1. Let a be a positive number such that the arithmetic mean of a and 2 exceeds their geometric mean by 1. Then the value of a is

(A) 3

(B) 5

(C) 9

(D) 8

(E) 10

2. The coefficient of the middle term in the expansion of $(x + 2y)^6$

(A) $^6C_3$

(B) $8(^6C_3)$

(C) $8(^6C_4)$

(D) $^6C_4$

(E) $8(^6C_5)$

3. Let $(1+x)^n = 1 + a_1x + a_2x^2 + \ldots + a_nx^n$. If a_1, a_2 and a_3 are in A.P., then the value of n is

(A) 4

(B) 5

(C) 6

(D) 7

(E) 8

4. The number of positive integers less than 40,000 that can be formed by using all the digits 1, 2, 3, 4 and 5 is equal to

(A) 24

(B) 78

(C) 32

(D) 216

(E) 72

5. If the sum of the coefficients in the expansion of $(a^2x^2 - 6ax + 11)^{10}$, where a is a constant, is 1024, then the value of a is

(A) 5

(B) 1

(C) 2

(D) 3

(E) 4

6. If ${}^{56}P_{r+6} : {}^{54}P_{r+3} = 30800 : 1$, then the value of r is

(A) 40

(B) 51

(C) 101

(D) 410

(E) 41

7. From 12 books, the difference between number of ways a selection of 5 books when one specified book is always excluded and one specified book is always included is

(A) 64

(B) 118

(C) 132

(D) 330

(E) 462

8. If $A = \begin{bmatrix} x & -2 \\ 3 & 7 \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} \frac{7}{34} & \frac{1}{17} \\ \frac{-3}{34} & \frac{2}{17} \end{bmatrix}$, then the value of x is

(A) 2

(B) 3

(C) −4

(D) 4

(E) –2

9. If $\begin{vmatrix} x^2+x & 3x-1 & -x+3 \\ 2x+1 & 2+x^2 & x^3-3 \\ x-3 & x^2+4 & 3x \end{vmatrix}$ = $a_0 + a_1x$ _ $a_2x^2 + \dots + a_7x^7$, then the value of a_0 is

(A) 25

(B) 24

(C) 23

(D) 22

(E) 21

10. The value of determinant $\begin{vmatrix} 15! & 16! & 17! \\ 16! & 17! & 18! \\ 17! & 18! & 19! \end{vmatrix}$ is equal to

(A) 15! + 16!

(B) 2 (15!) (16!) (17!)

(C) 15! + 16! + 17!

(D) 16! + 17!

(E) 2 (15! + 16!)

11. If A is a non-singular matrix of order 3, then *adj* (*adjA*) is equal t0

(A) A

(B) A^{-1}

(C) $\frac{1}{|A|}A$

(D) $|A|A$

(E) $\frac{1}{|A|}A^{-1}$

12. If $\begin{vmatrix} x-y-z \\ -y+z \\ z \end{vmatrix} = \begin{vmatrix} 0 \\ 5 \\ 3 \end{vmatrix}$, then the values of x, y and z are respectively

(A) 5, 2, 2

(B) 1, −2, 3

(C) 0, −3, 3

(D) 11, 8, 3

(E) 4, 1, 3

13. Which one of the following is true always for any two non-singular matrices A and B of same order?

(A) $AB = BA$

(B) $(AB)^t = A^tB^t$

(C) $(A + B)(A - B) = A^2 - B^2$

(D) $(AB)^{-1} = B^{-1}A^{-1}$

(E) $AB = -BA$

14. The solution set of the inequation $\frac{x=11}{x-3} > 0$ is

(A) $(-\infty, -11) \cup (3, \infty)$

(B) $(-\infty, -10) \cup (2, \infty)$

(C) $(-100, -11) \cup (1, \infty)$

(D) $(0, 5) \cup (-1, 0)$

(E) $(-5, 0) \cup (3, 7)$

15. If $3 \leq 3t - 18 \leq 18$, then which one of the following is true?

(A) $15 \leq 2t + 1 \leq 20$

(B) $8 \leq t < 12$

(C) $8 \leq t + 1 \leq 13$

(D) $21 \leq 3t \leq 24$

(E) $t \leq 7$ or $t \geq 12$

16. Let p : 7 is not greater than 4 and

q : Paris is in France

be two statements.

Then $\sim(p \vee q)$ is the statement

(A) 7 is greater than 4 or Paris is not in France

(B) 7 is not greater than 4 and Paris is not in France

(C) 7 is greater than 4 or Paris is in France

(D) 7 is not greater than 4 or Paris is not in France

(E) 7 is greater than 4 and Paris is not in France

17. If $S(p, q, r) = (\sim p) \vee [\sim(q \vee r)]$ is a compound statement, then $S(\sim p, \sim q, \sim r)$ is

(A) $\sim S(p, q, r)$

(B) $S(p, q, r)$

(C) $p \vee (q \wedge r)$

(D) $p \vee (q \vee r)$

(E) $S(p, q, \sim r)$

18. For any two statements p and q, $\sim (p \vee q) \vee (\sim p \wedge q)$ is logically equivalent to

(A) p

(B) $\sim p$

(C) q

(D) $\sim q$

(E) $p \vee q$

19. If tan $\alpha = \frac{b}{a}$, a > b > 0 and if $0 < \alpha < \frac{\pi}{4}$, then $\sqrt{\frac{a+b}{a-b}} - \sqrt{\frac{a-b}{a+b}}$ is equal to

