

JEE-Main-24-01-2025 (Memory Based)
[MORNING SHIFT]

Physics

Question: A force given by $F = \alpha + \beta x^2$ when $\alpha = 1$ acts on a particle from $x = 0$ to $x = 1$. If the work done is 5 joule then find β .

Options:

- (a) 12
- (b) 1/12
- (c) 1/3
- (d) 3/4

Answer: (a)

Question: If $I = I_A \sin \omega t + I_B \cos \omega t$, then find rms value of current

Options:

(a) $I_{rms} = I_A + I_B$

(b) $I_{rms} = \sqrt{I_A^2 + I_B^2}$

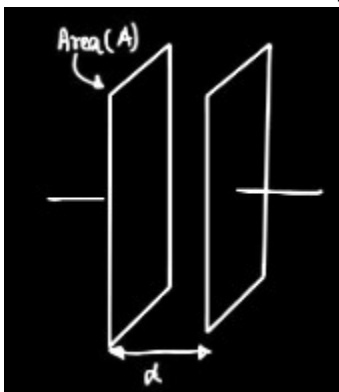
(c) $I_{rms} = \sqrt{\frac{I_A^2 + I_B^2}{2}}$

(d) $I_{rms} = \frac{1}{2} \sqrt{I_A^2 + I_B^2}$

Answer: (c)

Question: For a parallel plate capacitor having plate area A and separation between plate is d.

If electric field between plates is E, find energy density of capacitor.



Options:

- (a) $\frac{1}{4}\epsilon_0 E^2$
- (b) $\frac{1}{2}\epsilon_0 E^2$
- (c) $\frac{E^2}{2\epsilon_0}$
- (d) $\frac{E^2}{2\epsilon_0^2}$

Answer: (b)

Question: What is the relative shift of focal length of a lens when optical power is increased from 0.1 D to 2.5 D?

Options:

- (a) 24/25
- (b) 13/10
- (c) 21/25
- (d) 11/10

Answer: (a)



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Question: A particle of mass m is projected with a velocity V_0 making an angle of 45° with the horizontal. The magnitude of the angular momentum of the projectile about the horizontal point of projection when the particle is at maximum height h is :

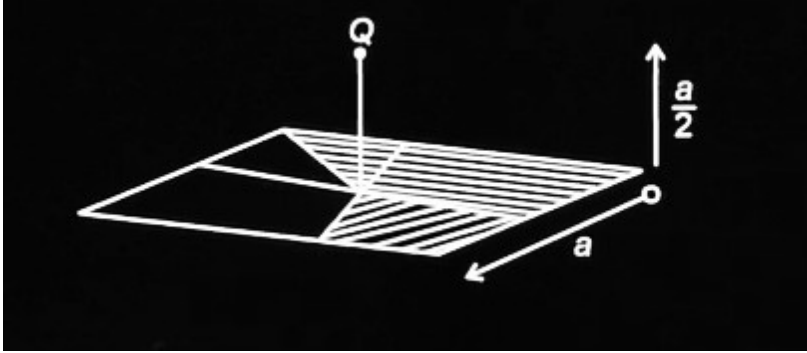
Options:

- (a) zero
- (b) $\frac{mV_0^3}{(4\sqrt{2}g)}$
- (c) $\frac{mV_0^3}{(\sqrt{2}g)}$
- (d) $m\sqrt{3gh^3}$

Answer: (b)

Question: The electric flux through the shaded area of square plate of side a due to point charge placed at distance of $a/2$ from it as shown in figure, is $\frac{NQ}{48\epsilon_0}$.

Then N is



- Options:
- (a) $N = 10$
 - (b) $N = 5$
 - (c) $N = 15$
 - (d) $N = 20$
- Answer: (b)

Question: In a square loop of side length $\frac{1}{\sqrt{2}}$ m, a current of 5 A is flowing. Find magnetic field at its centre in μT .

