MHT CET 2021 Mathematics Memory Based Question Paper PDF

1. With usual notations, in any $\triangle ABC$, if $a\cos B = b\cos A$, then the triangle is:

(A) an isosceles triangle

(B) an equilateral triangle

(C) a right angled triangle

(D) a scalene triangle

2. If θ lies in the first quadrant and $5\tan\theta = 4$, then $\frac{5\sin\theta - 3\cos\theta}{\sin\theta + 2\cos\theta}$ is equal to:

(A) $\frac{5}{14}$

(B) $\frac{3}{14}$

(C) $\frac{1}{14}$

(D) 0

3. If $\cos^{-1}x > \sin^{-1}x$, then:

(A) $\frac{1}{\sqrt{2}} < x \leq 1$

(B) $0 \leq x \leq \frac{1}{\sqrt{2}}$

(C) $-1 \leq x < \frac{1}{\sqrt{2}}$

(D) $x > 0$

4. The value of $\tan 3A - \tan 2A - \tan A$ is:

(A) $\tan 3A \tan 2A \tan A$

(B) $-\tan 3A \tan 2A \tan A$

(C) $\tan A \tan 2A - \tan 2A \tan 3A$

(D) $\tan 3A \tan A - \tan 2A \tan 3A$

5. The three straight lines $ax + by = c$, $bx + cy = a$ and $cx + ay = b$ are collinear, if:

(A) $b + c = a$

(B) $c + a = b$

(C) $a + b + c = 0$

(D) $a+b=c$

6. A line through the point $A(2,0)$ which makes an angle of 30° with the positive direction of X-axis is rotated about A in clockwise direction through an angle of 15°. Then, the equation of the straight line in the new position is:

(A) $(2-\sqrt{3})x+y-4+2\sqrt{3}=0$

(B) $(2-\sqrt{3})x-y-4+2\sqrt{3}=0$

(C) $(2-\sqrt{3})x-y+4+2\sqrt{3}=0$

(D) $(2-\sqrt{3})x+y+4+2\sqrt{3}=0$

7. Find the value of $\cos\left(\frac{x}{2}\right)$, if $\tan x=\frac{5}{12}$ and x lies in third quadrant.

(A) $\frac{5}{\sqrt{13}}$

(B) $\frac{5}{\sqrt{26}}$

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

(D) $\sqrt{\frac{1}{26}}$

8. The locus of a point which moves, so that the ratio of the length of the tangents to the circles $x^2+y^2+4x+3=0$ and $x^2+y^2-6x+5=0$ is $2:3$, is:

(A) $5x^2+5y^2-60x+7=0$

(B) $5x^2+5y^2+60x-7=0$

(C) $5x^2+5y^2-60x-7=0$

(D) $5x^2+5y^2+60x+7=0$

9. The circles $x^2+y^2+6x+6y=0$ and $x^2+y^2-12x-12y=0$:

(A) cut orthogonally

(B) touch each other internally

(C) intersect two points

(D) touch each other externally

10. The mean and variance of n observations $x_1,x_2,\ldots,x_n$ 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

11. The variance of first n natural numbers is:

(A) $\frac{n(n+1)}{2}$

(B) $\frac{(n+1)(n+5)}{12}$

(C) $\frac{(n+1)(n-5)}{12}$

(D) $\frac{n^2-1}{12}$

12. Out of 50 tickets numbered 00, 01, 02, ..., 49, one ticket is drawn randomly. The probability of the ticket having the product of its digits 7, given that the sum of the digits is 8, is:

(A) $\frac{1}{14}$

(B) $\frac{3}{14}$

(C) $\frac{1}{5}$

(D) None of these

13. The probability of India winning a test match against South Africa is 1/2 assuming independence form match to match played. The probability that in a match series India's second win occurs at the third day is:

(A) $\frac{1}{8}$

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

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

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

14. Consider the following statements:
r : If a number is a multiple of 9, then it is multiple of 3.
Let p and q denote the statements
p: A number is a multiple of 9.
q: A number is a multiple of 3.
Then, if p then q is the same as:

(A) p only if q

(B) q is a necessary condition for p

(C) $\sim q$ implies $\sim p$

(D) All of the above

15. The negation of the statement "7 is greater than 4 or 6 is less than 7" is:

(A) 7 is not greater than 4 and 6 is not less than 7

(B) 7 is not greater than 4 or 6 is not less than 7

(C) 7 is greater than 4 and 6 is less than 7

(D) None of the above

16. For an invertible matrix A, if $A(\text{adj } A) = \begin{bmatrix} 20 & 0 \\ 0 & 20 \end{bmatrix}$, then $|A| =$:

(A) 20

(B) -200

(C) 200

(D) -20

17. If matrix $A = \begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}$, then $A^2 - 4A + 5I$ is (where I is a unit matrix):