(A) $\frac{2\sin\alpha}{\sqrt{\cos 2\alpha}}$

(B) $\frac{2\cos\alpha}{\sqrt{\cos 2\alpha}}$

(C) $\frac{2\sin\alpha}{\sqrt{\sin 2\alpha}}$

(D) $\frac{2\cos\alpha}{\sqrt{\sin 2\alpha}}$

(E) $\frac{2\tan\alpha}{\sqrt{\cos 2\alpha}}$

20. If $\tan^{-1}(x + 2) + \tan^{-1}(x - 2) - \tan^{-1}\left(\frac{1}{2}\right) = 0$, then one of the values of x is equal to

(A) −1

(B) 5

(C) [redacted]

(D) 1

(E) $\frac{-1}{2}$

21. If $\alpha, \beta \in \left(0, \frac{\pi}{2}\right)$, sin α = $\frac{4}{5}$ and cos $(\alpha + \beta)$ = $\frac{-12}{13}$, then sin β is equal to

(A) $\frac{63}{65}$

(B) $\frac{61}{65}$

(C) $\frac{3}{5}$

(D) $\frac{5}{13}$

(E) $\frac{8}{65}$

22. The number of solutions of cos2θ = sinθ in (0,2π) is

(A) 1

(B) 2

(C) 3

(D) 4

(E) 0

23. The value of $\sin^{-1}\left(\frac{4}{5}\right)+2\tan^{-1}\left(\frac{1}{3}\right)$ is equal to

(A) $\frac{\pi}{3}$

(B) $\frac{\pi}{4}$

(C) $\frac{\pi}{2}$

(D) $\frac{\pi}{6}$

(E) $\frac{\pi}{12}$

24. The value of tan 40° + tan 20° + √3 tan 20° is equal to

(A) √12

(B) $\frac{\sqrt{3}}{2}$

(C) 1

(D) $\frac{\sqrt{3}}{2}$

(E) √3

25. The period of the function $f(\theta) = 4 + 4\sin^3\theta - 3\sin\theta$ is

(A) $\frac{2\pi}{3}$

(B) $\frac{\pi}{3}$

(C) $\frac{\pi}{2}$

(D) π

(E) 2π

26. The value of x in $\left(0, \frac{\pi}{2}\right)$ satisfying the equation $\sin x \cos x = \frac{1}{4}$ is

(A) $\frac{\pi}{6}$

(B) $\frac{\pi}{3}$

(C) $\frac{\pi}{8}$

(D) $\frac{\pi}{4}$

(E) $\frac{\pi}{12}$

27. The value of $\sin^{-1}(\cos(4095°))$ is equal to

(A) $\frac{-\pi}{3}$

(B) $\frac{\pi}{6}$

(C) $\frac{-\pi}{4}$

(D) $\frac{\pi}{4}$

(E) $\frac{\pi}{2}$

28. If *the distance between (2, 3) and −5, 2) is equal to the distance between (x, 2) and (1, 3), then the values of x are*

(A) −6, 8

(B) 6, 8

(C) −8, 6

(D) −7, 7

(E) −8, −6

29. The line segment joining the points (4, 7) and (−2, −1) is a diameter of a circle. If the cirle intersects the x − axis at A and B, then AB is equal to

(A) 4

(B) 5

(C) 6

(D) 7

(E) 8

30. If the three points (0, 1), (0, −1) and (x, 0) are vertices of an equilateral triangle, then the values of x are

(A) $\sqrt{3}$, $\sqrt{2}$

(B) $\sqrt{3}$, $-\sqrt{3}$

(C) $-\sqrt{5}$, $\sqrt{3}$

(D) $\sqrt{2}$, $-\sqrt{2}$

(E) $\sqrt{5}$, $-\sqrt{5}$

31. The area of the triangle formed by the points (2, 2), (5, 5), (6, 7) is equal to (in square units)

(A) $\frac{9}{2}$

(B) 5

(C) 10

(D) $\frac{3}{2}$

(E) 14

32. If the line $px - qy = r$ intersects the co-ordinates axes at $(a, 0)$ and $(0, b)$, then the value of $a + b$ is equal to

(A) $r\left(\frac{q+p}{pq}\right)$

(B) $r\left(\frac{q-p}{pq}\right)$

(C) $r\frac{(p-q)}{pq}$

(D) $r\left(\frac{p+q}{p-q}\right)$

(E) $r\left(\frac{p-q}{p+q}\right)$

33. The vertices of a triangle are $A(3, 7)$, $B(3, 4)$ and $C(5, 4)$. The equation of the bisector of the angle $\angle ABC$ is

(A) $y = x + 1$

(B) $y = x - 1$

(C) $y = 3x - 5$

(D) $y = x$

(E) $y = -x$

34. The equation of a straight line which passes through the point $(a\cos^3\theta, a\sin^3\theta)$ and perpendicular to $x \sec\theta + y \operatorname{cosec}\theta = a$ is