- Options:
- (a) 80
 - (b) 18
 - (c) 9
 - (d) 8
- Answer: (d)



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Question: The radius of circular motion of a satellite orbiting earth is changed from r to $1.03 r$. The percentage change in time period is

- Options:
- (a) 4.5 %
 - (b) 9 %
 - (c) 3 %
 - (d) 1 %
- Answer: (a)

Question: A plano convex lens of refractive index 1.5 and radius of curvature 2 cm is kept in air and another plano convex lens of same refractive index and radius liquid whose refractive index is 1 : 2. Find f_1/f_2

- Options:
- (a) $1/3$
 - (b) $2/3$
 - (c) $3/2$
 - (d) $3/1$
- Answer: (a)

Question: A car is negotiating a curved road of radius R with maximum velocity v . The road is banked at an angle θ . The coefficient of friction between the tyres of the car and the road is μ_s . Find μ_s

Options:

- (a) $\mu_s = \frac{V_0^2 - Rg \tan \theta}{Rg + V_0^2 \tan \theta}$
- (b) $\mu_s = \frac{V_0^2 - Rg \tan \theta}{Rg + V_0^2 \tan \theta}$
- (c) $\frac{V_0^2}{Rg}$
- (d) $\frac{V_0^2}{Rg \cos \theta}$

Answer: (a)

Question: Which statements are correct

S-1 : Zener diode works in inverse biased in heavily doped biasing

S-2 : LED work in forward bias and are heavily doped

S-3 : Photo diode work in forward bias and are lightly doped

S-4 : Solar cells are forward biased and are lightly doped

S-5 : An ideal P-N junction offers high resistance in reverse biasing and low resistance in forward biasing.

Options:

(a) S - 1, S - 2 and S - 5 are correct

(b) S - 1, S - 3 and S - 4 are correct

(c) S - 1, S - 2 and S - 4 are correct

(d) S - 1, S - 3 and S - 5 are correct

Answer: (a)

Question: An electron jumps from principal quantum state A to C by releasing photon of wavelength 2000 Å and from state B to C by releasing of photon of wavelength 6000 Å, then find the wavelength of photon for transition from A to B.

Options:

(a) 3000 Å

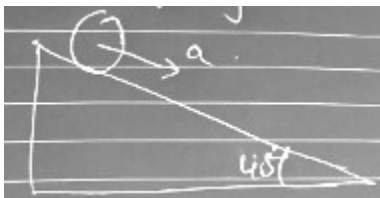
(b) 4000 Å

(c) 8000 Å

(d) 2000 Å

Answer: (a)

Question: The acceleration of a solid cylinder mass 'm' Radius 'R' rolling down an incline of 45° without slipping .



Options:

(a) 9 (b)

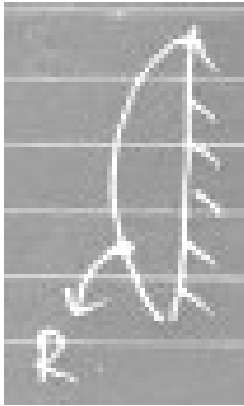
9/2 (c)

9√2/3 (d)

9√3/2

Answer: (3)

Question: For a given plano convex silvered as shown if equivalent focal length is F . Find radius of curvature of convex surface Refractive index(μ) surrounding as



Options:

(a) $\frac{(1 - \mu)}{2F}$

(b) $2(\mu - 1)F$

(c) $\frac{(\mu - 1)F}{2}$

(d) $(\mu - 1)F$

(e) $\frac{2F}{\mu - 1}$

Answer: (b)



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Question: A liquid drop is divided into 27 droplets and in that process work done is 10 J. If the same droplet is divided into 64 small droplets then find the work done.

Options:

(a) 30 J

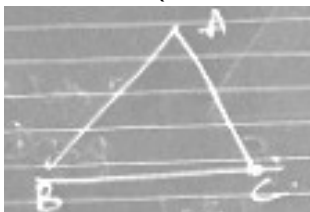
(b) 15 J

(c) 10 J

(d) 60 J

Answer: (b)

Question: In the given figure total resistance of the wire ABC is R . Find resistance across AB. ($AB = BC = CA$)



Options:

(a) $R/3$

(b) $2R/5$

(c) $3R/7$

(d) $2R/9$

Answer: (d)

Question: A particle starts performing simple harmonic motion from its mean position with time period 2s and amplitude of 1cm. The average speed of the particle after 12.5 sec from the start of its motion is nearly.

Options:

- (a) 2 m/s
- (b) 200 m/s
- (c) 0.02 cm/s
- (d) 2 cm/s

Answer: (d)

Question: In an ideal gas pressure is varying with temperature according to the given equation $P = 2T$. Find which of the following statements are correct (2 is a constant).

Statement 1 - process can be considered isochoric

Statement 2 - change in internal energy is 0

Statement 3 - Work done on the gas is 0

Statement 4 - No transfer of that energy

Options:

- (a) Statement 1,2,3
- (b) Statement 4
- (c) Statement 1 & 3
- (d) None of these

Answer: (c)

Question: In a parallel plate capacitor length and width are 3 cm and 1 cm respectively. Separation between plates is $3 \mu\text{m}$. By which of the following values capacitance increases by a factor of 10.

