MOCK TEST - 1

COMMON ENTRANCE TEST 2012

Subject: MATHEMATICS

Time: 1.10Hrs Max. Marks 60

Questions – 60

1. For any integer a, the remainder obtained when a^2 is divided by 4 is

(1) 0 or 2 (2) 1 or 2 (3) 0 or 1 (4) 1 or 3

2. It is observed that $23x + 17y = 1$ for some integers x and y. Then $(x, y) =$

(1) 4 (2) 2 (3) 1 (4) 3

3. The sum of all the positive divisors of 180 excluding 1 and itself is

(1) 365 (2) 456 (3) 637 (4) 526

4. If $x + y + z = \pi$ then the value of $\begin{vmatrix} sin(x+y+z) & sin B & cos z \\ -sin B & 0 & tan A \\ cos(x+y) & -tan A & 0 \end{vmatrix}$ is

(1) 2 (2) -1 (3) 1 (4) 0

5. If the value of a third order determinant is 11, then the value of the determinant formed by the cofactors will be

(1) 11 (2) 121 (3) 1331 (4) – 11

6. If $A = \begin{bmatrix} 1 & -1 & 2 \\ 2 & 3 & 1 \\ 1 & -2 & 3 \end{bmatrix}$ then $adj\ (A^{-1}) =$

(1) $\frac{1}{2} A$ (2) $2A$ (3) $8A$ (4) $\frac{1}{8}A$

7. The Eigen values of the matrix $\begin{bmatrix} x-a & 0 & 0 \\ x-b & x-c & 0 \\ x-d & x-e & x-f \end{bmatrix}$ are equal ∀ x, then

(1) $a + c = 2f$ (2) $a = b = d$ (3) $a = c = f$ (4) $a + c + f = 0$

8. If $\vec{a}$ and $\vec{b}$ are two unit vectors inclined at an angle θ to each other then $|\vec{a} + \vec{b}|$ will be less than 1 if θ lies between

(1) 0 and $\pi/2$ (2) $2\pi/3$ and π (3) $\pi/4$ and π (4) $\pi/3$ and $\pi/2$

9. The 3 vectors $7i - 11j + k$, $5i + 3j - 2k$ and $12i - 8j - k$ form the sides of

(1) an equilateral triangle (2) an isosceles triangle

(3) a scalene triangle (4) a right angled triangle

10. If $\vec{a} \times \vec{b} = \vec{c} \times \vec{d}$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{d}$ then

(1) $\vec{a} - \vec{b} = k(\vec{c} + \vec{d})$ (2) $\vec{a} - \vec{d} = k(\vec{b} - \vec{c})$

(3) $\vec{a} + \vec{d} = k(\vec{b} + \vec{c})$ (4) $\vec{a} + \vec{b} = k(c - \vec{d})$

11. If $\vec{a}, \vec{b}$ and $\vec{c}$ are non-coplanar vectors then

$[\vec{a} \times (\vec{b}+\vec{c}) \quad \vec{b} \times (\vec{c}+\vec{a}) \quad \vec{c} \times (\vec{a}+\vec{b})] =$

(1) 0 (2) $[\vec{a} \quad \vec{b} \quad \vec{c}]$ (3) 1 (4) 3

12. Which one below is **true**?

(1) Every binary operation, $*$ on a set satisfies the identity axiom.

(2) Every binary operation, $*$ on a set satisfies $a*(b*c) = (a*b)*c$.

(3) Every commutative binary operation is associative.

(4) Every binary operation defined on a set having exactly one element is both commutative and associative.

13. The total number of binary operations that can be defined on the set $\{0, 1\}$ is

(1) 6 (2) 24 (3) 8 (4) 16

14. In the set of positive real numbers, $a * b = \frac{ab}{3}$, the inverse of 3 is

(1) 1 (2) 3 (3) 9 (4) 1/3

15. If $0 < x < \frac{\pi}{2}$ then $cot^{-1}\left\{\frac{\sqrt{1+sin\,x} + \sqrt{1-sin\,x}}{\sqrt{1+sin\,x} - \sqrt{1-sin\,x}}\right\} =$