(A) $\frac{x}{a} + \frac{y}{a} = a \cos\theta$

(B) $x \cos\theta - y \sin\theta = a \cos2\theta$

(C) $x \cos\theta + y \sin\theta = a \cos2\theta$

(D) $x \cos\theta + y \sin\theta - a \cos2\theta = 1$

(E) $x \cos\theta - y \sin\theta + a \cos2\theta = -1$

35. The slopes of the lines which make an angle 45° with the line $3x - y = -5$ are

(A) 1, −1

(B) , −1

(C) 1,

(D) 2, $-\frac{1}{2}$

(E) −2,

36. The equation of one of the lines parallel to $4x + 3y = 5$ and at a unit distance from the point (−1, −4) is

(A) $3x + 4y - 3 = 0$

(B) $3x + 4y + 3 = 0$

(C) $4x - 3y + 3 = 0$

(D) $4x - 3y - 3 = 0$

(E) $4x - 3y - 4 = 0$

37. The equation of family of circles with centre at (h, k) touching the x – aix is given by

(A) $x^2 + y^2 - 2hx + h^2 = 0$

(B) $x^2 + y^2 - 2hx - 2ky + h^2 = 0$

(C) $x^2 + y^2 - 2hx - 2ky - h^2 = 0$

(D) $x^2 + y^2 - 2hx - 2ky = 0$

(E) $x^2 + y^2 + 2hx + 2ky = 0$

38. If two circles $(x + 7)^2 + (y - 3)^2 = 36$ and $(x - 5)^2 + (y + 2)^2 = 49$ touch each other externally, then the point of contact is

(A) $\left(\frac{-19}{13}, \frac{19}{13}\right)$

(B) $\left(\frac{-19}{13}, \frac{9}{13}\right)$

(C) $\left(\frac{17}{13}, \frac{9}{13}\right)$

(D) $\left(\frac{-17}{13}, \frac{9}{13}\right)$

(E) $\left(\frac{19}{13}, \frac{19}{13}\right)$

39. The equation of the chord of the circle $x^2 + y^2 = 81$ which is bisected at the point (−2, 3) is
    (A) $3x - y = 13$
    (B) $3x - 4y = 13$
    (C) $2x - 3y = 13$
    (D) $3x - 3y = 13$
    (E) $2x - 3y = -13$

40. The distance of the midpoint of line joining two points (4, 0) and (0, 4) from the centre of the circle $x^2 + y^2 = 16$ is
    (A) $\sqrt{2}$
    (B) $2\sqrt{2}$
    (C) $3\sqrt{2}$
    (D) $2\sqrt{3}$
    (E) $\sqrt{3}$

41. One of the points on the parabola $y^2 = 12x$ with focal distance 12, is
    (A) (3, 6)
    (B) $(9, 6\sqrt{3})$
    (C) $(7, 2\sqrt{21})$
    (D) $(8, 4\sqrt{6})$
    (E) $(1, \sqrt{12})$

42. If the length of the major axis of an ellipse is $\frac{17}{8}$ times the length of the mirror axis, then the eccentricity of the ellipse is

(A) $\frac{8}{17}$

(B) $\frac{15}{17}$

(C) $\frac{9}{17}$

(D) $\frac{2\sqrt{2}}{17}$

(E) $\frac{13}{17}$

43. If a point $P(x, y)$ moves along the ellipse $\frac{x^2}{25}+\frac{y^2}{16} = 1$ and if C is the centre of the ellipse, then the sum of maximum and minimum values of CP is

(A) 25

(B) 9

(C) 4

(D) 5

(E) 16

44. The distance between the foci of the conic $7x^2 - 9y^2 = 63$ is equal to

(A) 8

(B) 4

(C) 3

(D) 7

(E) 12

45. If $|\vec{a}| = 5$, $|\vec{b}| = 6$ and $\vec{a}.\vec{b} = -25$, then $|\vec{a}\times\vec{b}|$ is equal to

(A) 25

(B) 6√11

(C) 11√5

(D) 11√6

(E) 5√11

46. If $\vec{p}$, $\vec{q}$ and $\vec{r}$ are perpendicular to $\vec{q}+\vec{r}$, $\vec{r}+\vec{p}$ and $\vec{p}+\vec{q}$ respectively and if $|\vec{p}+\vec{q}| = 6$, $|\vec{q}+\vec{r}| = 4\sqrt{3}$ and $|\vec{r}+\vec{p}| = 4$ then $|\vec{p}+\vec{q}+\vec{r}|$

(A) 5√2

(B) 10

(C) 15

(D) 5

(E) 25

47. The vectors of magnitude *a*, 2*a*, 3*a* meet at a point and their directions are along the diagonals of three adjacent faces of a cube. Then the magnitude of their resultant is

(A) 5*a*

(B) 6*a*

(C) 10*a*

(D) 9*a*

(E) 7*a*

48. Which one of the following vectors is of magnitude 6 and perpendicular to both $\vec{a} = 2\hat{i}+2\hat{j}+\hat{k}$ and $\vec{b} = \hat{i}-2\hat{j}+\hat{k}$

(A) $2\hat{i}-\hat{j}-2\hat{k}$

(B) $2\left(2\hat{i}-\hat{j}+2\hat{k}\right)$

(C) $3\left(2\hat{i}-\hat{j}-2\hat{k}\right)$

(D) $2\left(2\hat{i}+\hat{j}-2\hat{k}\right)$

(E) $2\left(2\hat{i}-\hat{j}-2\hat{k}\right)$

49. If the vectors $\vec{a}=2\hat{i}+\hat{j}+4\hat{k}$, $\vec{b}=4\hat{i}-2\hat{j}+3\hat{k}$ and $\vec{c}=2\hat{i}-3\hat{j}-\lambda\hat{k}$ are coplanar, then the value of λ is equal to

(A) 2

(B) 1

(C) 3

(D) −1

(E) 0

50. Let $A(1, -1, 2)$ and $B(2, 3, -1)$ be two points. If a point P divides AB internally in the ratio 2:3, then the position vector of P is

