MHT CET 2024 Solution - May 9 Shift 1 & 2 PCM

Mathematics

Ques 1. The length of the perpendicular drawn from the point (1, 2, 3) to the line (z - 6)/3 = (y - 7)/2 = (z - 7)/- 2

- 4 units
- 5 units
- 6 units
- 7 units

Ans. D

Solution: To find the perpendicular distance from the point (1, 2, 3) to the given line, use the formula for the distance between a point and a line in 3D:

Distance = |(x2 - x1, y2 - y1, z2 - z1) · (A, B, C)| / sqrt(A^2 + B^2 + C^2)

Given line direction ratios (A, B, C) = (1/3, 1/2, -1/2) and the coordinates of a point on the line (7, 8, 9). The distance is found to be 7 units.

Ques 2. If |a| = √3; |b|=5; |b||c| = 10, angle between b and c is π/3, a is perpendicular to b x c. Then the value of | a x (b x c) | is

- 20
- 30
- 60
- 40

Ans. B

Solution: Since a is perpendicular to b × c, the magnitude |a × (b × c)| = |a| · |b| · |c| · sin(θ). Given |a| = √3, |b| = 5, |c| = 2, and θ = π/3:

|a × (b × c)| = √3 · 5 · 2 · sin(π/3) = √3 · 5 · 2 · √3/2 = 30

Ques 3. Let X be a random variable having Binomial distribution B(7, p). If P[X = 3] = 5P[X = 4], then variance of X is
- A 7/6
- B 35/36
- C 77/36
- D 1/36

Ans. B

 Solution: Given P[X = 3] = 5P[X = 4], we use the binomial probability formula and solve for p. The variance of a binomial distribution B(n, p) is np(1-p). After solving for p:
   Variance = 7 · 5/6 · 1/6 = 35/36

Ques 4. The particular solution of differential equation e dy/dt = (x + 1), y(0) = 3 is
- A y = x log(x) - x + 2
- B y = (x + 1) log(x + 1) - x + 3
- C y = (x + 1) log(x + 1) + x - 3
- D y = x log(x) + x - 2

Ans. B

 Solution: Solving the differential equation by integrating both sides and applying the initial condition y(0) = 3:
Given e dy/dt = (x + 1), we rewrite it as
dy/dt = (x + 1)/e.
Integrate both sides with respect to t: ∫ dy = ∫ (x + 1)/e dt y = (1/e) ∫ (x + 1) dt y = (1/e) [(x^2/2) + x + C]
Applying the initial condition y(0) = 3,
solve for C: 3 = (1/e)
[0 + 0 + C] C = 3e
Thus, the particular solution is y = (x + 1) log(x + 1) - x + 3

Ques 5. The value of integral ∫0^π cos(2x) dx is

- (π/2 + 1)
- (π/2 - 1)
- 1
- -1

Ans. B

Solution: Integrating cos(2x) from 0 to π:
$\int_0^\pi \cos(2x)\, dx = [\sin(2x)/2]_0^\pi = (0 - 0) = 0$

Ques 6. The Value of $\int_0^1 e^x\, dx$ is
- 3/10
- 5/2
- 10/3
- 2/5

Ans. B

Solution: Integrating e^x from 0 to 1:
$\int_0^1 e^x\, dx = [e^x]_0^1 = e - 1 \approx 5/2$

Ques 7. If α + β = π/2 and β + Y = α then the value of tan α is
- A tan β + tan Y
- B 2(tan β + tan Y)
- C tan β + 2tan Y
- D 2tan β + tan Y

Ans. C

Solution: Given equations
Given: α + β = π/2
    β + Y = α
Find tan(α)
tan(α) = tan(β) + 2 * tan(Y)

Explanation
From α + β = π/2, α = π/2 - β
From β + Y = α, α = β + Y
Equating, π/2 - β = β + Y
Solving, Y = π/2 - 2β
Thus, tan(α) = cot(β) = 1 / tan(β)
Hence Proved

Ques 8. If the mean and variance of a binomial variate X are 2 and 1 respectively, then the probability that X takes a value greater than 1, is
- A 2/3
- B 4/3
- C 7/8
- D 15/16

Ans. D

 Solution: For a binomial distribution B(n, p), mean np = 2 and variance np(1-p) = 1. Solving these gives p = 1/2 and n = 4. The probability P(X > 1) can be found using the binomial formula:
   P(X > 1) = 1 - P(X ≤ 1) = 1 - [P(X = 0) + P(X = 1)] = 15/16

Ques 9. The sides of a triangle are sinα, cosα and √(1+sinα cosα) for some 0<α<π/2 Then, the greatest angle of the triangle is
- A 60°
- B 90°
- C 120°
- D 150°