(1) $\frac{x}{2}$ (2) $\frac{\pi}{4} - \frac{x}{4}$ (3) $\frac{\pi}{4} - \frac{x}{4}$ (4) $-x$

16. The domain of $sin^{-1}(x-1)$ is

(1) $-2 \le x \le 0$ (2) $1 \le x \le 2$ (3) $0 \le x \le 2$ (4) $-2 \le x \le 1$

17. The general solution of $cot\left(\frac{\pi}{4} - \theta\right) + cot\left(\frac{\pi}{4} + \theta\right) = 4$ is, $\theta =$

$(n \in Z)$

(1) $n\pi \pm \frac{\pi}{6}$ (2) $n\pi \pm \frac{\pi}{4}$ (3) $n\pi \pm \frac{\pi}{3}$ (4) $n\pi \pm \frac{\pi}{5}$

18. $\left(\frac{1}{\sqrt{6}+\sqrt{2}} + i\frac{1}{\sqrt{6}-\sqrt{2}}\right)^{10} =$

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

19. For any integer n, the principal argument of $\frac{(\sqrt{3}+i)^{4n+1}}{(1-i\sqrt{3})^{4n}}$ is =

(1) $\pi/4$ (2) $\pi/3$ (3) $2\pi/3$ (4) $\pi/6$

20. If $x + iy = \frac{5+2i}{7+i}$ then $x^2 + y^2$ is

(1) $\frac{25}{14}$ (2) $\frac{29}{50}$ (3) $\frac{9}{5}$ (4) $\frac{12}{25}$

21. The angle between the tangents drawn from the origin to the circle $(x-7)^2 + (y+1)^2 = 25$ is

(1) $\pi/2$ (2) $\pi/3$ (3) $\pi/4$ (4) $\pi/6$

22. Two circles $x^2 + y^2 + ax = 0$ and $x^2 + y^2 = c^2$, $c > 0$

(1) touch each other internally

(2) intersect at two points
(3) touch each other externally
(4) intersect in the first and second quadrants

23. The radical axis of the circles $x^2 + y^2 + 4x = 1$ and $4x^2 + 4y^2 = 9$ is
(1) $16x + 5 = 0$ (2) $x - 2 = 0$ (3) $16x = 5$ (4) $x + 2 = 0$

24. If the line $hx + ky = 1$ touches the circle $x^2 + y^2 = a^2$ then the locus of the point (h, k) is a circle of radius
(1) a (2) $1/\sqrt{a}$ (3) $\sqrt{a}$ (4) $1/a$

25. The point at which the normal to the parabola , $y^2 = 4x$ makes equal angles with the positive axes is
(1) $(3, 6)$ (2) $(1, -2)$ (3) $(2, 4)$ (4) $(4, 3)$

26. The point of intersection of the perpendicular tangents to the parabola, $y^2 = 12x$, if slope of one of the tangents is $3/2$ is
(1) $\left(-3, -3/2\right)$ (2) $(3, -5/2)$ (3) $\left(-3, -5/2\right)$ (4) $(3, -3/2)$

27. The center of the hyperbola, $x = 2 + 4sec\theta$, $y = 3 + 5tan\theta$ is
(1) $(3, 2)$ (2) $(3, -2)$ (3) $(-2, 3)$ (4) $(2, 3)$

28. The equation to the auxiliary circle of the ellipse $16x^2 + 9y^2 = 144$ is
(1) $x^2 + y^2 = 16$ (2) $x^2 + y^2 = 36$
(3) $x^2 + y^2 = 25$ (4) $x^2 + y^2 = 7$

29. If $f(x) = e^x$ and $g(x) = logx$ then the derivative of $fog + gof$ is
(1) 1 (2) 3 (3) 0 (4) 2

30. If $sec\, y = x + y$ and $\frac{dx}{dy} + 1 = \frac{dt}{dy}$ then $t =$
(1) $sec\, y - y$ (2) $tan\, y$ (3) $sec\, y$ (4) sec y.tan y

31. If $f(x) = sec^{-1}\left(\frac{1 + sin^2x}{1 - sin^2x}\right), 0 < x < \frac{\pi}{2}$ then $f'\left(\frac{\pi}{4}\right) =$
(1) $\frac{\sqrt{2}}{3}$ (2) $\frac{2\sqrt{2}}{3}$ (3) $-\frac{2\sqrt{2}}{3}$ (4) $-\frac{\sqrt{2}}{3}$