(A) $\frac{1}{\sqrt{5}}\left(\hat{i}+\hat{j}+\hat{k}\right)$

(B) $\frac{1}{\sqrt{3}}\left(\hat{i}+6\hat{j}+\hat{k}\right)$

(C) $\frac{1}{\sqrt{3}}\left(\hat{i}+\hat{j}+\hat{k}\right)$

(D) $\frac{1}{\sqrt{5}}\left(\hat{i}+\hat{j}+9\hat{k}\right)$

(E) $\frac{1}{5}\left(7\hat{i}+3\hat{j}+4\hat{k}\right)$

51. If the scalar product of the vector $\hat{i}+\hat{j}+2\hat{k}$ with the unit vector along $m\hat{i}+2\hat{j}+3\hat{k}$ is equal to 2, then one of the values of m is

(A) 3

(B) 4

(C) 5

(D) 6

(E) 7

52. A plane makes intercepts *a*, *b*, *c* at *A*, *B*, **C** on the coordinate axes respectively. If the centre of the triangle *ABC* is at (3, 2, 1), then the equation of the plane is

(A) $x + 2y + 3z = 9$

(B) $2x - 2y - 6z = 18$

(C) $2x + 2y + 6z = 18$

(D) $2x + 2y + 6z = 18$

(E) $2x + 2y + 6z = 9$

53. If the plane $3x + y + 2z + 6 = 0$ is parallel to the line $\frac{3x-1}{2b} = 3 - y = \frac{z-1}{a}$

(A)

(B) $\frac{3}{2}$

(C) 3

(D) 4

(E) $\frac{5}{2}$

54. The equation of the line passing through the point (3, 0, –4) and perpendicular to the plane $2x - 3y + 5z - 7 = 0$ is

(A) $\frac{x-2}{3} = \frac{y}{-3} = \frac{z+4}{5}$

(B) $\frac{x-3}{2} = \frac{y}{-3} = \frac{z-4}{5}$

(C) $\frac{x-3}{2} = \frac{-y}{3} = \frac{z+4}{5}$

(D) $\frac{x+3}{2} = \frac{y}{3} = \frac{z-4}{5}$

(E) $\frac{x-2}{3} = \frac{y}{3} = \frac{z+4}{5}$

55. The plane $\vec{r} = s\left(\hat{i} + 2\hat{j} - 4\hat{k}\right) + t\left(3\hat{i} + 4\hat{j} - 4\hat{k}\right) + (1-t)\left(2\hat{i} - 7\hat{j} - 3\hat{k}\right)$ is parallel to the line

(A) $\vec{r} = \left(-\hat{i} + \hat{j} - \hat{k}\right) + t\left(-\hat{i} - 2\hat{j} + 4\hat{k}\right)$

(B) $\vec{r} = \left(-\hat{i} + \hat{j} - \hat{k}\right) + t\left(\hat{i} - 2\hat{j} + 4\hat{k}\right)$

(C) $\vec{r} = \left(\hat{i} + \hat{j} - \hat{k}\right) + t\left(-\hat{i} - 4\hat{j} + 7\hat{k}\right)$

(D) $\vec{r} = \left(-\hat{i} + \hat{j} - \hat{k}\right) + t\left(-2\hat{i} + 2\hat{j} + 4\hat{k}\right)$

(E) $\vec{r} = \left(-\hat{i} + \hat{j} - 3\hat{k}\right) + t\left(2\hat{i} + 6\hat{j} - 8\hat{k}\right)$

56. The distance between the line $\vec{r} = \left(2\hat{i} + 2\hat{j} - \hat{k}\right) + \lambda\left(2\hat{i} + \hat{j} - 2\hat{k}\right)$ and the plane $\vec{r}.\left(\hat{i} + 2\hat{j} + 2\hat{k}\right) = 10$ is equal to

(A) 5

(B) 4

(C) 3

(D) 2

(E) 1

57. Equation of the plane passing through the intersection of the planes $x + y + z = 6$ and $2x + 3y + 4z + 5 = 0$ and the point (1, 1, 1) is

(A) $20x + 23y + 26z - 69 = 0$

(B) $31x + 45y + 49z + 52 = 0$

(C) $8x + 5y + 2z - 69 = 0$

(D) $4x + 5y + 6z - 7 = 0$

(E) $x + y + 2z + 17 = 0$

58. The equation of the plane containing the lines $\frac{x-1}{2} = \frac{y+1}{-1} = \frac{z}{3}$ and $\frac{x}{2} = \frac{y-2}{-1} = \frac{z+1}{3}$ is

(A) $8x - y + 5z - 8 = 0$

(B) $8x + y - 5z - 7 + = 0$

(C) $x - 8y + 3z + 6 = 0$

(D) $8x + y - 5z + 7 = 0$

(E) $x + y + z - 6 = 0$

59. The vector equation of the straight line $\frac{1-x}{3}=\frac{y+1}{-2}=\frac{3-z}{-1}$

(A) $\vec{r}=\left(\hat{i}-\hat{j}+3\hat{k}\right)+\lambda\left(3\hat{i}+2\hat{j}-\hat{k}\right)$

(B) $\vec{r}=\left(\hat{i}-\hat{j}+3\hat{k}\right)+\lambda\left(3\hat{i}-2\hat{j}-\hat{k}\right)$

(C) $\vec{r}=\left(3\hat{i}-2\hat{j}-\hat{k}\right)+\lambda\left(\hat{i}-\hat{j}+3\hat{k}\right)$

