LIVE

JEE MAIN 2024

ATTEMPT – 02 , 04th April 2024 , SHIFT – 01

PAPER DISCUSSION

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CHEMISTRY

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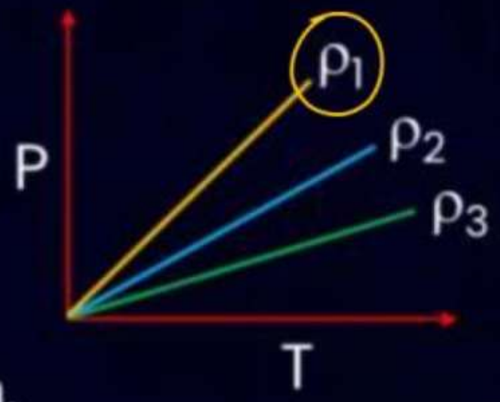
PHYSICAL CHEMISTRY

We are given with the following graph between P and T.

Ideal gas Eq^{n}



ρ = density

$PV = nRT$

$$d = \frac{PM}{RT}$$

$$P = \left(\frac{dR}{M}\right)T$$

$d \uparrow$ slope $\uparrow$

Choose the correct option.

A $\rho_1 > \rho_2 > \rho_3$

B $\rho_1 < \rho_2 < \rho_3$

C $\rho_1 = \rho_2 = \rho_3$

D $\rho_2 > \rho_1 > \rho_3$

De broglie wavelength of electron in n = 4... is _π a_0..... where a_0 is bohr radius.

$2\pi r = n\lambda$

$\lambda = \frac{2\pi r}{n} = 2\pi\left(\frac{16a_0}{4}\right)$

$\boxed{\lambda = 8\pi a_0}$

$r_n = 0.529\frac{n^2}{Z}$

$Z = 1$

$r_n = 0.529\, n^2$ (a_0)

$= a_0 \times 4^2 = 16a_0$

The reduction potential of hydrogen electrode in pure water is zero at 25°C. Then what is the pressure of H_2 (in bar).

(Nernst Eqn)

$2H^+ + 2e^- \rightarrow H_2$

$E_{H^+/H_2} = E^0_{H^+/H_2} - \frac{0.0591}{2} \log \frac{P_{H_2}}{[H^+]^2}$

0 0

$P_{H_2} = [H^+]^2 = (10^{-7})^2 = 10^{-14}$ bar.

$[H^+] = 10^{-7}$ M

A 10^{-14}

B 10^{-7}

C 1

D 0.5

Find the molarity of 5.85 gm of NaCl solution containing 500 ml.

A. 0.2 M
B. 20 M
C. 4 M
D. 2 M

Expected : Concentration Terms.

$$\text{Molarity} = \frac{\text{moles of NaCl}}{\text{Vol of soln in L}}$$

$$= \frac{5.85/58.5}{0.5} = \frac{0.1}{0.5} = 0.2\,M$$

For the titration of 20 ml $KMnO_4$ with 20 ml, 2M oxalic acid in acidic medium find molarity of the $KMnO_4$ solution ?

Medium

$KMnO_4 + H_2C_2O_4 + H^+ \longrightarrow Mn + CO_2$

($KMnO_4$: $n=5$; $H_2C_2O_4$: $n=2$; Mn: +2; CO_2: +4)

m. eq of $KMnO_4$ = m. eq of $H_2C_2O_4$

$20 \times M \times 5 = 20 \times 2 \times 2$

$M = \frac{4}{5} = 0.8M$

$N_1V_1 = N_2V_2$

If $k_{Net} = \frac{k_1 k_2}{k_3}$

E_{Net} = 400 kcal/mole
E_{a_1} = 200 kcal/mole
E_{a_2} = 300 kcal/mole

Tough

$\frac{k_1 k_2}{k_3} = k_{net}$

$k_1 = A_1 e^{-E_{a_1}/RT}$
$k_2 = A_2 e^{-E_{a_2}/RT}$
$k_3 = A_3 e^{-E_{a_3}/RT}$

For above data the value of E_{a_3} is ____kcal/mole. at constant temperature

$\{E_a = Activation\ energy\}$
$\{k = rate\ constant\}$

$E_{net} = E_1 + E_2 - E_3$

$400 = 200 + 300 - E_3$

$E_3 = 100$

#Q. 2ml $KMnO_4$ aqueous solution is titrated against 20ml, 2M $H_2C_2O_4$ aqueous solution in Acidic medium, then Molarity of $KMnO_4$ solution is_____?

