

MHT CET 2024 Mathematics Answer Key PDF

Answer Key

1. **Question 1** Option (A) – $(\sim p) \vee (\sim q)$

Explanation: The statement $(p \wedge \sim q) \vee (\sim p \wedge q) \vee (\sim p \wedge \sim q)$ simplifies to $(p \wedge \sim q) \vee [\sim p \wedge (q \vee \sim q)] = (p \wedge \sim q) \vee \sim p$. Applying distributive law gives $(\sim p \vee p) \wedge (\sim p \vee \sim q) = \sim p \vee \sim q$.

2. **Question 2** Correct Answer – 1

Explanation: Since B is the adjoint of A , we have $|B| = |A|^{n-1} = 4^2 = 16$. Expanding the determinant of matrix B yields $24 - 4a - 4 = 16$, which simplifies to $4a = 4 \implies a = 1$.

3. **Question 3** Correct Answer – $\begin{bmatrix} 1/2 & -1/2 & 1/2 \\ -4 & 3 & -1 \\ 5/2 & -3/2 & 1/2 \end{bmatrix}$

Explanation: The determinant of A is $|A| = -2$. Calculating the cofactor matrix and transposing it to find the adjoint, we divide each element of $\text{adj}(A)$ by -2 to obtain the inverse matrix A^{-1} .

4. **Question 4** Option (A) – $1/(\sqrt{1+x^2})$

Explanation: Let $\theta = \cot^{-1}(x)$, which implies $\cot \theta = x$. Using the right-triangle trigonometric definition, $\sin \theta = \frac{1}{\text{hypotenuse}} = \frac{1}{\sqrt{1+x^2}}$.

5. **Question 5** Option (D) – 0

Explanation: Differentiating $y = 5 \cos x - 3 \sin x$ twice yields $\frac{d^2 y}{dx^2} = -5 \cos x + 3 \sin x = -y$. Rearranging this relation directly gives $\frac{d^2 y}{dx^2} + y = 0$.

6. **Question 6** Option (B) – 75

Explanation: Let the two parts be x and y such that $x+y = 20$. Maximizing $P = (20-y)y^3$ yields $dP/dy = 60y^2 - 4y^3 = 0 \implies y = 15$ and $x = 5$. The product of the parts is $15 \times 5 = 75$.

7. **Question 7** Option (B) – $3^{7/6} - 3^{5/6}$

Explanation: Substituting $t = \tan x$ transforms the integral to $\int_{3^{-1/2}}^{3^{1/2}} t^{-4/3} dt$. Evaluating this definite integral yields $[-3t^{-1/3}]_{3^{-1/2}}^{3^{1/2}} = 3^{7/6} - 3^{5/6}$.

8. **Question 8** Option (C) – 0.37

Explanation: Using the cumulative distribution function values, $P[X = 4] = F(4) - F(3) = 0.62 - 0.48 = 0.14$ and $P[X = 5] = F(5) - F(4) = 0.85 - 0.62 = 0.23$. Summing these gives 0.37.

9. **Question 9** Option (C) – 1

Explanation: Equating the parametric coordinates of the two lines gives a system of linear equations in parameters s and t . Solving this system yields $s = -3/2$ and $t = -5$, which determines $k = 1$.

10. **Question 10** Correct Answer – Alkane containing a tertiary (3°) carbon atom (e.g., Isobutane / 2-Methylpropane)
Explanation: A tertiary alkane contains at least one carbon atom that is directly bonded to three other carbon atoms. Isobutane (2-methylpropane) is a typical example.
11. **Question 11** Correct Answer – Amine with the formula $R - NH_2$ (e.g., Ethylamine, Methylamine, or Aniline)
Explanation: A primary amine contains a nitrogen atom directly bonded to only one alkyl or aryl carbon group, retaining two hydrogen atoms on the nitrogen.
12. **Question 12** Correct Answer – 3
Explanation: The structure $CH_3-CH(Cl)-CH(CH_3)-CH(CH_3)-CH_2-CH_3$ contains three chiral carbon centers at the C2, C3, and C4 positions, as each of these carbons is bonded to four unique substituents.
13. **Question 13** Correct Answer – $pH = 14 - \left(pK_b + \log_{10} \frac{[salt]}{[base]}\right)$
Explanation: For a basic buffer system, the Henderson-Hasselbalch equation gives $pOH = pK_b + \log_{10} \frac{[salt]}{[base]}$. The pH is then determined using the standard relation $pH = 14 - pOH$.
14. **Question 14** Correct Answer – $V = a^3$, where $a = 2r$ (Simple Cubic), $a = \frac{4r}{\sqrt{3}}$ (BCC), or $a = 2\sqrt{2}r$ (FCC)
Explanation: The volume of a cubic unit cell is $V = a^3$. The edge length a is related to the atomic radius r depending on the specific crystal system (SC, BCC, or FCC).
15. **Question 15** Correct Answer – 2-Methylhexan-1-ol
Explanation: If the structure represents a "5-dimethylpentanol" where a methyl group is present at the C5 position, the longest continuous carbon chain is extended to 6 carbons, giving the systematic IUPAC name 2-methylhexan-1-ol.