(D) $\vec{r}=\left(3\hat{i}+2\hat{j}-\hat{k}\right)+\lambda\left(\hat{i}-\hat{j}+3\hat{k}\right)$

(E) $\vec{r}=\left(\hat{i}-\hat{j}+3\hat{k}\right)+\lambda\left(3\hat{i}+2\hat{j}+\hat{k}\right)$

60. The arithmetic mean of 7 consecutive integers starting with '*a*' is *m*. Then the arithmetic mean of 11 consecutive integers starting with '*a* + 2' is

(A) 2*a*

(B) 2*m*

(C) *a* + 4

(D) *m* + 4

(E) *a* + *m* + 2

61. The probability distribution of a random variable *X* is given by

x	−5	−4	−3	−2	−1	0	1	2	3	4	5
P(X=x)	*p*	2*p*	3*p*	4*p*	5*p*	7*p*	8*p*	9*p*	10*p*	11*p*	12*p*

62.

Then the value of *P* is

(A) $\frac{1}{72}$

(B) $\frac{3}{73}$

(C) $\frac{5}{72}$

(D) $\frac{1}{74}$

(E) $\frac{1}{73}$

63. The mean and variance of n observations $x_1, x_2, x_3, \ldots, x_n$ are 5 and 0 respectively. If $\sum_{i=1}^{n} x_i^2 = 400$, then the value of n is equal to

(A) 80

(B) 25

(C) 20

(D) 16

(E) 4

64. If A and B are mutually exclusive events and if $P(B) = \frac{1}{3}$, $P(A \cup B) = \frac{13}{21}$, then $P(A)$ is equal to

(A) $\frac{1}{7}$

(B) $\frac{4}{7}$

(C) $\frac{2}{7}$

(D) $\frac{5}{7}$

(E) $\frac{6}{7}$

65. If f is a real valued function such that $f(x + y) = f(x) + f(y)$ and $f(1) = 5$, then the value of $f(100)$ is

(A) 200

(B) 300

(C) 350

(D) 400

(E) 500

66. Let $f(x) = \dfrac{\left(e^{x}-1\right)^{2}}{\sin\left(\dfrac{x}{a}\right)\log\left(1+\dfrac{x}{4}\right)}$ for $x \neq 0$, and $f(0) = 12$. If f is continuous at $x = 0$, then the value of a is equal to

(A) 1

(B) −1

(C) 2

(D) −2

(E) 3

67. $\lim\limits_{x\to 0}\left(\dfrac{x}{\sqrt{1+x}-\sqrt{1-x}}\right)$ is equal to

(A) 0

(B) 1

(C) 2

(D) −1

(E) −2

68. $\lim\limits_{x\to 0}\left(\dfrac{x^{3}}{3x^{2}-4}-\dfrac{x^{2}}{3x+2}\right)$ is equal to

(A) $-\dfrac{1}{4}$

(B) $-\dfrac{1}{2}$

(C) 0

(D) $\frac{2}{9}$

(E) $\frac{-6}{5}$

69. If x^y = $e^{2(x-y)}$, then $\frac{dy}{dx}$ is equal to

(A) $\frac{2(1+\log x)}{(2+\log x)^2}$

(B) $\frac{1+\log x}{(2+\log x)^2}$

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

(D) $\frac{2(1-\log x)}{(2+\log x)^2}$

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

70. If y = $\sin^{-1} \sqrt{1-x}$, then $\frac{dy}{dx}$ is equal to

(A) $\frac{1}{\sqrt{1-x}}$

(B) $\frac{-1}{2\sqrt{1-x}}$

(C) $\frac{1}{\sqrt{x}}$

(D) $\frac{-1}{2\sqrt{x}\sqrt{1-x}}$

(E) $\frac{1}{\sqrt{x}\sqrt{1-x}}$

71. The derivative of $\sin^{-1}\left(2x\sqrt{1-x^2}\right)$ with respect to $\sin^{-1}(3x - 4x^3)$ is

(A) $\frac{2}{3}$

(B) $\frac{3}{2}$

(C)

(D) 1

(E) 0

72. If $y = \tan^{-1}x + \sec^{-1}x + \cot^{-1}x + \mathrm{cosec}^{-1}x$, then $\frac{dy}{dx} =$

(A) $\frac{x^2-1}{x^2+1}$

(B) π

(C) 0

(D) 1

(E) $\frac{1}{x\sqrt{x^2+1}}$

73. If $f(x) = |x-2| + |x+1| - x$, then $f^{-1}(-10)$ is equal to

(A) −3

(B) −2

(C) −1

(D) 0

(E) 1

74. If x = $a(1 + \cos\theta)$, $y = a(\theta + \sin\theta)$, then $\frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{2}$ is

(A) $\frac{-1}{a}$

(B) $\frac{1}{a}$

(C) —1

(D) –2

(E) $\frac{-2}{a}$

75. If $y = \tan^{-1}\left(\frac{\cos x}{1+\sin x}\right)$, then $\frac{dy}{dx}$ is equal to

(A)

(B) 2

(C) –2

(D) $\frac{-1}{2}$

(E) –1

76. The distance between the origin and the normal to the curve $y = e^{2x} + x^2$ at $x = 0$ is

(A) 2

(B) $\frac{2}{\sqrt{3}}$

(C) $\frac{2}{\sqrt{5}}$

(D)

(E) $\frac{1}{\sqrt{5}}$

77. The value of c in (0, 2) satisfying the mean value theorem for the function $f(x) = x(x-1)^2$, $x \in [0, 2]$ is equal to