[Stoichiometry - Easy]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INORGANIC CHEMISTRY

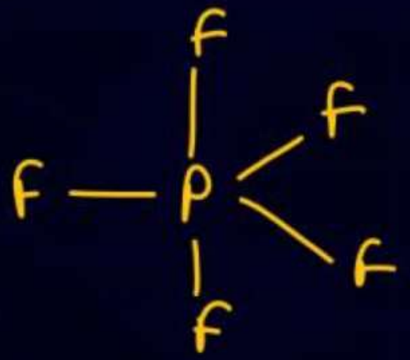
Which of the following have maximum dipole moment ?

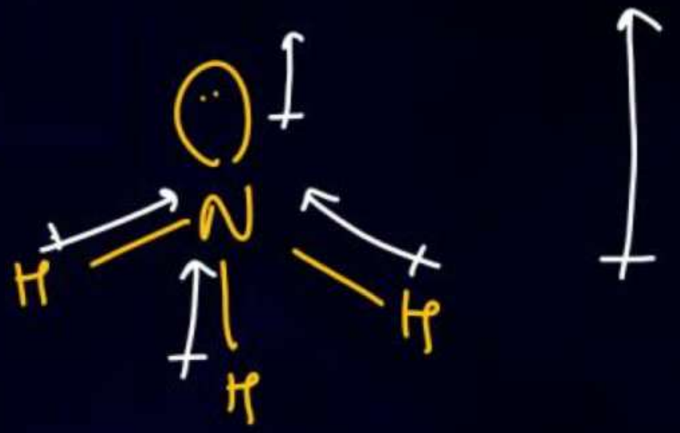
A NH_3

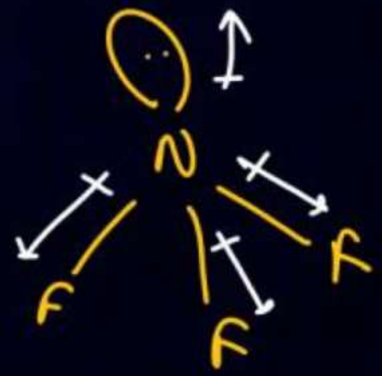
B PF_5

C NF_3

D PCl_5







Which one of the following Elemental shows one oxidation state other than its Elemental state?

A Cu

B Sc

C Ti

D Ni

Sc	Cr	Mn	Cu	Zn
+3			+1 +2	+2
	+6	+7		

$[Sc(H_2O)_6]^{3+}$

Which of the following is the correct order of first ionization enthalpy?

(A) Be < B < O < F < N

(B) B < Be < O < N < F

(C) B < Be < N < F < O

(D) Be < B < N < F < O

Number of complexes from the following with even number of unpaired electron is:

$[Cr(H_2O)_6]^{2+}$, $[Fe(H_2O)_6]^{2+}$, $[Ni(H_2O)_6]^{2+}$, $[Cu(H_2O)]^{2+}$, $[V(H_2O)_6]^{3+}$

4

(a) $Cr^{+2} : d^4$ (b) $Fe^{+2} : d^6$ (c) $Ni^{2+} : d^8$ (d) $Cu^{2+} : d^9$ (e) $V^{3+} : d^2$

