Consortium of Medical Engineering and Dental Colleges of Karnataka
(COMEDK-2005)

MATHEMATICS

1. The sum to infinity of the progression $9 - 3 + 1 - \frac{1}{3} + \ldots\ldots\ldots\ldots$ is

1) 9
2) $\frac{9}{2}$
3) $\frac{27}{4}$
4) $\frac{15}{2}$

2. If ${}^{n}C_{12} = {}^{n}C_{6}$ then ${}^{n}C_{2} = \ldots\ldots\ldots\ldots\ldots$

1) 72
2) 153
3) 306
4) 2556

3. The middle term in the expansion of $\left(x - \frac{1}{x}\right)^{18}$ is ....

1) ${}^{18}C_{9}$
2) $-{}^{18}C_{9}$
3) ${}^{18}C_{10}$
4) $-{}^{18}C_{10}$

4. If α, β, γ are the roots of the equation $2x^3 - 3x^2 + 6x + 1 = 0$, then $\alpha^2 + \beta^2 + \gamma^2$ is equal to ....

1) $\frac{15}{4}$
2) $\frac{15}{4}$
3) $\frac{9}{4}$
4) 4

5. The digit in the units place in the number 7^{289} is ....

1) 9
2) 7
3) 1
4) 3

6. When 2^{301} is divided by 5, the least positive remainder is ....

1) 4   2) 8

3) 2   4) 6

7. The contrapositive of "If two triangles are identical, then these are similar" is ....

1) If two triangles are not similar then these are not identical.
2) If two triangles are not identical then these are not similar.
3) If two triangles are not identical then these are similar.
4) If two triangles are not similar then these are identical.

8. The contrapositive of the inverse of $p \to \sim q$ is ....

1) $\sim q \to p$ 2) $p \to q$

3) $\sim q \to \sim p$ 4) $\sim p \to \sim q$

9. The converse of the contrapositive of $p \to q$ is ......

1) $\sim p \to q$ 2) $p \to \sim q$

3) $\sim p \to \sim q$ 4) $\sim q \to p$

10. If ω is a complex cube-root of unity then, $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \end{vmatrix}$ is equal to ....

1) -1 2) 1

3) 0   4) ω

11. The solutions of the equation $\begin{vmatrix} x & 2 & -1 \\ 2 & 5 & x \\ -1 & 2 & x \end{vmatrix} = 0$ are ....

1) 3, – 1
2) – 3, 1
3) 3, 1
4) – 3 , – 1

12. If $A = \begin{bmatrix} 3 & 5 \\ 2 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 17 \\ 0 & -10 \end{bmatrix}$ then, $|AB|$ is equal to ....

1) 80
2) 100
3) – 110
4) 92

13. The inverse of the matrix $\begin{bmatrix} 5 & -2 \\ 3 & 1 \end{bmatrix}$ is ....

1) $\frac{1}{11}\begin{bmatrix} 1 & 2 \\ -3 & 5 \end{bmatrix}$
2) $\begin{bmatrix} 1 & 2 \\ -3 & 5 \end{bmatrix}$
3) $\frac{1}{13}\begin{bmatrix} -2 & 5 \\ 1 & 3 \end{bmatrix}$
4) $\begin{bmatrix} 1 & 3 \\ -2 & 5 \end{bmatrix}$

14. The projection of the vector $2\hat{i} + \hat{j} - 3\hat{k}$ on the vector $\hat{i} - 2\hat{j} + \hat{k}$ is ....

1) $-\frac{3}{\sqrt{14}}$
2) $\frac{3}{\sqrt{14}}$
3) $-\sqrt{\frac{3}{2}}$
4) $\frac{3}{\sqrt{2}}$

15. A unit vector perpendicular to the plane containing the vectors $\hat{i} - \hat{j} + \hat{k}$ and $-\hat{i} + \hat{j} + \hat{k}$ is ....

1) $\frac{i - j}{\sqrt{2}}$
2) $\frac{\hat{i} + \hat{k}}{\sqrt{2}}$
3) $\frac{\hat{j} - \hat{k}}{\sqrt{2}}$
4) $\frac{i + j}{\sqrt{2}}$

16. If $\hat{a}, \hat{b}$ and $\hat{c}$ are mutually perpendicular unit vectors, then $\left|\hat{a} + \hat{b} + \hat{c}\right|$ is equal to ....