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

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

(C) $\frac{1}{3}$

(D) $\frac{2}{3}$

(E) $\frac{5}{3}$

78. The point on the curve $x^2 + y^2 = a^2$, $y \geq 0$ at which the tangent is parallel to x–axis is

(A) $(a, 0)$

(B) $(-a, 0)$

(C) $\left(\frac{a}{2}, \frac{\sqrt{3}}{2}a\right)$

(D) $(0, a)$

(E) $(0, a^2)$

79. The angle between the curves, $y = x^2$ and $y^2 - x = 0$ at the point (1, 1), is

(A) $\frac{\pi}{2}$

(B) $\tan^{-1} \frac{4}{3}$

(C) $\frac{\pi}{3}$

(D) $\frac{\pi}{4}$

(E) $\tan^{-1}\frac{3}{4}$

80. An edge of a variable cube is increasing at the rate of 10 cm/sec. How fast the volume of the cube will increase when the edge is 5 cm long?
    (A) 750 cm^3/sec
    (B) 75 cm^3/sec
    (C) 300 cm^3/sec
    (D) 150 cm^3/sec
    (E) 25 cm^3/sec

81. The minimum value of $f(x) = \left|3-x\right|+7$ is
    (A) 0
    (B) 6
    (C) 7
    (D) 8
    (E) 10

82. If the error committed in measuring the radius of the circle is 0.05%, then the corresponding error in calculating the area is
    (A) 0.05%
    (B) 0.0025%
    (C) 0.25%
    (D) 0.1%
    (E) 0.2%

83. If $\int \frac{x+2}{2x^2+6x+5}\,dx = P\int \frac{4x+6}{2x^2+6x+5}\,dx + \frac{1}{2}\int \frac{dx}{2x^2+6x+5}$, then the valus of P is
    (A) $\frac{1}{3}$

(B)

(C) $\frac{1}{4}$

(D) 2

(E) 1

84. $\int (x+1)(x+2)^7(x+3)dx$ is equal to

(A) $\frac{(x+2)^{10}}{10} - \frac{(x+2)^8}{8} + C$

(B) $\frac{(x+1)^2}{2} - \frac{(x+2)^8}{8} - \frac{(x+3)^2}{2} + C$

(C) $\frac{(x+2)^{10}}{10} + C$

(D) $\frac{(x+1)^2}{2} + \frac{(x+2)^8}{8} - \frac{(x+3)^2}{2} + C$

(E) $\frac{(x+2)^9}{9} - \frac{(x+2)^7}{7} + C$

85. $\int (x^2+1)\sqrt{x+1}\, dx$ is equal to

(A) $\frac{(x+1)^{\frac{7}{2}}}{7} - 2\frac{(x+1)^{\frac{5}{2}}}{5} + 2\frac{(x+1)^{\frac{3}{2}}}{3} + C$

(B) $2\left[\frac{(x+1)^{\frac{7}{2}}}{7} - 2\frac{(x+1)^{\frac{5}{2}}}{5} + 2\frac{(x+1)^{\frac{3}{2}}}{3}\right] + C$

(C) $\frac{(x+1)^{\frac{7}{2}}}{7} - 2\frac{(x+1)^{\frac{5}{2}}}{5} + C$

(D) $$\frac{(x+1)^{\frac{7}{2}}}{7}-3\frac{(x+1)^{\frac{5}{2}}}{5}+11(x+1)^{\frac{1}{2}}+C$$

(E) $$(x+1)^{\frac{7}{2}}+(x+1)^{\frac{5}{2}}+(x+1)^{\frac{3}{2}}+C$$

86. $\int \frac{1+x}{x+e^{-x}}\,dx$ is equal to

(A) $\log\left|\left(x-e^{-x}\right)\right|+C$

(B) $\log\left|\left(x+e^{-x}\right)\right|+C$

(C) $\log\left|\left(1+xe^{x}\right)\right|+C$

(D) $\left(1+xe^{x}\right)^{2}+C$

(E) $\log\left|\left(1-xe^{x}\right)\right|+C$

87. $\int \frac{\log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}}\,dx$ is equal to