- (a) $l=6 \text{ cm}$, $b = 5 \text{ cm}$, $d = 3 \mu\text{m}$
- (b) $l=5 \text{ cm}$, $b=2 \text{ cm}$, $d= 1 \mu\text{m}$
- (c) $l =5 \text{ cm}$, $b= 1 \text{ cm}$, $d= 30 \mu\text{m}$
- (d) $l=1 \text{ cm}$, $b=1 \text{ cm}$, $d =30 \mu\text{m}$

Options:

- (a) A, B
- (b) A, C
- (c) B, C
- (d) B, C, D

Answer: (a)

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Chemistry

Question: Which of the following is the strongest oxidizing agent?

Options:

- (a) Eu^{2+}
- (b) Ce^{2+}
- (c) Ce^{4+}
- (d) Eu^{4+}

Answer: (c)

Question: The difference in melting point and boiling point of oxygen and sulphur can be explain

Options:

- (a) Electronegativity
- (b) Electron gain enthalpy
- (c) Atomicity
- (d) Ionisation energy

Answer: (c)

Question: Ribose present in DNA is

- (A) It is a pentose sugar
 - (B) Present in pyranose form
 - (C) anomeric carbon is present
 - (D) Present in D configuration
 - (E) It is reducing sugar in free form
- Choose the correct statements :

Options:

- (a) A, C & E only
- (b) A, D & E only
- (c) A, B, C, D & E
- (d) A & E only

Answer: (b)

Question: Process is nonspontaneous at freezing point but spontaneous at boiling point, find ΔH and ΔS .

Options:

- (a) Both are Positive
- (b) Both are Negative
- (c) ΔS Positive, ΔH Negative
- (d) ΔS Negative, ΔH Positive

Answer: (a)

Question: Find the most stable carbocation among the following carbocations.

Options:

- (a)
- (b)
- (c)
- (d)

Answer: (b)

Question: Which of the following is most reactive towards nucleophilic addition reaction?

Options:

- (a) Para-nitro benzaldehyde
 (b) Para-methyl benzaldehyde
 (c) Benzaldehyde
 (d) Acetophenone

Answer: (a)

Question: Which compound react fastest with HBr

Options:

- (a)
- (b)
- (c)
- (d)

Answer: (a)

Question: For an ideal mono atomic gas undergoing an isobaric process, the ratio of

ΔU is

Options:

- (a) 5/3
 (b) 7/5
 (c) 4/3
 (d) 5/4

Answer: (a)



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Question: In H₂O, and CH₄

- (A) All central atoms are sp³ hybridised
- (B) Order of dipole moment is CH₄ < NH₃ < H₂O
- (C) NH₃ in H₂O is basic in nature, NH₃ and H₂O are Bronsted-Lowry acid and base respectively
- (D) Bond angle of H₂O, NH₃ and CH₄ respectively are 104.5°, 107° and 109.5°

Options:

- (a) A and B only
- (b) A, B and C only
- (c) A, B, C and D
- (d) A, B and D only

Answer: (d) Question: In the preparation of potassium permanganate from pyrolusite

are (MnO₂),

the fusion of pyrolusite ore is done with an alkali metal hydroxide like KOH in the presence of air or an oxidising agent like KNO₃, which first produces.

Options:

- (a) K₂MnO₆
- (b) K₂MnO₄
- (c) KMnO₄
- (d) KMnO

Answer: (b)



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Question: Which of the following complex problem 2 mole of AgCl ppt in presence of exceed amount of AgNO₃

Options:

- (a) CoCl₃. 4NH₃
- (b) CoCl₃. 5NH₃
- (c) CoCl₃. 3NH₃
- (d) CoCl₃. 6NH₃

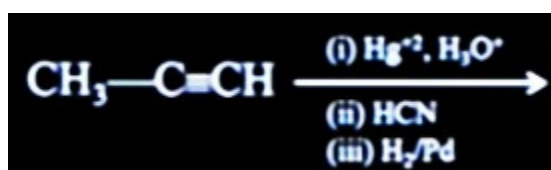
Answer: (b) Question: In Duma's which gas evolved?