1) 3 2) $\sqrt{3}$

3) $\sqrt{a^2 + b^2 + c^2}/3$ 4) 1

17. The identity element in the group $M = \left\{\begin{pmatrix} x & x \\ x & x \end{pmatrix} x \in R, x \neq 0\right\}$ with respect to matrix multiplication is ....

1) $\begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$ 2) $\frac{1}{2}\begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$

3) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ 4) $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$

18. In the group $G = \{1, 3, 7, 9\}$ under multiplication modulo 10, the inverse of 3 is ....

1) 1 2) 3

3) 7 4) 9

19. In the group $\{0, 1, 2, 4, 5\}$ under addition modulo 6 a subgroup is ....

1) $\{0, 2, 5\}$ 2) $\{1, 4, 5\}$

3) $\{0, 1, 3\}$ 4) $\{0, 2, 4\}$

20. In the group $(Q^+, *)$ of positive rational numbers w.r.t. the binary operation $*$ defined $a * b = \frac{ab}{3} \; \forall \; a, b \in Q^+$ the solution of the equation $5 * x = 4^{-1}$ in Q^+ is ....

1) $\frac{27}{20}$ 2) $\frac{20}{27}$

3) $\frac{1}{20}$ 4) 20

21. $(0, -1)$ and $(0, 3)$ are two opposite vertices of a square. The other two vertices are ....

1) $(0, 1), \ (0, -3)$
2) $(3, -1), \ (0, 0)$
3) $(2, 1), \ (-2, 1)$
4) $(2, 2), \ (1, 1)$

22. The equation to the line bisecting the join of $(3, -4)$ and $(5, 2)$ and having its intercepts on the x-axis and the y-axis in the ratio 2 : 1 is ....

1) $x + y - 3 = 0$
2) $2x - y = 9$
3) $x + 2y = 2$
4) $2x + y = 7$

23. The distance between the pair of parallel lines $x^2 + 2xy + y^2 - 8ax - 8ay - 9a^2 = 0$ is ....

1) $2\sqrt{5}\,a$
2) $\sqrt{10}\,a$
3) $10a$
4) $5\sqrt{2}\,a$

24. The equation to the circle with centre $(2, 1)$ and touching the line $3x + 4y = 5$ is ....

1) $x^2 + y^2 - 4x - 2y + 5 = 0$
2) $x^2 + y^2 - 4x - 2y - 5 = 0$
3) $x^2 + y^2 - 4x - 2y + 4 = 0$
4) $x^2 + y^2 - 4x - 2y - 4 = 0$

25. The condition for a line $y = 2x + c$ to touch the circle $x^2 + y^2 = 16$ is ....

1) $c = 10$
2) $c^2 = 80$
3) $c = 12$
4) $c^2 = 64$

26. The two circles $x^2 + y^2 - 2x + 22y + 5 = 0$ and $x^2 + y^2 + 14x + 6y + k = 0$ intersect orthogonally provided k is equal to ....

1) 47
2) -47
3) 49
4) -49

27. The radius of the circle $x^2 + y^2 + 4x + 6y + 13 = 0$ is ....

1) $\sqrt{26}$
2) $\sqrt{13}$
3) $\sqrt{23}$
4) 0

28. The centre of the circle $x = 2 + 3\, Cos\, \theta$, $y = 3\, Sin\, \theta - 1$ is ....

1) $(3, 3)$
2) $(2, -1)$
3) $(-2, 1)$
4) $(-1, 2)$

29. The sum of the focal distances of any point on the conic $\frac{x^2}{25} + \frac{y^2}{16} = 1$ is ....

1) 10
2) 9
3) 41
4) 18

30. The eccentricity of the hyperbola $\frac{x^2}{16} - \frac{y^2}{25} = 1$ is ....

1) $\frac{3}{4}$
2) 5
3) $\frac{\sqrt{41}}{4}$
4) $\frac{\sqrt{41}}{5}$

31. The ends of the latus-rectum of the conic $x^2 + 10x - 16y + 25 = 0$ are ....

1) $(3, -4), (13, 4)$
2) $(-3, -4), (13, -4)$
3) $(3, 4), (-13, 4)$
4) $(5, -8), (-5, 8)$

32. The equation to the hyperbola having its eccentricity 2 and the distance between its foci 8 is ....

1) $\frac{x^2}{12} - \frac{y^2}{4} = 1$
2) $\frac{x^2}{4} - \frac{y^2}{12} = 1$
3) $\frac{x^2}{8} - \frac{y^2}{2} = 1$
4) $\frac{x^2}{16} - \frac{y^2}{9} = 1$