$\uparrow\downarrow + e_g$

$\uparrow\downarrow\ \uparrow\downarrow\ \uparrow\downarrow\ t_{2g}$

M^{3+} — N/C — SFL

$[Co(H_2O)_6]^{3+}$ $Co^{3+} : d^6$

Co^{3+} — O/N/C — SFL

SFL

$\uparrow\downarrow\ \uparrow\downarrow\ \uparrow\downarrow$

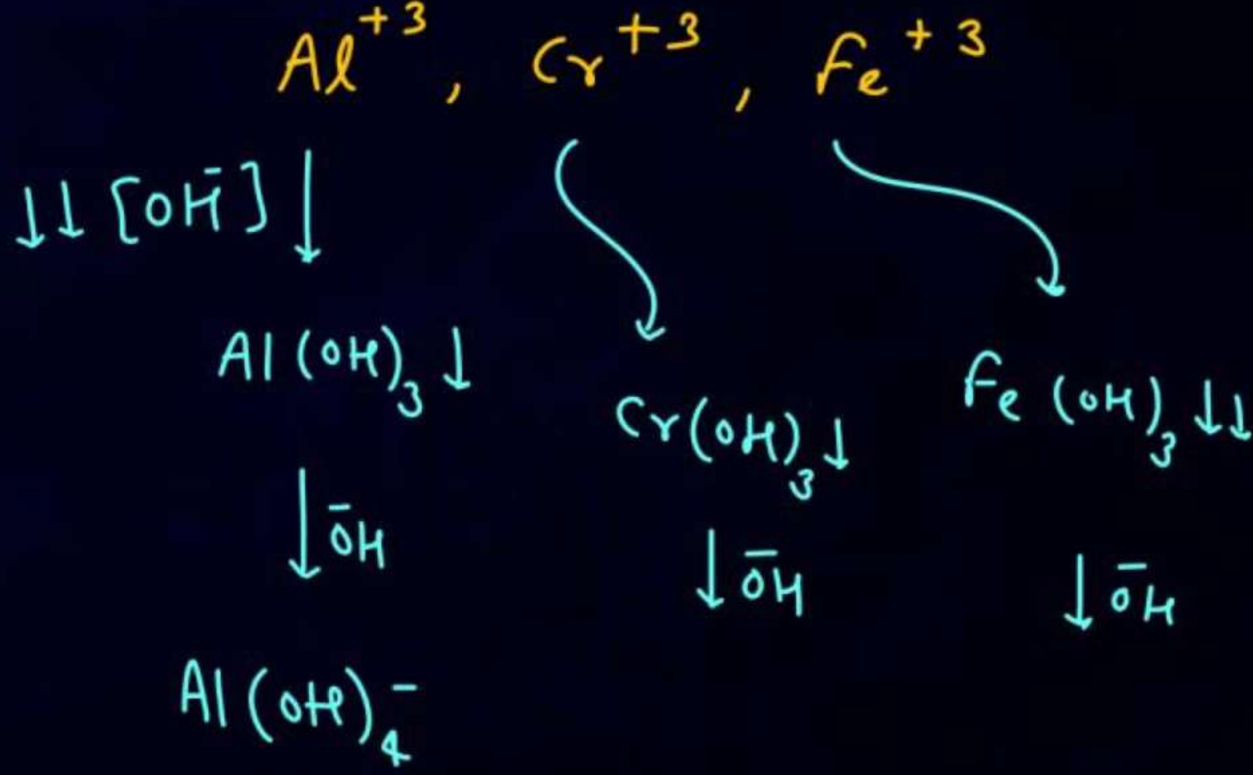
In analysis of 3rd group of basic radicals, why NH_4OH is added in presence of NH_4Cl?