Options:

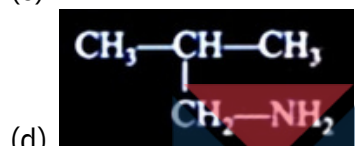
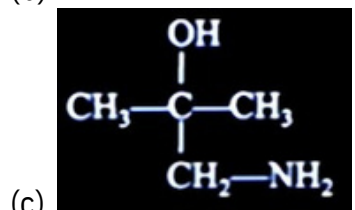
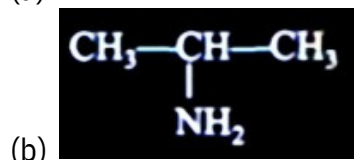
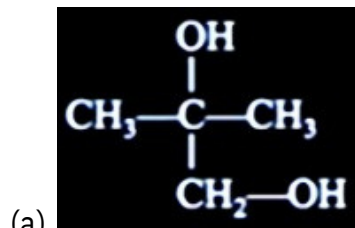
- (a) N₂
- (b) O₂
- (c) SO₂
- (d) SO₃

Answer: (a) Question: Find product of following sequence of

reaction is



Options:



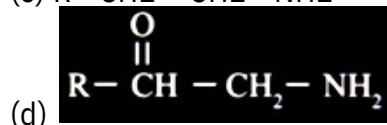
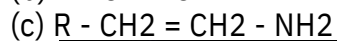
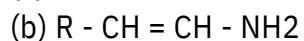
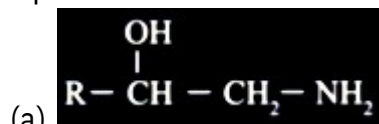
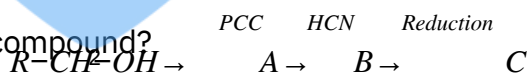
Answer: (c)

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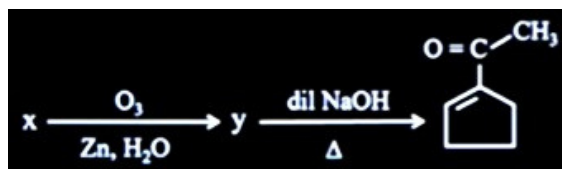
Question:

What is 'C' compound?

Options:



Answer: (a)

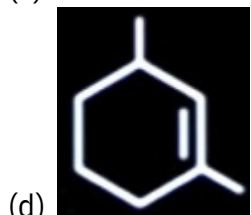
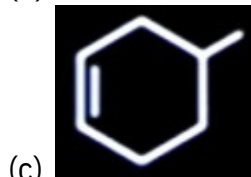
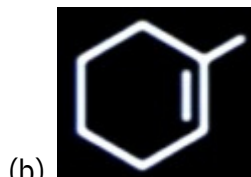


Question:

Options:

x would be:





Answer: (b)

Question: Calculate the standard cell potential of the cell in which following reaction takes place:



Given that:

$$E^\circ(\text{Ag}^+/\text{Ag}) = x \text{ volt}$$

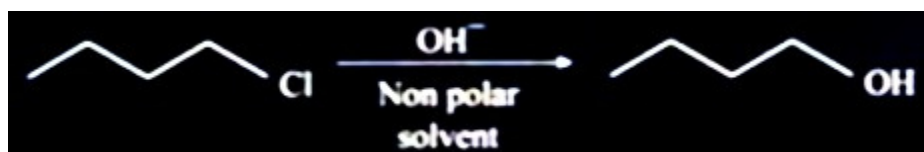
$$E^\circ(\text{Fe}^{2+}/\text{Fe}) = y \text{ volt}$$

$$E^\circ(\text{Fe}^{3+}/\text{Fe}) = z \text{ volt}$$

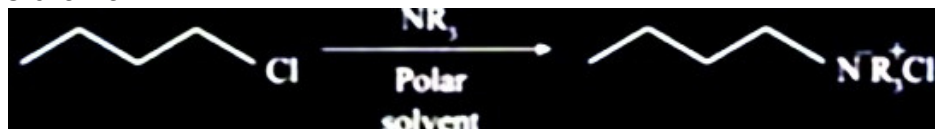
Options:

(a) $x + y - z$ (b) $x + 3y - 2z$ (c) $y - 2x$ (d) $x - 3z + 2y$

Answer: (d) Question: Statement-I



Statement-II



Options:

(a) Statement-1 is false, statement-2 is true

(b) Statement-1 is true, statement-2 is true, statement-2 is the correct explanation of statement-1

(c) Statement-1 is true, statement-2 is false

(d) Statement-1 is true, statement-2 is true, statement-2 is not the correct explanation of Statement-1

Answer: (d)

Question: If the K_{sp} of $\text{Cr}(\text{OH})_3$ is 1.6×10^{-32} . The molar solubility of salt in water is 1.56×10^{-x} , then value of x is

Answer: (8)

$$1.6 \times 10^{-30} = 27s^4 \quad \frac{1.6 \times 10^{-32}}{27} = s^4 \quad 1.56 \times 10^{-8} = s$$

Question: If 10 mol CO and 10 mol of Fe_3O_4 reacts according to $\text{Fe}_3\text{O}_4 + 4\text{CO} \rightarrow 4\text{CO}_2 + 3\text{Fe}$. What is the Weight of Fe produce?

