MHT CET 2023 Mathematics Memory Based Question Paper PDF

1. The equation of the line, passing through $(1,2,3)$ and parallel to planes $x-y+2z=5$ and $3x+y+z=6$, is:

(A) $\frac{x-1}{-3}=\frac{y-2}{5}=\frac{z-3}{4}$

(B) $\frac{x-1}{-3}=\frac{y-2}{-5}=\frac{z-3}{4}$

(C) $\frac{x-1}{4}=\frac{y-2}{5}=\frac{z-3}{3}$

(D) $\frac{x-1}{5}=\frac{y-2}{7}=\frac{z-3}{1}$

2. $\lim_{x\to 0}\frac{x\cot 4x}{\sin^2 x\cdot\cot^2(2x)}$ is equal to:

(A) 0

(B) 1

(C) 4

(D) $1/4$

3. $\int\frac{1}{\cos^3 x\sqrt{\sin 2x}}dx=$:

(A) $\sqrt{2}\left(\sqrt{\tan x}+\frac{1}{5}(\tan x)^{5/2}\right)+c$

(B) $\left(\sqrt{\tan x}+\frac{2}{5}(\tan x)^{5/2}\right)+c$

(C) $\frac{1}{\sqrt{2}}\left(\sqrt{\tan x}+\frac{2}{5}(\tan x)^{5/2}\right)+c$

(D) $2\left(\sqrt{\tan x}+\frac{1}{5}(\tan x)^{5/2}\right)+c$

4. The shortest distance (in units) between the lines $\frac{x+1}{3}=\frac{y+2}{1}=\frac{z+1}{2}$ and $\bar{r}=(2\hat{i}-2\hat{j}+3\hat{k})+\lambda(\hat{i}+2\hat{j})$ is:

(A) $\frac{8}{3\sqrt{5}}$

(B) $\frac{1}{3\sqrt{5}}$

(C) $\frac{7}{3\sqrt{5}}$

(D) $\frac{2}{3\sqrt{5}}$

5. The maximum value of $z = 7x + 8y$ subject to the constraints $x + y \leq 20, y \geq 5, x \leq 10, x \geq 0, y \geq 0$ is:

(A) 150

(B) 160

(C) 110

(D) 180

6. The value of $\int_0^{\pi} \left|\sin x - \frac{2x}{\pi}\right| dx$ is:

(A) $\pi/4$

(B) $\pi/2$

(C) π

(D) 2π

7. If $f(x) = \sin^{-1}\left(\frac{2\log x}{1+(\log x)^2}\right)$, then $f'(e)$ is:

(A) $2/e$

(B) $1/2e$

(C) e

(D) $1/e$

8. If the pair of lines given by $(x\cos\alpha + y\sin\alpha)^2 = (x^2 + y^2)\sin^2\alpha$ are perpendicular to each other, then α is:

(A) 0

(B) $\pi/2$

(C) $\pi/4$

(D) $\pi/6$

9. The solution of $e^{y-x}\frac{dy}{dx} = \frac{y(\sin x+\cos x)}{(1+y\log y)}$ is:

(A) $\frac{e^y}{y} = e^x \sin x + c$

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

(C) $e^y \log y = e^x \sin x + c$

(D) $e^y y = e^x \sin x + c$

10. For $x > 1$, if $(2x)^{2y} = 4e^{2x-2y}$, then $(1 + \log_e 2x)^2 \frac{dy}{dx}$ is equal to:

(A) $\frac{x\log_e 2x+\log_e 2}{x}$

(B) $\frac{x\log_e 2x-\log_e 2}{x}$

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

(D) $x\log_e 2x-\frac{\log_e 2}{2}$

11. A poster is to be printed on a rectangular sheet of paper of area 18 m^2. The margins at the top and bottom of 75 cm each and at the sides 50 cm each are to be left. Then the dimensions i.e. height and breadth of the sheet, so that the space available for printing is maximum, are _____ respectively:

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

(B) $3\sqrt{3}$ m, $2\sqrt{3}$ m

(C) 3 m, 6 m

(D) 6 m, 3 m

12. The equation of the normal to the curve $3x^2-y^2=8$, which is parallel to the line $x+3y=10$, is:

(A) $x+3y+6=0$

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

(C) $x+3y+8=0$

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

13. An irregular six faced die is thrown and the probability that, in 5 throws it will give 3 even numbers is twice the probability that it will give 2 even numbers. The number of times, in 6804 sets of 5 throws, you expect to give no even number is:

(A) 18

(B) 28

(C) 27

(D) 19

14. If the curves $y^2=6x$ and $9x^2+by^2=16$ intersect each other at right angle, then value of 'b' is:

(A) 9/2

(B) 6

(C) 7/2

(D) 4

15. The circles $x^2+y^2+2ax+c=0$ and $x^2+y^2+2by+c=0$ touch each other externally, if:

(A) $\frac{1}{a^2}-\frac{1}{b^2}=\frac{1}{c}$

(B) $\frac{1}{a^2}+\frac{1}{b^2}=\frac{1}{c}$

(C) $\frac{1}{a^2}+\frac{1}{b^2}=\frac{1}{c^2}$

(D) $\frac{1}{a^2}-\frac{1}{b^2}=\frac{1}{c^2}$

16. Given $f(x)=\begin{cases}\frac{1-\cos 4x}{x^2}, & \text{if } x<0\\ a, & \text{if } x=0\\ \frac{\sqrt{x}}{\sqrt{16-\sqrt{x}}-4}, & \text{if } x>0\end{cases}$

If $f(x)$ is continuous at $x=0$, then value of a is:

(A) -8

(B) 2

(C) -2

(D) 8

17. A,B,C,D are four points in a plane with position vectors $\bar{a},\bar{b},\bar{c},\bar{d}$ respectively such that $(\bar{a}-\bar{d})\cdot(\bar{b}-\bar{c})=(\bar{b}-\bar{d})\cdot(\bar{c}-\bar{a})=0$. The point D, then is the _____ of $\triangle ABC$:

(A) centroid

(B) circumcentre

(C) incentre

(D) orthocentre

18. Two adjacent sides of a parallelogram $ABCD$ are given by $\overline{AB}=2\hat{i}+10\hat{j}+11\hat{k}$ and $\overline{AD}=-\hat{i}+2\hat{j}+2\hat{k}$. The side AD is rotated by angle α in plane of parallelogram so that AD becomes AD'. If AD' makes a right angle with the side AB, then the cosine of the angle α is:

(A) $8/9$

(B) $1/9$

(C) $\sqrt{17}/9$

(D) $4\sqrt{5}/9$

19. The value of x, for which $\sin(\cot^{-1}(x))=\cos(\tan^{-1}(1+x))$, is:

(A) 0

(B) 1

(C) $-1/2$

(D) $1/2$

20. The unit vector which is orthogonal to the vector $3\hat{i}+2\hat{j}+6\hat{k}$ and coplanar with the vectors $2\hat{i}+\hat{j}+\hat{k}$ and $\hat{i}+\hat{j}+\hat{k}$ is:

(A) $\frac{8\hat{i}-3\hat{j}+3\hat{k}}{\sqrt{82}}$

(B) $\frac{-8\hat{i}-3\hat{j}+3\hat{k}}{\sqrt{82}}$

(C) $\frac{-8\hat{i}+3\hat{j}+3\hat{k}}{\sqrt{82}}$

(D) $\frac{8\hat{i}+3\hat{j}+3\hat{k}}{\sqrt{82}}$

Chemistry

21. Which of the following expressions represents molar conductivity of AB_3 type electrolyte?

(A) $3\lambda^{\circ}_{A^{...}}+\lambda^{\circ}_{B^{-}}$

(B) $\lambda^{\circ}_{A^{...}}+\lambda^{\circ}_{B^{-}}$

(C) $\lambda^{\circ}_{A^{...}}+3\lambda^{\circ}_{B^{-}}$

(D) $2\lambda^{\circ}_{A^{...}}+\lambda^{\circ}_{B^{-}}$

22. What is the mass of $KClO_{3(s)}$ required to liberate 22.4 dm^3 oxygen at STP during thermal decomposition? (Molar Mass of $KClO_{3(s)} = 122.5$ g/mol)

(A) 122.5 g

(B) 81.67 g

(C) 10.25 g

(D) 8.16 g

23. Identify product B in the following reaction: Aniline $\xrightarrow[273\ K]{NaNO_2+HCl} A \xrightarrow[\Delta]{H_2O} B+N_2\uparrow$

(A) Chlorobenzene

(B) Benzyl alcohol

(C) Benzenediazoniumchloride

(D) Phenol

24. If 0.15 m aqueous solution of KCl freezes at -0.511°C, calculate van't Hoff factor of KCl (cryoscopic constant of water is 1.86 K kg mol^{-1}):

(A) 1.45

(B) 1.26

(C) 1.82

(D) 3.00

25. Which among the following is NOT the feature of reversible process?

(A) The driving and opposing forces differ by large amount.

(B) The process can be reversed by infinitesimal change in pressure.

(C) A reversible process proceeds very slowly.

(D) The system attains mechanical equilibrium at the end of every step.

26. Which from following formulae is of galena?

(A) $CaSO_4 \cdot 2H_2O$

(B) PbS

(C) ZnS

(D) $BaSO_4$

27. What is the solubility of $AgCl_{(s)}$ if its solubility product is 1.6×10^{-10}?

(A) 1.26×10^{-5} M

(B) 1.00×10^{-9} M

(C) 2.6×10^{-5} M

(D) 1.56×10^{-9} M

28. Which nanoparticle catalyst is used in photocatalysis?

(A) TiO_2

(B) Pd

(C) Pt

(D) Au

Physics

29. A glass prism deviates the red and violet rays through 9° and 11° respectively. A second prism of equal angle deviates them through 11° and 13° respectively. The ratio of dispersive power of second prism to first prism is:

(A) $5:6$

(B) $6:5$

(C) $9:13$

(D) $13:9$

30. Eight small drops of mercury each of radius 'r', coalesce to form a large single drop. The ratio of total surface energy before and after the change is:

(A) $2:1$

(B) $1:1$

(C) $1:4$

(D) $1:8$

31. In the digital logic circuit, the output Y will be '1' for inputs:

(A) $A=0, B=0$

(B) $A=0, B=1$

(C) $A=1, B=0$

(D) $A=1, B=1$

32. Two different radioactive elements with half lives 'T_1' and 'T_2' have undecayed atoms 'N_1' and 'N_2' respectively present at a given instant. The ratio of their activities at that instant is:

(A) $\frac{N_1T_1}{N_2T_2}$

(B) $\frac{N_2T_2}{N_1T_1}$

(C) $\frac{N_1T_2}{N_2T_1}$

(D) $\frac{N_1N_2}{T_1T_2}$

33. The equation of wave motion is $Y = 5\sin(10\pi t - 0.02\pi x + \pi/3)$ where x is in metre and t in second. The velocity of the wave is:

(A) 300 m/s

(B) 400 m/s

(C) 500 m/s

(D) 600 m/s