(A) $\left[\log\left(x+\sqrt{1+x^2}\right)\right]^2+C$

(B) $x\log\left(x+\sqrt{1+x^2}\right)+C$

(C) $\frac{1}{2}\log\left(x+\sqrt{1+x^2}\right)+C$

(D) $\frac{1}{2}\left[\log\left(x+\sqrt{1+x^2}\right)\right]^2+C$

(E) $\frac{x}{2}\log\left(x+\sqrt{1+x^2}\right)+C$

88. $\int \frac{dx}{\sqrt{1-e^{2x}}}$ is equal to

(A) $\log\left|e^{-x}+\sqrt{e^{-2x}-1}\right|+C$

(B) $\log\left|e^{x}+\sqrt{e^{2x}-1}\right|+C$

(C) $-\log\left|e^{-x}+\sqrt{e^{-2x}-1}\right|+C$

(D) $-\log\left|e^{-2x}+\sqrt{e^{-2x}-1}\right|+C$

(E) $\log\left|e^{-2x}+\sqrt{e^{-2x}-1}\right|+C$

89. $\int \frac{\cos x + x\sin x}{x^2 + x\cos x}\,dx$ is equal to

(A) $\log\left|\frac{\sin x}{1+\cos x}\right|+C$

(B) $\log\left|\frac{\sin x}{x+\cos x}\right|+C$

(C) $\log\left|\frac{2\sin x}{x+\cos x}\right|+C$

(D) $\log\left|\frac{x\sin x}{x+\cos x}\right|+C$

(E) $\log\left|\frac{x}{x+\cos x}\right|+C$

90. The integral $\int_0^1 \frac{2\sin^{-1}\frac{x}{2}}{x}\,dx$ equals

(A) $\int_0^{\frac{\pi}{6}} \frac{xdx}{\tan x}$

(B) $\int_0^{\frac{\pi}{6}} \frac{2x}{\tan x}\,dx$

(C) $\int_0^{\frac{\pi}{2}} \frac{2xdx}{\tan x}$

(D) $\int_0^{\frac{\pi}{6}} \frac{xdx}{\sin x}$

(E) $\int_0^{\frac{\pi}{6}} \frac{2x}{\sin x}\,dx$

91. The area of the plane region bounded by the curve $x = y^2 - 2$ and the line $y = -x$ is (in square units)

(A) $\frac{13}{3}$

(B) $\frac{2}{5}$

(C) $\frac{9}{2}$

(D) $\frac{5}{2}$

(E) $\frac{13}{2}$

92. If $\int_0^a f(2a-x)\,dx = m$ and $\int_0^a f(x)\,dx = n$, then $\int_0^{2a} f(x)\,dx$ is equal to

(A) $2m + n$

(B) $m + 2n$

(C) $m - n$

(D) $n - m$

(E) $m + n$

93. $\int_{-100}^{100} f(x)\,dx$ is equal to

(A) $\int_{-100}^{100} f(x^2)\,dx$

(B) $\int_{-100}^{100} f(-x^2)\,dx$

(C) $\int_{-100}^{100} f\left(\frac{1}{x}\right)dx$

(D) $\int_{-100}^{100} f(-x)dx$

(E) $\int_{-100}^{100} \left[f(x)+f(-x)\right]dx$

94. $\int_{-1}^{1} \left(e^{x^3}+e^{-x^3}\right)\left(e^{x}-e^{-x}\right)dx$ is equal to

(A) $\frac{e^2}{2} - 2e$

(B) $e^2 - 2e$

(C) $2(e^2 - e)$

(D) $2e^{-2}$ – $2e$

(E) 0

95. The family of curves $y = e^{a\sin x}$, where a is an arbitrary constant, is represented by the differential equation

(A) $\log y = \tan x \frac{dy}{dx}$

(B) $y \log y = \tan x \frac{dy}{dx}$

(C) $y \log y = \sin x \frac{dy}{dx}$

(D) $\log y = \cos x \frac{dy}{dx}$

(E) $y \log y = \cos x \frac{dy}{dx}$

96. The integrating factor of $x\frac{dy}{dx} + (1+x)y = x$ is

(A) x

(B) $2x$

(C) $e^{x\log x}$

(D) e^x

(E) xe^x

97. The degree and order of the differential equation $y = px + \sqrt[3]{a^2p^2 + b^2}$, where $p = \frac{dy}{dx}$, are

(A) 3,1

(B) 1, 3

(C) 1, 1

(D) 3, 3

(E) 3, 2

98. The solution of the differential equation $\frac{dy}{dx} + 1 = e^{x+y}$ is

(A) $x + e^{x+y} = C$

(B) $x - e^{x+y} = C$

(C) $x + e^{-(x+y)} = C$

(D) $x - e^{-(x+y)} = C$

(E) $xe^{x+y} + y = C$

99. Let $f(x) = \frac{\alpha x^2}{x+1}, x \neq -1$. The value of α for which $f(a) = a$, $(a \neq 0)$ is

(A) $1 - \frac{1}{a}$

(B) $\frac{1}{a}$

(C) $1 + \frac{1}{a}$

(D) $\frac{1}{a} - 1$

(E) $\frac{-1}{a}$

100. For $a, b \in R$, define $a*b = \frac{a}{a+b}$, where $a+b \neq 0$. If $a*b = 5$, then the value of $b*a$ is

(A) 5

(B) −5

(C) 4

(D) −7

(E) −4

101. Let A = {x, y, z} and B = {a, b, c, d}. Which one of the following is not a relation

from A to B?

(A) {(x, a), (x, c)}

(B) {(y, c), (y, d)}

(C) {(z, a), (z, d)}

(D) {(z, b), (y, b), (a, d)}

(E) {(x, c)}

102. The domain of $\sin^{-1}\left[\log_2\left(\frac{x}{12}\right)\right]$ is

(A) [2, 12]

(B) [−1, 1]

(C) $\left[\frac{1}{3}, 24\right]$

(D) $\left[\frac{2}{3}, 24\right]$

(E) [6, 24]

103. If $f(x) = x^2 - 1$ and $g(x) = (x + 1)^2$, then $(g \circ f)(x)$ is

(A) $(x+1)^4-1$

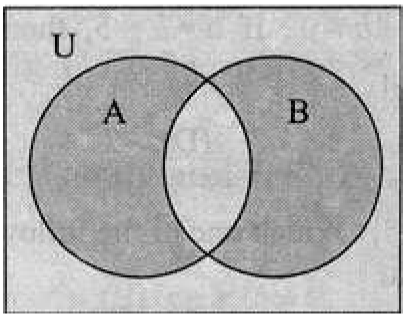
(B) x^4-1

(C) x^4

(D) $(x+1)^4$

(E) $(x-1)^4-1$

104. The shaded region in the figure represents



(A) $A \cap B$

(B) $A \cup B$

(C) $B - A$

(D) $A - B$

(E) $(A - B) \cup (B - A)$

105. If $(x+iy)^{\frac{1}{3}}$ = 2 + 3i, then 3x + 2y is equal to

(A) −20

(B) −60

(C) −120

(D) 60

(E) 156

106. The modulus of the complex number z such that $\left|z+3-i\right|=1$ and arg z = π

is equal to

(A) 1

(B) 2

(C) 9

(D) 4

(E) 3

107. If z_1, z_2, ... , z_n are complex numbers such that $\left|z_1\right| = \left|z_2\right| = \ldots = \left|z_n\right| = 1$, then $\left|z_1 + z_2 + \ldots + z_n\right|$ is equal to