33. The solution of $Sin^{-1} x - Sin^{-1} 2x = \mp \frac{\pi}{3}$ is ....

1) $\pm \frac{1}{3}$
2) $\pm \frac{1}{4}$
3) $\pm \sqrt{3}$
4) $\pm \frac{1}{2}$

34. In a ΔABC if the sides are $a = 3, b = 5$ and $c = 4$, then $Sin \frac{B}{2} + Cos \frac{B}{2}$ is equal to ....

1) $\sqrt{2}$
2) $\frac{\sqrt{3} + 1}{2}$
3) $\frac{\sqrt{3} - 1}{2}$
4) 1

35. The value of $Cos\left(270^0 + \theta\right) Cos\left(90^0 - \theta\right) - Sin\left(270^0 - \theta\right) Cos\theta$ is ....

1) 0
2) -1
3) $\frac{1}{2}$
4) 1

36. If $12\,Cot^2\,\theta - 31\,Cosec\,\theta + 32 = 0$, then the value of $Sin\,\theta$ is ....

1) $\frac{3}{5}$ or 1

2) $\frac{2}{3}$ or $\frac{-2}{3}$

3) $\frac{4}{5}$ or $\frac{3}{4}$

4) $\pm\frac{1}{2}$

37. The circum-radius of the triangle whose sides are 13, 12 and 5 is ....

1) 15

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

3) $\frac{15}{2}$

4) 6

38. If $Tan^{-1}\,x + Tan^{-1}\,y = \frac{\pi}{4}$ then ....

1) $x + y + xy = 1$

2) $x + y - xy = 1$

3) $x + y + xy + 1 = 0$

4) $x + y - xy + 1 = 0$

39. The general solution of $Sin\,x - Cos\,x = \sqrt{2}$, for any integer n is ....

1) $n\pi$

2) $2n\pi + \frac{3\pi}{4}$

3) $2n\pi$

4) $(2n + 1)\pi$

40. The amplitude of $\frac{1 + i\sqrt{3}}{\sqrt{3} + i}$ is ....

1) $\frac{\pi}{3}$

2) $\frac{\pi}{4}$

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

4) $\frac{\pi}{6}$

41. The modulus and amplitude of $\frac{1+2i}{1-(1-i)^2}$ are ....

1) $\sqrt{2}$ and $\frac{\pi}{6}$

2) 1 and 0

3) 1 and $\frac{\pi}{3}$

4) 1 and $\frac{}{4}$

42. The real part of $\frac{1}{1 + Cos\ \theta + i\ Sin\ \theta}$ is ....

1) $\frac{1}{2}$

2) $\frac{1}{2}$

3) $\sqrt{2}$

4) $\frac{1}{\sqrt{2}}$

43. $\lim_{x \to 0} \frac{Tan\ x - Sin\ x}{x^3}$ is equal to ....

1) $\frac{1}{2}$

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

3) 0

4) 1

44. If $y = \frac{e^x + e^{-x}}{e^x - e^{-x}}$ then $\frac{dy}{dx}$ is equal to ....

1) $Sech^2\, x$

2) $Cosech^2\, x$

3) $-\, Sech^2\, x$

4) $-\, Cosech^2\, x$

45. If $f(x) = \begin{cases} \frac{Sin\ 5x}{x^2 + 2x}, & x \neq 0 \\ k + \frac{1}{2}, & x = 0 \end{cases}$ is continuous at $x = 0$,

then the value of k is

1) 1

2) -2

3) 2

4) $\frac{1}{2}$

46. If $y = Tan^{-1} \dfrac{\sqrt{1+x^2} - \sqrt{1-x^2}}{\sqrt{1+x^2} + \sqrt{1-x^2}}$, then $\dfrac{dy}{dx}$ is equal to ....