(A) To reduce NH_4^+ ion concentration

(B) To reduce OH^- ion concentration

(C) To increase NH_4^+ ion concentration

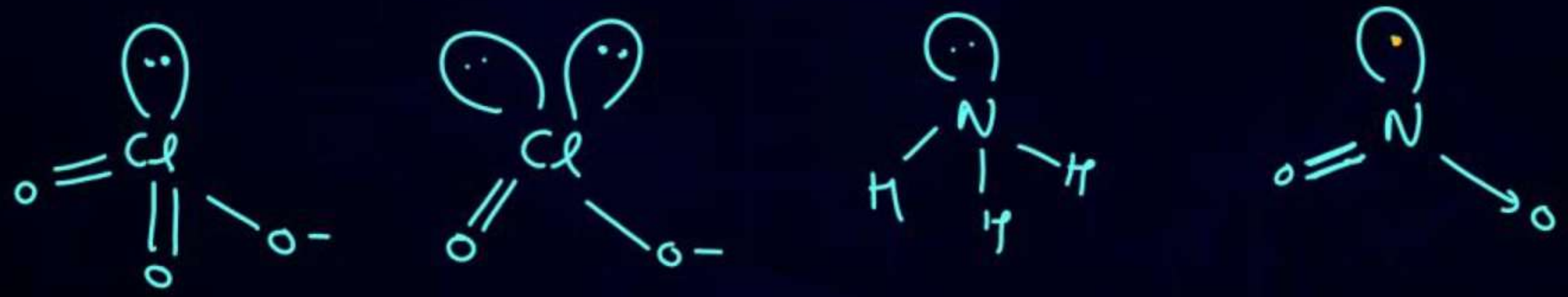
(D) To increase OH^- ion concentration



How many of the following compounds are sp^3 hybridised?

ClO_3^-, ClO_2^-, NH_3, NO_2

(3)



1 lp + 3 sA

2 LP + 2 sA

1 LP + 3 sA

1 + 2 = 3 ≡ sp2

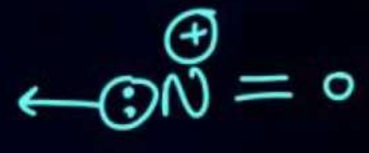
Formula of sodium nitroprusside is:

A $Na_2[Fe(CN)_5NO]$

B $Na_2[Fe(CN)_4NO]$

C $Na_4[Fe(CN)_5NO]$

D $Na_4[Fe(CN)_4NO]$



S^{2-}

$Na_2S + Na_2[Fe(CN)_5(NO)]$

+2 +1

$NO^+ \quad S^{2-} \equiv NOS^-$

+2 -1

$Na_4[Fe(CN)_5(NOS)]$

Voilet **

Decreasing order of the field strength of the following ligands will be:

CO, CN^-, Cl^-, H_2O

(A) $CO > CN^- > H_2O > Cl^-$

(B) $CO > CN^- > Cl^- > H_2O$

(C) $CN^- > CO > H_2O > Cl^-$

(D) $CN^- > CO > Cl^- > H_2O$

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PHYSICS

Position of a particle given as $x = t^4 + 6t^3 + 2t$. Find acc. of particle at $t = 5$ sec.

$$v = \frac{dx}{dt} = 4t^3 + 18t^2 + 2$$

$$a = \frac{dv}{dt} = 12t^2 + 36t$$

[Motion in a st. line, Variable acceleration]

$$a_{t=5} = 12 \times 5^2 + 36 \times 5$$

$$= 480 \text{ m/s}^2$$

Find I_{rms} where $I = 6 + \sqrt{56}\sin(100\ \pi t + \pi/3)$ [Alternating Current RMS value]

$I_{rms} = 6 + \frac{\sqrt{56}}{\sqrt{2}}$

$I = 6 + \sqrt{56}\ \sin\left(100\pi t + \frac{\pi}{3}\right)$

Root Mean Square

$I^2 = \left[6 + \sqrt{56}\ \sin\left(100\pi t + \frac{\pi}{3}\right)\right]^2$

$= \underbrace{36}_{I} + 56\ \sin^2\left(100\pi t + \frac{\pi}{3}\right) + 12\sqrt{56}\ \sin\left(100\pi t + \frac{\pi}{3}\right)$

$I^2_{avg} = 36 + 56 \times \frac{1}{2} + 0$

$= 36 + 28 = \sqrt{64} = 8$ Amp

Ball is thrown from height h it rebounds to h/2 Loss of energy and velocity before it reaches ground respectively are....

