considered to be suitable. If a bolt is selected at random, the probability that it will be suitable is

(a) $\frac{1}{5}$ (b) $\frac{7}{10}$
(c) $\frac{1}{10}$ (d) $\frac{3}{10}$

2. The area enclosed within the curve $|x| + |y| = 1$ is

(a) 1 sq unit (b) $2\sqrt{2}$ sq unit
(c) $\sqrt{2}$ sq unit (d) 2 sq unit

3. If $P(B) = \frac{3}{4}$, $P(A \cap B \cap \overline{C}) = \frac{1}{3}$ and $P(\overline{A} \cap B \cap \overline{C}) = \frac{1}{3}$, then $P(B \cap C)$ is

(a) 1/12 (b) 1/6
(c) 1/15 (d) 1/9

4. The value of
$\sin\left(\sin^{-1}\frac{1}{3} + \sec^{-1}3\right) +$
$\cos\left(\tan^{-1}\frac{1}{2} + \tan^{-1}2\right)$ is

(a) 1 (b) 2
(c) 3 (d) 4

5. $\int_0^{\pi/2} \frac{\sqrt{\cot x}}{\sqrt{\cot x} + \sqrt{\tan x}}\, dx$ is equal to

(a) 1 (b) -1
(c) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$

6. Area bounded by the curve $y = \log_e x$, $x = 0$, $y \le 0$ and x-axis is

(a) 1 sq unit (b) 1/2 sq unit
(c) 2 sq unit (d) none of these

7. If $|\vec{a} \times \vec{b}|^2 + |\vec{a} \cdot \vec{b}|^2 = 144$ and $|\vec{a}| = 4$, then $|\vec{b}|$ is equal to

(a) 12 (b) 3
(c) 8 (d) 4

8. Given that $|\vec{a}| = 3$, $|\vec{b}| = 4$, $|\vec{a} \times \vec{b}| = 10$, then $|\vec{a} \cdot \vec{b}|^2$ equals

(a) 88 (b) 44
(c) 22 (d) none of these

9. $\lim_{x \to 0} x \log \sin x$ is equal to

(a) zero
(b) ∞
(c) 1
(d) cannot be determined

10. If $x = 1 + a + a^2 + \ldots\ldots$ to infinity and $y = 1 + b + b^2 + \ldots\ldots$ to infinity, where a, b are proper fractions, then $1 + ab + a^2b^2 + \ldots$ to infinity is equal to

(a) $\frac{xy}{x + y - 1}$ (b) $\frac{xy}{x - y - 1}$
(c) $\frac{xy}{x - y + 1}$ (d) $\frac{xy}{x + y + 1}$

11. $\cos^4\theta - \sin^4\theta$ is equal to

(a) $1 + 2\sin^2\left(\frac{\theta}{2}\right)$ (b) $2\cos^2\theta - 1$
(c) $1 - 2\sin^2\left(\frac{\theta}{2}\right)$ (d) $1 + 2\cos^2\theta$

12. If $y = f(x) = \frac{x + 2}{x - 1}$, then

(a) $x = f(y)$
(b) $f(1) = 3$
(c) y increases with x for $x < 1$
(d) f is a rational function of x

13. A person standing on the bank of a river observes that the angle subtended by a tree on the opposite bank is 60°. When he retreats 20 m from the bank, he finds the angle to be 30°. The breadth of the river in feet is

(a) 15 (b) $15\sqrt{3}$
(c) $10\sqrt{3}$ (d) 10

14. If $\tan\alpha = \frac{m}{m+1}$ and $\tan\beta = \frac{1}{2m+1}$, then $\alpha + \beta$ is equal to

(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{4}$
(c) zero (d) $\frac{\pi}{2}$

15. If $f(x) = x[\sqrt{x} - \sqrt{x+1}]$, then

(a) $f(x)$ is continuous but not differentiable at $x = 0$
(b) $f(x)$ is not differentiable at $x = 0$
(c) $f(x)$ is differentiable at $x = 0$
(d) none of the above