Answer: (420g)



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Maths

Question: If the 5th, 6th, and 7th term of the binomial expansion of $(1+x)^{2n+4}$ are in A.P. Then the greatest binomial coefficient in the expansion of $(1+x)^{n+4}$ is

Options:

- (a) 10
- (b) 35
- (c) 25
- (d) 14

Answer: (b)

$${}^N C_4, {}^N C_5, {}^N C_6 \rightarrow AP, N = n + 4$$

$${}^N C_4 + {}^N C_6 = 2 \cdot {}^N C_5$$

$$\Rightarrow \frac{{}^N C_4}{{}^N C_5} + \frac{{}^N C_6}{{}^N C_5} = 2$$

$$\Rightarrow \frac{5}{N-4} + \frac{N-5}{6} = 2$$

$$\Rightarrow 30 + n^2 - 9N + 20 = 12N - 98$$

$$\Rightarrow N^2 - 21N + 98 = 0$$

$$\Rightarrow (N-7)(N-14) = 0 \Rightarrow N = 7, 14$$

$$\text{Greatest Binomial Coefficient} = {}^7 C_3 = {}^7 C_4 = \frac{7 \times 6 \times 5}{6} = 35$$

or ${}^{14} C_7$

Question: The number of 3 digit numbers which is divisible by 2 and 3 but not divisible by 4 and 9.

Options:

- (a) 150
- (b) 25
- (c) 125
- (d) 50

Answer: (d)

Divisible by 2 but not by 4 = 225

102, 106, 110,998

out of this divisible by 3

102, 114, 126,990

$12n + 90 = n = 1, 2, \dots, 75$

So only divisible by 3 but not by 9

$n = 1, 2, 4, 5, 7, 8, \dots$ i.e., 50

Question: If A is 3×3 matrix such that $\det(A) = 2$. Then \det

$$(\text{adj}(\text{adj}(\text{adj}(\text{adj}A))))$$

Options:

- (a) 2^{32}
- (b) 2^{16}
- (c) 2^8
- (d) 2^{12}

Answer: (b)

$$|A| = 2$$

$$||adj(adj(adjA))||$$

$$= |A|^{24} = 2^{16}$$

Question: Evaluate $\lim_{x \rightarrow 0} \cos ecx. (\sqrt{2\cos^2x + 3\cos x} - \sqrt{\cos^2x + \sin x + 4})$

Options:

- (a) 1
- (b) 0
- (c) $\frac{1}{2\sqrt{5}}$
- (d) $-\frac{1}{2\sqrt{5}}$



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Answer: (d)

$$\lim_{x \rightarrow 0} \frac{\sqrt{2\cos^2x + 3\cos x} - \sqrt{\cos^2x + \sin x + 4}}{\sin x}$$

$$\frac{\frac{1}{2\sqrt{2\cos^2x + 3\cos x}} [(4\cos x)(-\sin x) - 3\sin x] - \frac{1}{2\sqrt{\cos^2x + \sin x + 4}} [(2\cos x)(\sin x) + \cos x]}{\cos x}$$

$$= 0 - \frac{1}{2\sqrt{5}} = -\frac{1}{2\sqrt{5}}$$

Question: If $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = 3\hat{i} + \hat{j} - \hat{k}$ and \vec{c} is coplanar with \vec{a} and \vec{b} . Also $\vec{a} \cdot \vec{c} = 5$ and \vec{c} is perpendicular to \vec{b} . Then $|\vec{c}|$ is

Options:

- (a) 18
- (b) 16
- (c) $\frac{\sqrt{5}}{14}$

$$(d) \sqrt{\frac{11}{6}}$$

Answer: (d)

$$\vec{a} = (1, 2, 3), \vec{b} = (3, 1, -1), a \cdot c = 5$$

$$\vec{c} = \lambda \vec{b} \times (\vec{a} \times \vec{b})$$

$$= \lambda [b^2 \vec{a} - (\vec{b} \cdot \vec{a}) \vec{b}]$$

$$= \lambda (11(\hat{i} + 2\hat{j} + 3\hat{k}) - (2)(3\hat{i} + \hat{j} - \hat{k}))$$

$$= \lambda (5\hat{i} + 20\hat{j} + 35\hat{k})$$

$$= 5\lambda (\hat{i} + 4\hat{j} + 7\hat{k})$$

$$\vec{a} \cdot \vec{c} = 5 \Rightarrow 5\lambda(1 + 8 + 21) = 5$$

$$\Rightarrow 5\lambda = \frac{1}{6}$$

$$|\vec{c}| = 5\lambda\sqrt{66} = \frac{\sqrt{66}}{6} = \sqrt{\frac{66}{36}} = \sqrt{\frac{11}{6}}$$