(A) Null matrix

(B) Skew symmetric matrix

(C) symmetric Matrix

(D) None of the above

18. If $f(x) = \begin{cases} \frac{3\sin \pi x}{5x} & x \neq 0 \\ 2k & x = 0 \end{cases}$ is continuous at $x = 0$, then the value of k is:

(A) $\frac{\pi}{10}$

(B) $\frac{3\pi}{10}$

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

(D) $\frac{3\pi}{5}$

19. If $f(x) = \begin{cases} \frac{\sin^3(\sqrt{x}) \cdot \log(1+3x)}{(\tan^{-1}\sqrt{x})^2 (e^{5\sqrt{x}}-1)x} & x \neq 0 \\ a & x = 0 \end{cases}$ is continuous in [0, 1] then a equals:

(A) 0

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

(C) 2

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

20. The differential equation of all parabolas having vertex at the origin and axis along positive Y-axis is:

(A) $x^2\frac{dy}{dx}-y=0$

(B) $x\frac{dy}{dx}+2y=0$

(C) $x\frac{dy}{dx}=2y$

(D) $x^3\frac{dy}{dx}=3y$

21. The order and degree of the differential equation $\sqrt{\frac{dy}{dx}}-4\frac{dy}{dx}-7x=0$ are:

(A) 1 and 1/2

(B) 2 and 1

(C) 1 and 1

(D) 1 and 2

22. The solution of the differential equation $e^{-x}(y+1)dy+(\cos^2 x-\sin 2x)ydx=0$ subjected to the condition that $y=1$, when $x=0$ is:

(A) $y+\log y+e^x\cos^2 x=2$

(B) $\log(y+1)+e^x\cos^2 x=1$

(C) $y+\log y=e^x\cos^2 x$

(D) $(y+1)+e^x\cos^2 x=2$

23. $\int_{-1}^{1}\frac{17x^5-x^4+29x^3-31x+1}{x^2+1}dx$ is equal to:

(A) $\frac{4}{5}$

(B) $\frac{5}{4}$

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

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

24. The number of ways of arranging letters of the 'HAVANA', so that V and N do not appear together, is:

(A) 60

(B) 80

(C) 100

(D) 120

25. Out of 7 consonants and 4 vowels, the number of words (not necessarily meaningful) that can be made, each consisting of 3 consonants and 2 vowels, is:

(A) 24800

(B) 25100

(C) 25200

(D) 25400

26. If $f(x) = \sin^2 x + \sin^2(x + \frac{\pi}{3}) + \cos x \cos(x + \frac{\pi}{3})$ and $g(\frac{5}{4}) = 1$, then $gof(x)$ is equal to:

(A) 1

(B) -1

(C) 2

(D) -2

27. Range of the function $f(x) = \frac{x}{1+x^2}$ is:

(A) $(-\infty, \infty)$

(B) $[-1, 1]$

(C) $[-\frac{1}{2}, \frac{1}{2}]$

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

28. The domain of $f(x) = \sin^{-1}[\log_2(\frac{x}{2})]$ is:

(A) $0 \leq x \leq 1$

(B) $0 \leq x \leq 4$

(C) $1 \leq x \leq 4$

(D) $4 \leq x \leq 6$

29. If $f(x) = \frac{k}{2^x}$ is a probability distribution of a random variable X that can take on the values $x = 0, 1, 2, 3, 4$, then k is equal to:

(A) $\frac{16}{15}$

(B) $\frac{15}{16}$

(C) $\frac{31}{16}$

(D) None of these

30. $\lim_{x \to 0} \frac{e^{x^2} - \cos x}{x^2}$ is equal to:

(A) 0

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

(C) 1

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

31. Evaluate $\lim_{x\to\sqrt{2}} \frac{x^4-4}{x^2+3\sqrt{2}x-8}$:

(A) $\frac{8}{5}$

(B) $\frac{8}{3}$

(C) $\frac{5}{8}$

(D) $\frac{3}{8}$

32. What will be projection of the vector $4\hat{i}-3\hat{j}+\hat{k}$ on the line joining the points $(2,3,-1)$ and $(-2,-4,3)$?

(A) 1

(B) 2

(C) 3

(D) 4