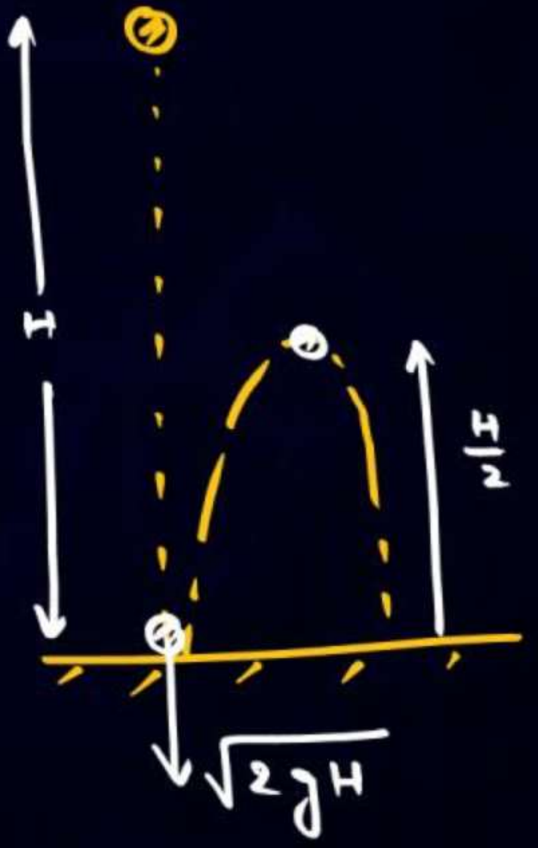
[Work, Power & Energy]

A) 50%.... $\sqrt{gh}$

B) 50% $\sqrt{2gh}$.....

C) 40% $\sqrt{gh}$

D) 40% $\sqrt{2gh}$



De Broglie wavelength of electron in n = 4.... is_ π a ....., Where a is bohr radius

[Atomic Structure, Bohr's mod]

$\lambda = \frac{h}{p}$

$= \frac{K}{\left[\frac{nK}{2\pi r}\right]}$

$\lambda = \frac{2\pi r}{n}$

$= \frac{2\pi}{\pi}\left[\frac{n^2}{2}a\right]$

$= 2\pi n a$

$L = \frac{nh}{2\pi}$

$mvr = \frac{nh}{2\pi}$

$mv = \frac{nh}{2\pi r}$

$\lambda_{n=4} = 2\pi \times 4a$

$= 8\pi a$

Ans

Magnitude of current is zero when voltage is maximum when

[Alternating Current]

A pure inductor

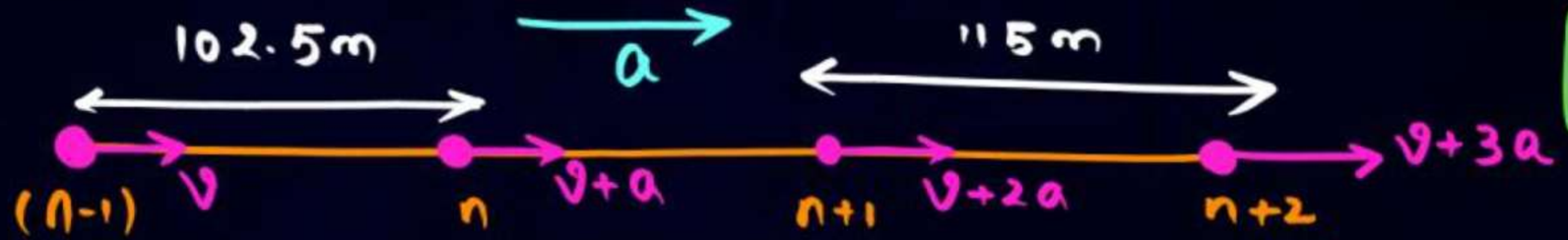
B pure capacitor

C pure resistance

D combination of inductor and capacitor

A body travel 102.5 m in n^{th} second and 115.0 m in $(n+2)^{th}$ sec. find acceleration.