Question: The area of the region bounded by $S(x, y)$ such that $S = \{(x, y) : x^2 + 4x + 2 \leq y \leq |x + 2|\}$ is (in sq. units)

Options:

(a) —

(b) 5^4

(c) —

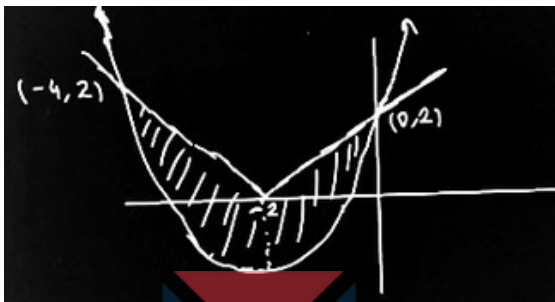
(d) 7^2

Answer: (c)



$$(x + 2)^2 - 2 \leq y \leq |x + 2|$$

$$\begin{aligned} A &= \int_{-4}^{-2} (-x - 2 - x^2 - 4x - 2) dx + \int_{-2}^0 (x + 2 - x^2 - 4x - 2) dx \\ &= \int_{-4}^{-2} (-x^2 - 5x - 4) dx + \int_{-2}^0 (-x^2 - 3x) dx \\ &= \left(-\frac{x^3}{3} - \frac{5x^2}{2} - 4x \right)_{-4}^{-2} + \left(-\frac{x^3}{3} - \frac{3x^2}{2} \right)_{-2}^0 \\ &= \frac{10}{3} + \frac{10}{3} = \frac{20}{3} \end{aligned}$$



Question: If $\frac{dy}{dx} + \left(\frac{x}{1+x^2} \right) y = \frac{\sqrt{x}}{\sqrt{1+x^2}}; y(0) = 0$, then $y(1)$ will be

- Options:
- (a) —
 - (b) $\frac{2}{3}$
 - (c) $\frac{\sqrt{2}}{3}$
 - (d) $\frac{2}{\sqrt{3}}$

Answer: (c)

$$\frac{dy}{dx} + \frac{x}{1+x^2} y = \frac{\sqrt{x}}{\sqrt{1+x^2}}, P = \frac{-x}{1+x^2}, Q = \sqrt{\frac{x}{1+x^2}}$$

$$I.F = e^{\int -\frac{x}{1+x^2}}$$

$$\text{Let } 1+x^2 = t, 2x dx = dt, -x dx = -\frac{dt}{2}$$

$$\text{So I.F} = e^{-\frac{1}{2} \int \frac{1}{t} dt} = e^{-\frac{1}{2} \log t} = \sqrt{t} = \sqrt{1+x^2}$$

$$\text{Now } y \cdot \text{I.F} = \int \sqrt{\frac{x}{1+x^2}} \times \sqrt{1+x^2} dx$$

$$y \cdot \sqrt{1+x^2} = \int \sqrt{x} dx = \frac{2}{3} x^{\frac{3}{2}} + c$$

$$y(0) = 0 \text{ so } 0 = C$$

$$y(1) = y \cdot \sqrt{2} = \frac{2}{3} \times 1 + 0$$

$$y = \frac{\sqrt{2}}{3}$$

Question: If α and β are real numbers such that $\sec^2(\tan^{-1}\alpha) + \operatorname{cosec}^2(\cot^{-1}\beta) = 36$ and $\alpha + \beta = 8$, then $(\alpha^2 + \beta^2)$ is ($\alpha > \beta$)

Options:

- (a) 23
- (b) 28
- (c) 24
- (d) 27

Answer: (b)

$$\sec^2(\tan^{-1}\alpha) + \operatorname{cosec}^2(\cot^{-1}\beta) = 36, \quad \alpha + \beta = 8$$

$$1 + \alpha^2 + 1 + \beta^2 = 36 \Rightarrow \alpha^2 + \beta^2 = 34$$

$$\Rightarrow \alpha^2 + (8 - \alpha)^2 = 34$$

$$\Rightarrow 2\alpha^2 - 16\alpha + 30 = 0$$

$$\alpha^2 - 8\alpha + 15 = 0 \Rightarrow \alpha = 5, \beta = 3$$

$$\alpha^2 + \beta^2 = 28$$

Question: $f(x) - 6f\left(\frac{1}{x}\right) = \frac{35}{3x} - \frac{5}{2}$. If $\lim_{x \rightarrow 0} \left(\frac{1}{\alpha x} + f(x)\right) = \beta$, find $(\alpha + 2\beta)$.