(A) $\left|z_1 z_2 z_3 \ldots z_n\right|$

(B) $\left|z_1\right| + \left|z_2\right| + \ldots + \left|z_n\right|$

(C) $\left|\frac{1}{z_1} + \frac{1}{z_2} + \ldots + \frac{1}{z_n}\right|$

(D) n

(E) $\sqrt{n}$

108. The value of $\frac{\cos 30^o + i \sin 30^o}{\cos 60^o - i \sin 60^o}$ is equal to

(A) i

(B) $-i$

(C) $\frac{1+\sqrt{3}i}{2}$

(D) $\frac{1-\sqrt{3}i}{2}$

(E) $1+i$

109. If $z = r(\cos\theta + i\sin\theta)$, then the value of $\frac{z}{\bar{z}} + \frac{\bar{z}}{z}$

(A) $\cos 2\theta$

(B) $2 \cos 2\theta$

(C) $2 \cos \theta$

(D) $2 \sin \theta$

(E) $2 \sin 2\theta$

110. If $z_1 = \sqrt{2}\left(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}\right)$ and $z_2 = \sqrt{3}\left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right)$, then $|z_1 z_2|$ is

(A) 6

(B) √2

(C) √6

(D) √3

(E) √2 + √3

111. The value of *a* for which the equation $2x^2 + 2\sqrt{6}x + a = 0$ has equal roots, is

(A) 3

(B) 4

(C) 2

(D) √3

(E) √2

112. If $\frac{3}{2} + \frac{7}{2}i$ is a solution of the equation $ax^2 - 6x + b = 0$ where *a* and *b* are real numbers, then the value of *a* + *b* is equal to

(A) 10

(B) 22

(C) 30

(D) 29

(E) 31

113. If the roots of the equation $x^2 - bx + c = 0$ are two consecutive integers, then $b^2 - 4c$ is

(A) −1

(B) 0

(C) 1

(D) 2

(E) 3

114. If α and β are the roots of the equation $ax^2 + bx + c = 0$, ($c \neq 0$), then the equation whose roots are $\frac{1}{a\alpha + b}$ and $\frac{1}{a\beta + b}$ is

(A) $acx^2 - bx + 1 = 0$

(B) $x^2 - acx + bc + 1 = 0$

(C) $acx^2 + bx - 1 = 0$

(D) $x^2 + acx - bc + 11 = 0$

(E) $acx^2 - bx - 11 = 0$

115. If a and b are the roots of the equation $x^2 + ax + b = 0$, $a \neq 0$, $b \neq 0$, then the values of a and b are respectively

(A) 2 and −2

(B) 2 and −1

(C) 1 and −2

(D) 1 and 2

(E) −1 and 2

116. If $x^2 + px + q = 0$, has the roots α and β, then the value of $(\alpha - \beta)^2$ is equal to

(A) $p^2 - 4q$

(B) $(p^2 - 4q)^2$

(C) $p^2 + 4q$

(D) $(p^2 + 4q)^2$

(E) $q^2 - 4p$

117. If the sum to first n terms of the A.P. 2, 4, 6, ... is 240, then the value of n is

(A) 14

(B) 15

(C) 16

(D) 17

(E) 18

118. The value of

$$\frac{1}{\sqrt{10}-\sqrt{9}}-\frac{1}{\sqrt{11}-\sqrt{10}}+\frac{1}{\sqrt{12}-\sqrt{11}}-\ldots-\frac{1}{\sqrt{121}-\sqrt{120}}$$

is equal to

(A) −10

(B) 11

(C) 14

(D) 13

(E) −8

119. An A.P. consists of 23 terms. If the sum of the three terms in the middle is 141 and the sum of the last three terms is 261, then the first term is

(A) 6

(B) 5

(C) 4

(D) 3

(E) 2

120. If $a_1, a_2, a_3, \ldots, a_n$ are in A.P. with common difference 5 and if $a_i a_j \neq -1$ for $i,j = 1,2,\ldots,n$,

then $\tan^{-1}\left(\frac{5}{1+a_1a_2}\right)+\tan^{-1}\left(\frac{5}{1+a_2a_3}\right)+\ldots+\tan^{-1}\left(\frac{5}{1+a_{n-1}a_n}\right)$

is equal to

(A) $\tan^{-1}\left(\frac{5}{1+a_na_{n-1}}\right)$

(B) $\tan^{-1}\left(\frac{5a_1}{1+a_na_1}\right)$

(C) $\tan^{-1}\left(\frac{5n-5}{1+a_na_1}\right)$

(D) $\tan^{-1}\left(\frac{5n-5}{1+a_1a_{n+1}}\right)$

(E) $\tan^{-1}\left(\frac{5n}{1+a_1a_n}\right)$

121. The sum of all two digit natural numbers which leave a remainder 5 when they are divided by 7 is equal to

(A) 715

(B) 702

(C) 615

(D) 602

(E) 589