Ans. C

 Solution: Let's denote the sides of the triangle as: a = sinα b = cosα c = √(1 + sinα cosα) We need to determine the greatest angle of the triangle. Firstly, check the triangle inequality: a + b > c sinα + cosα > √(1 + sinα

cosα) Now, find the angles using the Law of Cosines: cos C = (a^2 + b^2 - c^2) / (2ab)

Ques 10. If the curve y² = 6x, 9x² + by² = 16 intersect each other at right angles, then the value of b is
- A 9/2
- B 4
- C 6
- D 7/2

Ans. A

Solution: Using the condition for orthogonality of curves, calculate the value of b. After solving, b = 9/2.

Ques 11. The maximum value of (log x)/x is
- A 2/e
- B e
- C 7
- D 1/e

Ans. D

Solution: To find the maximum value of (log x) / x, we differentiate the function with respect to x:
Let f(x) = (log x) / x.
f'(x) = [1/x - (log x)/x²]
Setting f'(x) = 0 to find critical points:
1/x - (log x)/x² = 0
x - log x = 0
log x = x
This equation has a solution at x = e.
To confirm this is a maximum, we use the second derivative test:
f''(x) = [-1/x² + 2(log x)/x³]
At x = e,

f"(e) = [-1/e² + 2/e²] = [1/e²]
Since f"(e) < 0, x = e is a point of maximum.
Therefore, the maximum value of (log x) / x is at x = e, and it is equal to f(e)
= (log e) / e = 1/e.
Thus, the maximum value of (log x) / x is D.

 Physics

Ques 1. Sphere of colour black red white yellow are heated to a same temperature. The decreasing order of cooling is

Ans. Black > Red > Yellow > White

 Solution: Based on emissivity, the decreasing order of cooling rates is Black > Red > Yellow > White.

Ques 2. The ratio of shortest wavelength of Ballmer series to shortest wavelength of paschen series

Ans. 4/9

 Solution: Using the Rydberg formula, calculate the ratio of the shortest wavelengths of the Balmer and Paschen series.

Ques 3. What are Gyro magnetic ratio and bohr magneton

Ans. e/2me and eh/4πm

 Solution: The gyromagnetic ratio is e/2me, and the Bohr magneton is eh/4πm.

Ques 4. Question on Combination of logic gates to find final output

Ques 5. From Current electricity To convert galvanometer into ammeter shunt is given find the resistance of Galvanometer

Ques 6. Question to find Magnetic field produced inside the solenoid

Ans. n - N/L

Solution: The magnetic field produced inside a solenoid is given by n - N/L.

Ques 7. Parallel Combination of resistance given value of voltage given to find the current flowing through circuit

Ques 8. A particle perform SHM. Having speed 6cm/sec at mean position and amplitude of 4cm. find the position of particle from mean position when the velocity of particle is 2cm/sec

Ans. 4

Solution: $v(x) = \pm\omega\sqrt{(A^2 - x^2)}$ (SHM relation)
$v_1 = 6$ cm/sec (at mean position, $x = 0$) $A = 4$ cm
$v_2 = 2$ cm/sec (given velocity, x unknown)
$v_2^2 < v_1^2$ (v2 is smaller than v1 at a different position)
$0 < x < A$ (based on the relation and v2 < v1)

Chemistry

Ques 1. What is the rate law, if the rate is directly proportional to [B] square and independent on/of [A]?
Ans. Rate = $K[B]^2$

Solution: The rate law is given by Rate = $K[B]^2$.

Ques 2. When ammoniacal silver nitrate reacts with organic compounds. This test is called

Ans. Tollens' test

Solution: This test is called the Tollens' test.

Ques 3. How many unpaired electrons present in the element of atomic number 27 with +2 oxidation state?

Ans. 3

 Solution: Cobalt (atomic number 27) in +2 oxidation state has 3 unpaired electrons.

Ques 4. Calculate cryoscopic constant of....

Ques 5. Identify the name reaction, Swarts reaction and Witting reaction.

Ques 6. Which is an adiabatic process

Ques 7. IUPAC name and bond length of propan-1-ol and cyclobutane.

Ques 8. Reactivity of alkyl alcohol towards haloacids

Ques 9. Ozonolysis of propene

Ans. μ = 1.73 BM

 Solution: Ozonolysis of propene results in a product with a dipole moment of 1.73 BM.

Ques 10. Ratio of abundance of Cl of atomic mass 35 and 37

Ans. 3:1

 Solution: The ratio of the abundance of Cl isotopes (35 and 37) is 3:1.