34. If $\sin x + \sin^2 x = 1$, then $\cos^6 x + \cos^{12} x + 3\cos^{10} x + 3\cos^8 x$ is equal to

(a) 1 (b) $\cos^3 x \sin^3 x$
(c) 0 (d) ∞

35. The integrating factor of the differential equation $\frac{dy}{dx} + \frac{1}{x} y = 3x$ is

(a) x (b) $\ln x$ (c) 0 (d) ∞

36. $\int_0^{\pi/2} x \sin^2 x \cos^2 x \, dx$ is equal to

(a) $\frac{\pi^2}{32}$ (b) $\frac{\pi^2}{16}$
(c) $\frac{\pi}{32}$ (d) none of these

37. If H is harmonic mean between P and Q, then the value of $\frac{H}{P} + \frac{H}{Q}$ is

(a) 2 (b) $\frac{PQ}{(P+Q)}$
(c) $\frac{(P+Q)}{PQ}$ (d) none of these

38. The value of 'p' for which the equation $x^2 + pxy + y^2 - 5x - 7y + 6 = 0$ represents a pair of straight lines is

(a) 5/2 (b) 5 (c) 2 (d) 2/5

39. Angle between the vectors $\sqrt{3}(\vec{a} \times \vec{b})$ and $\vec{b} - (\vec{a} \cdot \vec{b})\vec{a}$ is

(a) $\frac{\pi}{2}$ (b) 0 (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{3}$

40. The equation of the circle passing through (4,5) having the centre (2, 2) is

(a) $x^2 + y^2 + 4x + 4y - 5 = 0$
(b) $x^2 + y^2 - 4x - 4y - 5 = 0$
(c) $x^2 + y^2 - 4x = 13$
(d) $x^2 + y^2 - 4x - 4y + 5 = 0$

41. The smallest positive integer n for which $\left(\frac{1+i}{1-i}\right)^n = 1$ is

(a) $n = 8$ (b) $n = 12$
(c) $n = 16$ (d) none of these

42. The equation of tangents drawn from the origin to the circle $x^2 + y^2 - 2rx - 2hy + h^2 = 0$ are

(a) $x = 0, y = 0$
(b) $x = 1, y = 0$
(c) $(h^2 - r^2)x - 2rhy = 0, y = 0$
(d) $(h^2 - r^2)x - 2rhy = 0, x = 0$

43. The value of $9^{1/3} \times 9^{1/9} \times 9^{1/27} \times \ldots \infty$ is

(a) 9 (b) 1
(c) 3 (d) none of these

44. Let $0 < P(A) < 1$, $0 < P(B) < 1$ and $P(A \cup B) = P(A) + P(B) - P(A)P(B)$, then

(a) $P(B/A) = P(B) - P(A)$
(b) $P(A' \cup B') = P(A') + P(B')$
(c) $P(A \cap B) = P(A')P(B')$
(d) none of the above

45. The probability that in the toss of two dice we obtain the sum 7 or 11, is

(a) $\frac{1}{6}$ (b) $\frac{1}{18}$ (c) $\frac{2}{9}$ (d) $\frac{23}{108}$

46. If $2^x + 2^y = 2^{x+y}$, then $\frac{dy}{dx}$ is equal to

(a) $\frac{(2^x + 2^y)}{(2^x - 2^y)}$ (b) $\frac{(2^x + 2^y)}{(1 + 2^{x+y})}$
(c) $2^{x-y}\left(\frac{2^y - 1}{1 - 2^x}\right)$ (d) $\frac{2^{x+y} - 2^x}{2^y}$

47. If the probability of A to fail in an examination is 0.2 and that for B is 0.3, then probability that either A or B is fail, is