1) $\dfrac{x^2}{\sqrt{1-x^4}}$ 2) $\dfrac{x^2}{\sqrt{1+x^4}}$

3) $\dfrac{x}{\sqrt{1+x^4}}$ 4) $\dfrac{x}{\sqrt{1-x^4}}$

47. If $x = Sin\ t,\ y = Cos\ pt$, then

1) $(1-x^2)y_2 + xy_1 + p^2 y = 0$ 2) $(1-x^2)y_2 + xy_1 - p^2 y = 0$

3) $(1+x^2)y_2 - xy_1 + p^2 y = 0$ 4) $(1-x^2)y_2 - xy_1 + p^2 y = 0$

48. If ST and SN are the lengths of the subtangent and the subnormal at the point $\theta = \dfrac{\pi}{2}$ on the curve $x = a(\theta + Sin\ \theta),\ y = a(1 - Cos\ \theta),\ a \neq 1$, then ....

1) $ST = SN$ 2) $ST = 2SN$

3) $ST^2 = aSN^3$ 4) $ST^3 = aSN$

49. If θ is the acute angle of intersection at a real point of intersection of the circle $x^2 + y^2 = 5$ and the parabola $y^2 = 4x$ then $Tan\ \theta$ is equal to ....

1) 1 2) $\sqrt{3}$

3) 3 4) $\dfrac{1}{\sqrt{3}}$

50. A spherical balloon is being inflated at the rate of 35 cc/min. The rate of increase of the surface area of the balloon when its diameter is 14 cm is ....

1) 7 Sq.cm/min 2) 10 Sq.cm/min

3) 17.5 Sq.cm/min 4) 28 Sq.cm/min

(Space for Rough Work)

51. $\int \frac{Sin(2x)\,dx}{1+Cos^2 x} =$

1) $-\frac{1}{2} Log\left(1 + Cos^2 x\right) + C$

2) $2\, Log\left(1 + Cos^2 x\right) + C$

3) $\frac{1}{2} Log\left(1 + Cos\ 2x\right) + C$

4) $C - Log\left(1 + Cos^2 x\right)$

52. $\int \frac{e^x\,(1 + Sin\,x)}{1 + Cos\,x}\, dx =$

1) $e^x\ Tan\left(\frac{x}{2}\right) + C$

2) $e^x\ Tan\ x + C$

3) $e^x \left(\frac{1 + Sin\ x}{1 - Cos\ x}\right) + C$

4) $C - e^x\ Cot\left(\frac{x}{2}\right)$

53. $\int \frac{1 + Tan\,x}{e^{-x}\ Cos\ x}\, dx =$ ....

1) $e^{-x}\ Tan\ x + C$

2) $e^{-x}\ Sec\ x + C$

3) $e^x\ Sec\ x + C$

4) $e^x\ Tan\ x + C$

54. $\int_{\pi/4}^{\pi/2} Cosec^2\ x\ dx =$ ....

1) -1

2) 1

3) 0

4) $\frac{1}{2}$

55. $\int Log\left(1 + Tan\ x\right) dx =$

1) $\frac{\pi}{8}\ log_e\ 2$

2) $\frac{\pi}{4}\ log_2\, e$

3) $\frac{\pi}{4}\ log_e\ 2$

4) $\frac{\pi}{8}\ log_e\left(\frac{1}{2}\right)$

56. The area bounded by the parabola $y^2 = 4ax$ and the line $x = a$ and $x = 4a$ is ....

1) $\frac{35a^2}{3}$ 2) $\frac{4a^2}{3}$

3) $\frac{7a^2}{3}$ 4) $\frac{28a^2}{3}$

57. A population $p(t)$ of 1000 bacteria introduced into nutrient medium grows according to the relation $p(t) = 1000 + \frac{1000\,t}{100 + t^2}$. The maximum size of this bacterial population is ....

1) 1100 2) 1250

3) 1050 4) 5250

58. The differential equation representing a family of circles touching the y-axis at the origin is ....

1) $x^2 + y^2 - 2xy\frac{dy}{dx} = 0$ 2) $x^2 + y^2 + 2xy\frac{dy}{dx} = 0$

3) $x^2 - y^2 - 2xy\frac{dy}{dx} = 0$ 4) $x^2 - y^2 + 2xy\frac{dy}{dx} = 0$

59. The area of the region bounded by the curve $9x^2 + 4y^2 - 36 = 0$ is ....

1) 9π 2) 4π

3) 36π 4) 6π

60. The general solution of the differential equation $(2x - y + 1)\,dx + (2y - x + 1)\,dy = 0$ is ....

1) $x^2 + y^2 + xy - x + y = C$ 2) $x^2 + y^2 - xy + x + y = C$

3) $x^2 - y^2 + 2xy - x + y = C$ 4) $x^2 - y^2 - 2xy + x - y = C$