[kinematics 1D]
[Uniform acceleration]



$$102.5 = \left[\frac{v + v+a}{2}\right] \times 1 \quad \Rightarrow \quad v + \frac{a}{2} = 102.5$$

$$115 = \left[\frac{v+2a + v+3a}{2}\right] \times 1 \quad v + \frac{5a}{2} = 115$$

$$2a = 12.5$$

$$a = 6.25\ m/s^2$$

A rod of uniforms mass density of mass M and length L bent into a semi circle a mass m is placed on the centre of circle then the gravitational force is

[Gravitation]

$$f = \frac{GMm}{R^2}\frac{\sin(\theta/2)}{\theta/2}$$

$$\pi R = L$$

$$R = \frac{L}{\pi}$$

$$= \frac{GMm}{R^2}\frac{\sin(\pi/2)}{\pi/2}$$

$$= \frac{2GMm}{\pi R^2} = \frac{2GMm}{\pi\left(\frac{L}{\pi}\right)^2}$$

$$= \frac{2\pi GMm}{L^2}$$

Celsius scale 40 C increase then find the increase in temperature on Fahrenheit scale

$$\Delta f = \frac{9}{5}\Delta c$$

$$= \frac{9}{5} \times 40^{8}$$

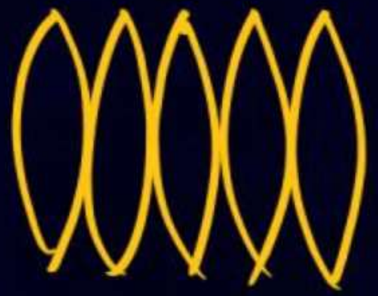
$$= 72^{\circ}f$$

{Thermal prop. of matter
↳ Thermometry}

Five identical convex lenses are placed one after the other in close contact.The power of this arrangement is 25 D. Then, the focal length of one such lens is

[Ray optics]

Combination of lens



$P = 5D$

$f = \frac{100}{5} = 20\,cm$

A 10 D

B 5 D

C 125 D

D 20 D

[Current Electricity]

3D Network.

★ A cubical arrangement of 12 resistors each having resistance R is shown. Find I.

$R_{eq} = \frac{3R}{4}$

(A) $V_0/3R$

(B) $V_0/6R$

(C) $V_0/4R$

(D) $V_0/8R$

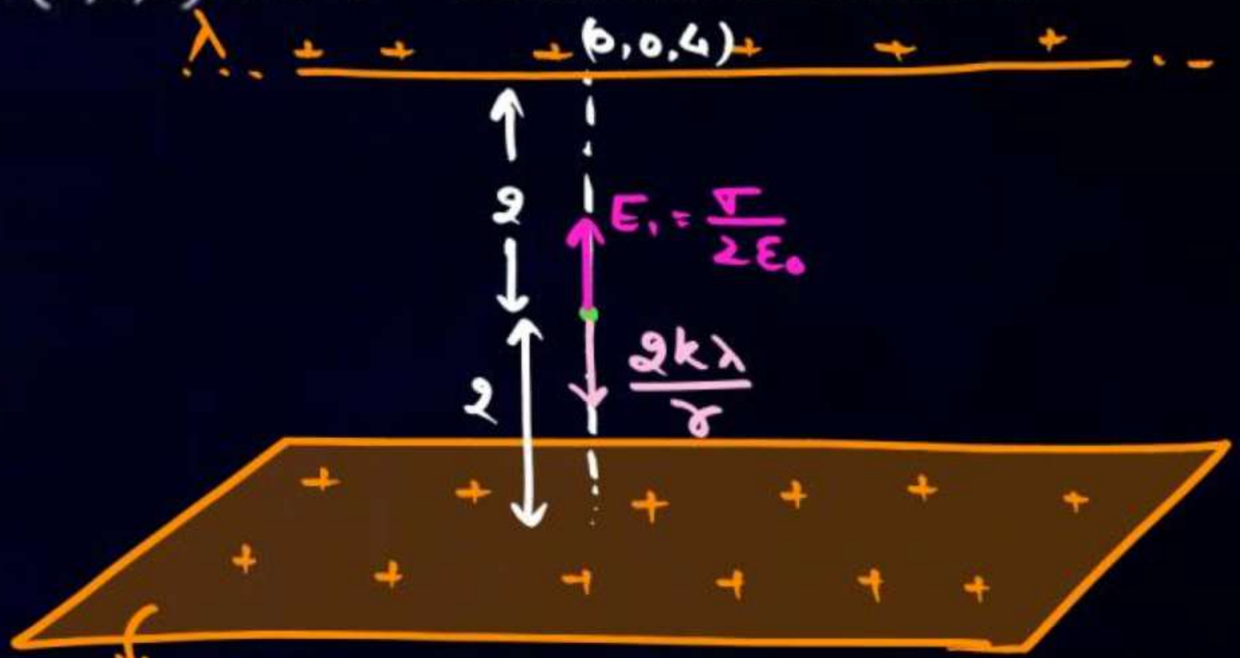
I_0

1 : 3

$\frac{I_0}{4}$

[Electric Charges & field]