32. If $x = f(t)$, $y = g(t)$ then $\frac{d^2y}{dx^2} =$
(1) $\frac{f'g'' - f''g'}{(f')^3}$ (2) $\frac{g'}{f''}$ (3) $\frac{f'g'' - f''g'}{(f')^2}$ (4) $\frac{g''}{f'}$

33. If the line $ax + by + c = 0$ is a normal to the curve $xy = 1$ then
(1) $b = 0$ (2) $a > 0, b > 0$ (3) $a = b = 1$ (4) $a > 0, b < 0$

34. The angle between the two curves $x^2 + y^2 = 4x$ and $x^2 + y^2 = 8$ at $(2, 2)$ is $cos^{-1}p$. then $p =$
(1) $\sqrt{3}/2$ (2) $3/4$ (3) $1/\sqrt{2}$ (4) $1/2$

35. The least perimeter of a rectangle of area 100 sq. units is
(1) 40 units (2) 50 units (3) 25 units (4) 20 units

36. If $s = 2t^3 - 9t^2 + 15t - 6$, the acceleration vanishes at $t =$

(1) $1/2$ (2) $3/2$ (3) 2 (4) $2/3$

37. If $\int e^x \left\{c.log(x^2 + 1) + \frac{bx}{x^2 + 1}\right\} dx = \frac{bc}{2} e^x.log\,(x^2 + 1)$ then $(b,\ c)$ is

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

38. If $\int \sqrt{\frac{cos\,x - cos^3x}{1 - cos^3x}}\, dx = kcos^{-1}\left(t^{3/2}\right) + c$ and $0 < x < \pi/2$ then $(k,\ t) =$

(1) $(1/3, \cos x)$ (2) $(2/3, \sin x)$ (3) $(1/3, \sin x)$ (4) $(2/3, \cos x)$

39. $\int cos\,x.cosec^2x\ dx =$

(1) $cosec\ x$ (2) $-cosec\ x$ (3) $cos\ 2x$ (4) $-cos\ 2x$

40. The area bounded by the curve, $y = x.sin\,x$ the x-axis and the lines $x = 0$ and $x = 2\pi$ is

(1) 2π (2) 6π (3) 4π (4) π

41. If $[x]$ denotes the greatest integer function then $\int_0^{3/2} [x^2]\, dx =$

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

42. If $I_1 = \int_0^1 \frac{tan^{-1}x}{x}\, dx$ and $I_2 = \frac{1}{2}\int_0^{\pi/2} \frac{t}{sin\,t}\, dt$ then

(1) $I_1 = 2I_2$ (2) $2I_1 = I_2$ (3) $I_1 = I_2$ (4) $I_1 = 4I_2$

43. If $I_1 = \int_{1-k}^{k} x.f\big(x(1-x)\big)\, dx$ and $I_2 = \int_{1-k}^{k} (1 - x).f\big(x(1-x)\big)\, dx$, $2k - 1 > 0$, then $I_1 : I_2 =$

(1) 2 (2) 1 (3) k (4) $2k$

44. The differential equation of the family of curves $y = cos\ bx$ is

(1) $\frac{{y_1}^2}{1 - y^2} = \left(\frac{cos^{-1}y}{x}\right)^2$ (2) $\frac{{y_1}^2}{1 + y^2} = \left(\frac{sin^{-1}y}{x}\right)^2$

(3) ${y_1}^2 = 1 - y^2$ (4) ${y_1}^2 = 1 + y^2$

45. The particular solution of the equation, $\frac{dy}{dx} = \cos(x + y)$, at $(0,\ \pi/2)$ is

(1) $y = 2\tan^{-1}(x + 1) + x$ (2) $y = \tan^{-1}(x + 1) + x$

(3) $y = \tan^{-1}(x + 1) - x$ (4) $y = 2\tan^{-1}(x + 1) - x$

46. The sum to n terms of $\frac{3}{1^2.2^2} + \frac{5}{2^2.3^2} + \frac{7}{3^2.4^2} + \cdots$ is $\frac{624}{625}$. The value of n is