(a) 0.5 (b) 0.44 (c) 0.8 (d) 0.25

48. If $f(x) = \cos(\log x)$, then $f(x)f(y) - \frac{1}{2}\left[f\left(\frac{x}{y}\right) + f(xy)\right]$ has the value

(a) -1 (b) $\frac{1}{2}$ (c) -2 (d) zero

49. If $y = 3^{x-1} + 3^{-x-1}$ (x real), then the least value of y is

(a) 2 (b) 6
(c) 2/3 (d) none of these

50. The value of θ lying between $\theta = 0$ and $\frac{\pi}{2}$ and satisfying the equation

$$\begin{vmatrix} 1 + \sin^2\theta & \cos^2\theta & 4\sin 4\theta \\ \sin^2\theta & 1 + \cos^2\theta & 4\sin 4\theta \\ \sin^2\theta & \cos^2\theta & 1 + 4\sin 4\theta \end{vmatrix} = 0 \text{ is}$$

(a) $\frac{7\pi}{24}$ (b) $\frac{5\pi}{24}$ (c) $\frac{11\pi}{2}$ (d) $\frac{\pi}{24}$

51. $\left(\frac{-1 + \sqrt{-3}}{2}\right)^{100} + \left(\frac{-1 - \sqrt{-3}}{2}\right)^{100}$ is equal to

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

52. If α, β be the two roots of the equation $x^2 + x + 1 = 0$, then the equation whose roots are $\frac{\alpha}{\beta}$ and $\frac{\beta}{\alpha}$ is

(a) $x^2 + x + 1 = 0$ (b) $x^2 - x + 1 = 0$
(c) $x^2 - x - 1 = 0$ (d) $x^2 + x - 1 = 0$

53. In a binomial distribution, the mean is 4 and variance is 3. Then, its mode is
(a) 5 (b) 6
(c) 4 (d) none of these

54. The equation of a line passing through $(-2, -4)$ and perpendicular to the line $3x - y + 5 = 0$ is
(a) $3y + x - 8 = 0$ (b) $3x + y + 6 = 0$
(c) $x + 3y + 14 = 0$ (d) none of these

55. $\lim_{x \to 0} (\text{cosec } x)^{1/\log x}$ is equal to
(a) 0 (b) 1
(c) $1/e$ (d) none of these

56. The minimum value of
$f(x) = \sin^4 x + \cos^4 x, 0 \le x \le \frac{\pi}{2}$ is
(a) $\frac{1}{2\sqrt{2}}$ (b) $\frac{1}{4}$ (c) $\frac{-1}{2}$ (d) $\frac{1}{2}$

57. A vector of magnitude 5 and perpendicular to $(\hat{\mathbf{i}} - 2\hat{\mathbf{j}} + \hat{\mathbf{k}})$ and $(2\hat{\mathbf{i}} + \hat{\mathbf{j}} - 3\hat{\mathbf{k}})$ is
(a) $\frac{5\sqrt{3}}{3}(\hat{\mathbf{i}} + \hat{\mathbf{j}} + \hat{\mathbf{k}})$ (b) $\frac{5\sqrt{3}}{3}(\hat{\mathbf{i}} + \hat{\mathbf{j}} - \hat{\mathbf{k}})$
(c) $\frac{5\sqrt{3}}{3}(\hat{\mathbf{i}} - \hat{\mathbf{j}} + \hat{\mathbf{k}})$ (d) $\frac{5\sqrt{3}}{3}(-\hat{\mathbf{i}} + \hat{\mathbf{j}} + \hat{\mathbf{k}})$

58. $\int_{-\pi/3}^{\pi/3} \frac{x \sin x}{\cos^2 x} dx$ is
(a) $\frac{1}{3}(4\pi + 1)$ (b) $\frac{4\pi}{3} - 2 \log \tan \frac{5\pi}{12}$
(c) $\frac{4\pi}{3} + \log \tan \frac{5}{12}$ (d) none of these

59. $\sum_{r=0}^{m} {}^{n+r}C_n$ is equal to
(a) ${}^{n+m+1}C_{n+1}$ (b) ${}^{n+m+2}C_n$
(c) ${}^{n+m+3}C_{n-1}$ (d) none of these

60. The angle between the lines $2x = 3y = -z$ and $6x = -y = -4z$ is
(a) 90° (b) 0° (c) 30° (d) 45°

Answer – Key

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