Infinite charge sheet in x - y plane of uniform surface charge density σ and infinite long wire of linear charge density λ placed at (0,0,4) and $\sigma = 2\lambda$ then if net electric field at (0,0,2) is $\frac{x\lambda}{4\varepsilon_0}$ find the value of x ?



$$E_1 - E_2 = \frac{\sigma}{2\varepsilon_0} - \frac{2k\lambda}{\gamma}$$

$$= \frac{2\lambda}{2\varepsilon_0} - \frac{2\lambda}{4\pi\varepsilon_0 \gamma}$$

$$= \frac{\lambda}{\varepsilon_0} - \frac{\lambda}{4\pi\varepsilon_0}$$

$$= \frac{\lambda}{\varepsilon_0}\left[1 - \frac{1}{4\pi}\right] = \frac{\lambda}{4\varepsilon_0}\left[\frac{4\pi - 1}{\pi}\right]$$

On a given rough incline plane, a solid sphere and a hollow cylinder having the same radius are rolled one by one, with same speed. Ratio of heights attained by solid sphere and hollow cylinder is

A 9/10

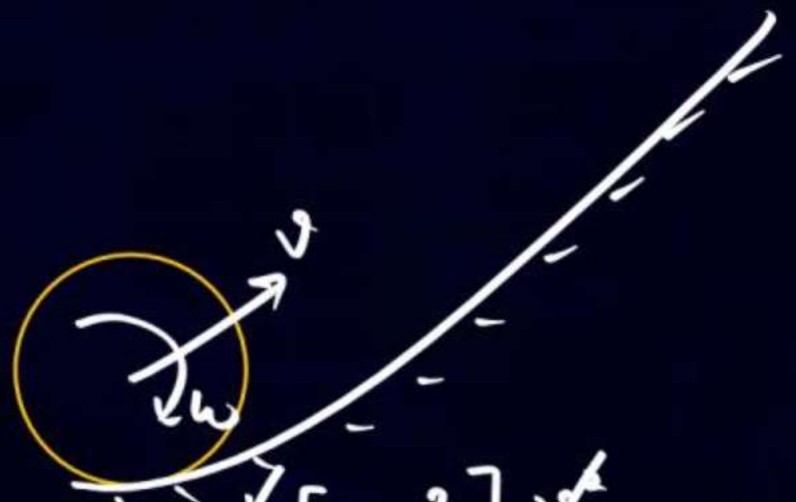
B 3/10

C 7/10

D 6/10

$2/5 mR^2$ mR^2

[Rotation]



$\frac{1}{2}mv^2 + \frac{1}{2}I\omega^2 = mgH$

$\frac{1}{2}mv^2 + \frac{1}{2}I\left[\frac{v}{R}\right]^2 = mgH$

$\frac{1}{2}\left[m + \frac{I}{R^2}\right]v^2 = mgH$

$\frac{1}{2}\left[1 + \frac{I}{mR^2}\right]\frac{v^2}{g} = H$

Solid sph. $\rightarrow H_1 = \frac{1}{2}\left[1 + \frac{2}{5}\right]\frac{v^2}{g}$

Hollow cyl. $\rightarrow H_2 = \frac{1}{2}[1+1]\frac{v^2}{g}$

$\frac{H_1}{H_2} = \frac{7}{5} \times \frac{1}{2} = \frac{7}{10}$ Ans

an electron is moving in a circular path around a long straight wire carrying uniform charge density , then variation of its Kinetic energy with radius of circle is