Solution:

$$f(x) - 6f\left(\frac{1}{x}\right) = \frac{35}{3x} - \frac{5}{2}$$

$$6f\left(\frac{1}{x}\right) - 36f(x) = \left(\frac{35x}{3} - \frac{5}{2}\right) \times 6$$

$$-35f(x) = \frac{35}{3x} - \frac{5}{2} + 70x - 15$$

$$-35f(x) = 70x + \frac{35}{3x} - \frac{35}{2}$$

$$f(x) = \frac{1}{2} - 2x - \frac{1}{3x}$$

$$\lim_{x \rightarrow 0} \frac{1}{\alpha x} + \frac{1}{2} - 2x - \frac{1}{3x}$$

$$= \left(\frac{1}{\alpha} - \frac{1}{3}\right) + \frac{1}{2} - 2x$$

$$\alpha = 3$$

$$\beta = \frac{1}{2}$$

Question: $I_{m,n} = \int_0^1 x^{m-1}(1-x)^{n-1} dx$, then $I(9, 13)$ is equal to

Solution :

$$I_{m,n} = \int_0^1 x^{m-1}(1-x)^{n-1} dx$$

$$I_{9,13} = \int_0^1 x^8(1-x)^{12} dx$$

$$= x^8 \frac{(1-x)^{-13}}{-13} \Big|_0^1 - \int_0^1 8x^7 \frac{(1-x)^{13}}{-13} dx$$

$$= \frac{8}{13} \int_0^1 x^7(1-x)^{13} dx$$

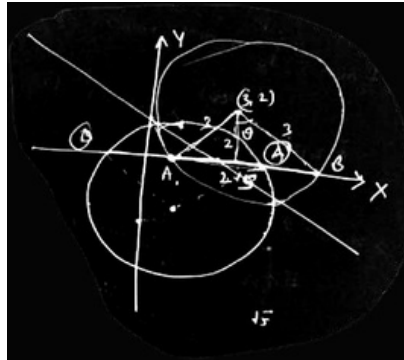
$$= \frac{8!}{13-14 \dots 20} \int_0^1 (1-x)^{20} dx$$

$$= \frac{1}{{}^{20}C_8} \times \frac{1}{21}$$

Question: Consider the circle $x^2 + y^2 - 2x + 4y - 4 = 0$. This circle is reflected about the line $x + 2y = 2$. A chord of this reflected circle through origin and parallel to x-axis meets the circle at A and B. Find the area of region bounded by AB and circle (smaller one).

Solution :

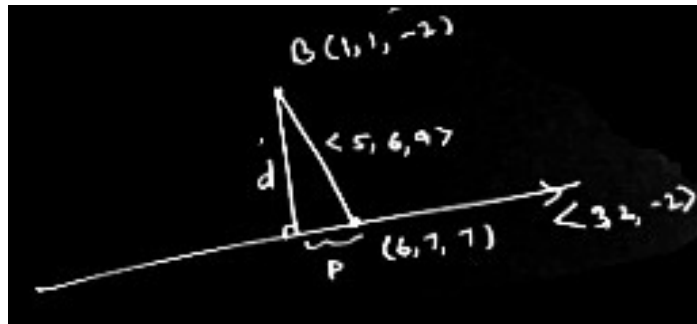
$$\begin{aligned}(x - 3)^2 + (y - 2)^2 &= 9 \\(x - 3)^2 &= 5 \\x &= 3 \pm \sqrt{5} \\m &= \sin \theta = \frac{\sqrt{5}}{3} \\A &= x\theta. 3^2 - \frac{1}{2} \times 2\sqrt{5} \times 2 \\&= \left[9\sin^{-1} \frac{\sqrt{5}}{3} - 2\sqrt{5} \right]\end{aligned}$$



Question: A and C are two points on the line $\frac{x-6}{3} = \frac{y-7}{2} = \frac{z-7}{-2}$ such that AC = 6. B is (1, 1, -2). Find area of ΔABC

Solution :

$$\begin{aligned}P &= \frac{15+12-18}{\sqrt{17}} \\&= \frac{9}{\sqrt{17}} \\d &= \sqrt{142 - \frac{81}{17}} = \sqrt{\frac{2333}{17}} \\A &= \frac{1}{2} \times 6 \times \sqrt{\frac{2333}{17}} \\&= 35.13\end{aligned}$$



Question: Let the parabola $y = x^2 + px - 3$ cuts the coordinate axes at P, Q and R. A circle with centre (-1, -1) passes through P, Q and R, then the area of triangle PQR.