(1) 23 (2) 26 (3) 25 (4) 24

47. If $log_4 5 = k$ then $log_{100} 5 =$

(1) $\frac{k}{k+1}$ (2) $\frac{2k}{k+1}$ (3) $\frac{2k}{2k+1}$ (4) $\frac{k}{2k+1}$

48. The value of $2[\,{}^nC_1 + 2\{\,{}^nC_2 + 2({}^nC_3 + 2(...+ 2.{}^nC_n))\}] = 242$.
The value of $n =$

(1) 5 (2) 6 (3) 7 (4) 4

49. Which one below is **false**?

(1) $\sim(p \leftrightarrow q) \equiv \sim(p \wedge \sim q) \wedge (\sim p \wedge q)$

(2) $\sim(p \leftrightarrow q) \equiv \sim\{(p \rightarrow q) \wedge (q \rightarrow p)\}$

(3) $\sim(p \leftrightarrow q) \equiv \sim(p \rightarrow q) \vee \sim(q \rightarrow p)$

(4) $\sim(p \leftrightarrow q) \equiv \{(p \wedge \sim q) \vee \sim(q \rightarrow p)\}$

50. The set of all values of x for which $f(x) = \frac{1}{\sqrt{|x| - x}}$ is a function is

(1) $\{x : x \in R, x > 0\}$ (2) $\{x : x \in R, x < 0\}$

(3) $\{x : x \in R, x < 1\}$ (4) $\{x : x \in R, x > 1\}$

51. If $\alpha, \beta, \gamma, \delta$ are the roots of $x^4 - 2x^3 + 3x^2 - 4x + 5 = 0$ then $\sum \frac{\alpha}{\beta\gamma\delta} =$

(1) $2/5$ (2) $-2/5$ (3) 2 (4) – 2

52. The medians AD and BE of the triangle with vertices $A(0, b)$, $B(0, 0)$ and $C(a, 0)$ are mutually perpendicular if

(1) $a = \sqrt{2}b$ (2) $b = \sqrt{2}a$ (3) $a = 2\sqrt{2}b$ (4) $b = -2\sqrt{2}a$

53. The combined equation of the diagonals of a parallelogram $PQRS$ is $6x^2 + 16xy - 6y^2 - 31x + 13y + 28 = 0$. Then $PQRS$ must be

(1) a rhombus (2) a rectangle (3) a trapezium (4) a triangle

54. A point (x, y) moves under the conditions $x.\cos\alpha + y.\sin\alpha = a$ and $x.\sin\alpha - y.\cos\alpha = b$. If $(2, 3)$ is a point on this locus then $a^2 + b^2 =$

(1) 1 (2) 13 (3) 5 (4) 4

55. Which of the following is **false** with regard to $Cos\, 2\theta + 2\cos\theta$?

(1) greatest value is 3 (2) least value is $-3/2$

(3) can be zero for some θ (4) cannot be equal to one

56. In ΔABC, if $(s - a).\tan\left(\frac{A}{2}\right) = k.\tan\left(\frac{B}{2}\right)$ then $k =$

(1) s (2) b (3) $s - b$ (4) sb

57. $Sin\, 12°.\sin 24°.\sin 48°.\sin 84° =$

(1) $1/64$ (2) $1/16$ (3) $3/16$ (4) $5/32$

58. If the arcs of same length in two circles subtend angles of $60°$ and $75°$ at their centers, then the ratio of their radii is

(1) $1 : 3$ (2) $3 : 8$ (3) $5 : 4$ (4) $5 : 3$

59. The function $f(x) = \begin{cases} x.\sin\left(\frac{1}{x}\right), & x \neq 0 \\ 0, & x = 0 \end{cases}$ then

(1) f is continuous at $x = 0$ (2) f is continuous only at $x = 0$

(3) f is discontinuous only at $x = 0$

(4) f is discontinuous at infinite number of points

60. $\lim_{x \to 0} \left(\frac{3^{2x} - 2^{2x}}{x}\right)^2 =$

(1) $(\log(9/4))^2$ (2) $(\log(3/2))^2$ (3) $\log(9/4)$ (4) $\log(3/2)$