COMMON ENTRANCE TEST - 2005

DATE	SUBJECT	TIME
03 - 05 - 2005	MATHEMATICS	02.30 PM to 03.50 PM

MAXIMUM MARKS	TOTAL DURATION	MAXIMUM TIME FOR ANSWERING
60	80 MINUTES	70 MINUTES

MENTION YOUR CET NUMBER					QUESTION BOOKLET DETAILS	
					VERSION CODE	SERIAL NUMBER
					A - 1	089857

IMPORTANT INSTRUCTIONS TO CANDIDATES

(Candidates are advised to read the following instructions carefully, before answering on the OMR answer sheet.)

1. Ensure that you have entered your Name and CET Number on the top portion of the OMR answer sheet.
2. **ENSURE THAT THE TIMING MARKS ON THE OMR ANSWER SHEET ARE NOT DAMAGED / MUTILATED / SPOILED.**
3. This Question Booklet is issued to you by the invigilator after the 2nd Bell. i.e., after 02.35 p.m.
4. Carefully enter the Version Code and Serial Number of this question booklet on the top portion of the OMR answer sheet.
5. As answer sheets are designed to suit the Optical Mark Reader (OMR) system, please take special care while filling the entries pertaining to CET Number and Version Code.
6. Until the 3rd Bell is rung at 02.40 p.m. :
   - Do not remove the staple present on the right hand side of this question booklet.
   - Do not look inside this question booklet.
   - Do not start answering on the OMR answer sheet.
7. After the 3rd Bell is rung at 02.40 p.m., remove the staple present on the right hand side of this question booklet and start answering on the bottom portion of the OMR answer sheet.
8. This question booklet contains 60 questions and each question will have four different options / choices.
9. During the subsequent 70 minutes :
   - Read each question carefully.
   - Determine the correct answer from out of the four available options / choices given under each question.
   - **Completely darken / shade the relevant circle with a BLUE OR BLACK INK BALLPOINT PEN against the question number on the OMR answer sheet.**

CORRECT METHOD OF SHADING THE CIRCLE ON THE OMR SHEET IS AS SHOWN BELOW :

① ② ● ④

10. Please note that :
    - For each correct answer : ONE mark will be awarded.
    - For each wrong answer : QUARTER (1/4) mark will be deducted.
    - If more than one circle is shaded : ONE mark will be deducted.
    - **Even a minute unintended ink dot on the OMR sheet will also be recognised and recorded by the scanner. Therefore, avoid multiple markings of any kind.**
11. Use the space provided on each page of the question booklet for Rough work AND do not use the OMR answer sheet for the same.
12. After the last bell is rung at 03.50 p.m., stop writing on the OMR answer sheet.
13. Hand over the OMR ANSWER SHEET to the room invigilator as it is.
14. After separating and retaining the top sheet (CET Cell Copy), the invigilator will return the bottom sheet replica (Candidate's copy) to you to carry home for self-evaluation.
15. **Preserve the replica of the OMR answer sheet for a minimum period of One year.**

MATHEMATICS

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

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

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

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

(Space for Rough Work)

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, $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega \end{vmatrix}$ is equal to ....

1) -1
2) 1
3) 0
4) ω

(Space for Rough Work)

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

(Space for Rough Work)

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 $M = \left\{\begin{pmatrix} x & x \\ x & x \end{pmatrix} \middle| x \in R, x \neq 0\right\}$ 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

(Space for Rough Work)

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) $c^2 = 64$

(Space for Rough Work)

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

(Space for Rough Work)

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

(Space for Rough Work)

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

(Space for Rough Work)

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 $\frac{\pi}{4}$

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) $\frac{1}{2}$

(Space for Rough Work)

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

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. $\int_0^{\pi/4} Log\left(1+Tan\,x\right)dx =$

1) $\frac{\pi}{8}\,log_e\,2$
2) $\frac{\pi}{4}\,log_2\,e$
3) $\frac{\pi}{4}\,log_e\,2$
4) $\frac{\pi}{8}\,log_e\left(\frac{1}{2}\right)$

(Space for Rough Work)

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

(Space for Rough Work)

(Space for Rough Work)

A-1