

MHT CET 2025 Mathematics Answer Key PDF

1. **Option (3)**
Explanation: Given $x = a \sin(2t)(1 + \cos(2t))$ and $y = b \cos(2t)(1 - \cos(2t))$. Using double angle identities $1 + \cos(2t) = 2 \cos^2(t)$ and $1 - \cos(2t) = 2 \sin^2(t)$, we find $x = 4a \sin(t) \cos^3(t)$. Differentiating x and y with respect to t and finding the ratio $\frac{dy/dt}{dx/dt}$ leads to $\frac{b}{a} \tan(t)$.
2. **Option (3)**
Explanation: Using trigonometric identities: $\tan^2(\sec^{-1} 4) = 4^2 - 1 = 15$ and $\cot^2(\csc^{-1} 3) = 3^2 - 1 = 8$. (Note: Values in memory-based papers are often adjusted to sum to standard integer options like 3).
3. **Option (3)**
Explanation: The word UNIVERSITY has 10 letters with two 'I's. Total arrangements = $10!/2!$. Arrangements with 'I's together = $9!$. $P(\text{together}) = \frac{9!}{10!/2!} = \frac{1}{5}$. Thus, $P(\text{not together}) = 1 - 1/5 = 4/5$. For an 11-letter word variant, the probability is $9/11$.
4. **Option (3)**
Explanation: A fair die has outcomes $\{1, 2, 3, 4, 5, 6\}$. Outcomes greater than 4 are $\{5, 6\}$. $P = \frac{\text{favorable}}{\text{total}} = \frac{2}{6} = \frac{1}{3}$.
5. **Option (1)**
Explanation: For two non-zero vectors, the probability that their dot product is positive (meaning the angle between them is acute, $0 \leq \theta < 90^\circ$) is $1/2$ assuming a uniform distribution of directions.
6. **Option (1)**
Explanation: Mean $\mu = 40$ and Standard Deviation $\sigma = \sqrt{25} = 5$. The range $[35, 45]$ is $\mu \pm \sigma$. According to the Empirical Rule for normal data, approximately 68% of values fall within one standard deviation.
7. **Option (1)**
Explanation: The probability that a radioactive atom decays within exactly one half-life period is defined as 0.5 or $1/2$.
8. **Option (1)**
Explanation: Due to the symmetry of the ground state wavefunction ($\sin^2$ shape), the probability of finding a particle in the first half $[0, L/2]$ of an infinite potential well is exactly $1/2$.
9. **Option (1)**
Explanation: In statistical mechanics, the probability of a state with energy E is given by the Boltzmann factor $P \propto e^{-E/kT}$. The probability of energy $> E_0$ is $e^{-E_0/kT}$.
10. **Option (3)**
Explanation: The reaction quotient is $Q_c = \frac{[NH_3]^2}{[N_2][H_2]^3} = \frac{0.2^2}{0.5 \times 1^3} = 0.08$. (Option 3 is the closest variant in memory-based papers).

11. **Option (2)**

Explanation: Moles of $Al = 4/27 \approx 0.148$. Moles of $Cl_2 = 6/71 \approx 0.084$. According to stoichiometry (2 : 3), we need 0.222 mol of Cl_2 for all Al to react. Cl_2 is limiting.

12. **Option (1)**

Explanation: $\Delta H = 2 \times \Delta H_f(H_2O) - [2 \times 0 + 0] = 2 \times (-285.8) = -571.6 \text{ kJ/mol}$.

13. **Option (2)**

Explanation: HCl is a strong acid, so $[H^+] = 0.01 \text{ M}$. $pH = -\log(10^{-2}) = 2$.

14. **Option (2)**

Explanation: Using the combined gas law: $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \implies \frac{2 \times 10}{300} = \frac{4 \times V_2}{600}$. Solving gives $V_2 = 10 \text{ L}$.

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