Solution :

$$\begin{aligned}R(0, -3) \quad r &= \sqrt{5} \quad P(\alpha, 0) \quad Q(\beta, 0) \\(x + 1)^2 + (y + 1)^2 &= 5 \\(\alpha + 1)^2 + 1 &= 5 \\(\alpha + 1)^2 &= 4 \\ \alpha &= 1, -3 \\P(1, 0), Q(-3, 0) \\ \text{Area} &= \frac{1}{2} \times 4 \times 3 = 6\end{aligned}$$

Question: Find the product of all real roots of equation $(x^2 - 9x + 11)^2 - (x - 4)(x - 5) = 2$ is

Solution :

$$(x^2 - 9x + 11)^2 - (x^2 - 9x + 20) = 2$$

$$(t + 11)^2 - (t + 20) = 2, t = x^2 - 9x \geq \frac{-81}{4}$$

$$t^2 - 21t + 99 - 0 \Rightarrow t = \frac{-21 \pm 3\sqrt{5}}{2} = -7.14, -13.8$$

Product of roots = 99

$$\sum_{i=1}^{10} x_i = 55 \text{ and } \sum_{i=1}^{10} x_i^2 = 328$$

Question: For a distribution of 10 observations, $\sum_{i=1}^{10} x_i = 55$ and $\sum_{i=1}^{10} x_i^2 = 328$. If the observations 4 and 5 are replaced by 6 and 8 respectively, then the new variance is

- Options:
- (a) 2.5
 - (b) 2.7
 - (c) 3.4
 - (d) 3.6

Answer: (b)

$$\sum x = 55 - 4 - 5 + 6 + 8 = 60$$

$$\sum x^2 = 328 - 16 - 25 + 36 + 64 = 387$$

$$\bar{x} = 6$$

$$\sigma^2 = \frac{387}{10} - 6^2 = 38.7 - 36 = 2.7$$



Question: A and B playing a game (throwing a pair of dice alternatively). A wins the game when sum = 5 and B wins the game when sum = 8. Probability of A winning given that A starts the game.

Solution :

$$P(A) = \frac{4}{36} = \frac{1}{9}, P(B) = \frac{5}{36}$$

$$P(A \text{ wins}) = \frac{4}{36} + \frac{32}{36} \cdot \frac{31}{36} \cdot \frac{4}{36} + \dots \text{to } \infty$$

$$= \frac{\frac{4}{36}}{2 - \frac{32}{36} \cdot \frac{31}{36}} = \frac{\frac{1}{9}}{1 - \frac{8}{9} \cdot \frac{31}{36}} = \frac{\frac{1}{9}}{1 - \frac{62}{81}}$$

$$= \frac{9}{19}$$

Question: If the images of the points A(1,3), B(3,1) and C(2,4) in the line $x + 2y = 4$ are D, E and F respectively, then the centroid of the triangle DEF is

Solution :

The mirror line is $x + 2y - 4 = 0$

image of A (1,3) is $\frac{x-1}{1} = \frac{y-3}{2} = -2\left(\frac{1+6-4}{5}\right)$

image of B (3, 1) is $\frac{x-3}{1} = \frac{y-1}{2} = -2\left(\frac{3+2-4}{5}\right)$

image of (2, 4) is $\frac{x-2}{1} = \frac{y-4}{2} = -2\left(\frac{2+8-4}{5}\right)$

$$x = \frac{-2}{5}, y = -\frac{4}{5}$$

So $D = \left(-\frac{1}{5}, \frac{3}{5}\right), E = \left(\frac{13}{5}, \frac{1}{5}\right), F = \left(\frac{-2}{5}, \frac{-4}{5}\right)$

$$\text{Centroid} = \left(\frac{\frac{-1}{5} + \frac{13}{5} + \frac{-2}{5}}{3}, \frac{\frac{3}{5} + \frac{1}{5} + \frac{-4}{5}}{3}\right)$$

$$= \left(\frac{10}{15}, \frac{10}{15}\right) = \left(\frac{2}{3}, 0\right)$$



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