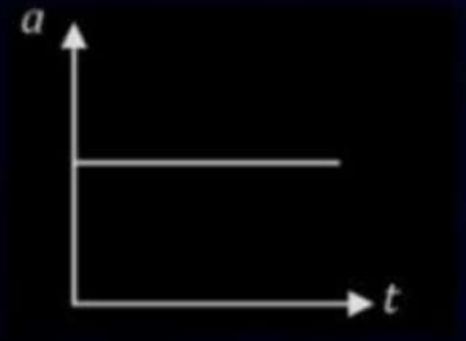
$$f = \frac{mv^2}{r}$$

$$\frac{2k\lambda}{r} \cdot e = \frac{mv^2}{r}$$

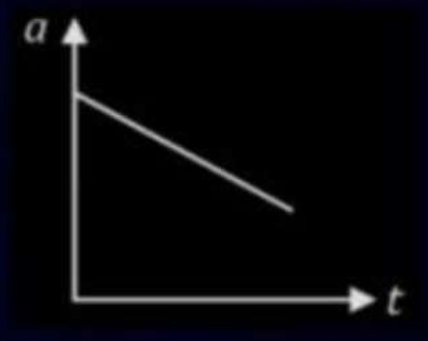
$$\frac{k\lambda e}{m} = \frac{1}{2}mv^2 \rightarrow K.E \propto r^0$$

A wooden block is initially at rest on a smooth surface. Now a horizontal force is applied on the block which increases linearly with time. The acceleration time (a – t) graph for the block would be

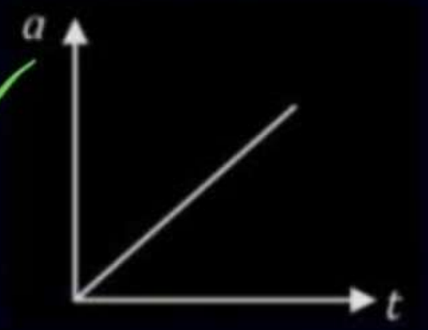
A



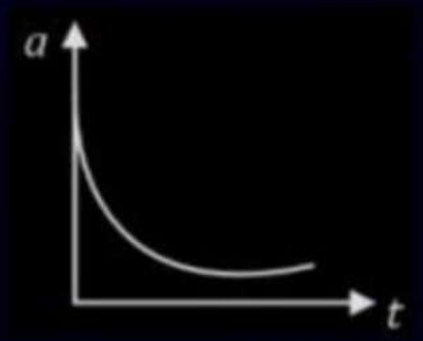
B



C



D

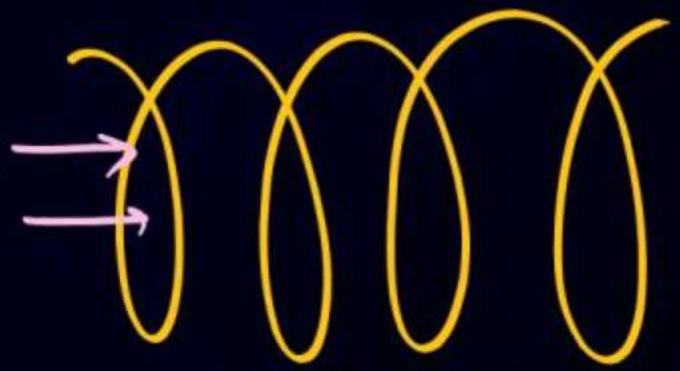


An electron is projected along the axis of solenoid which carries constant current i, the trajectory of electron shall be :

[Magnetic Effect of current]

(A) Circular path

(B) Uniform motion along the axis

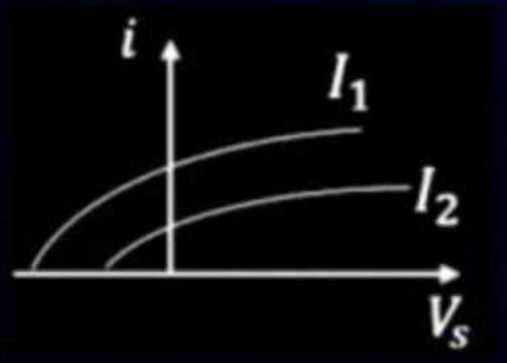


(C) Uniform accelerated motion in straight line

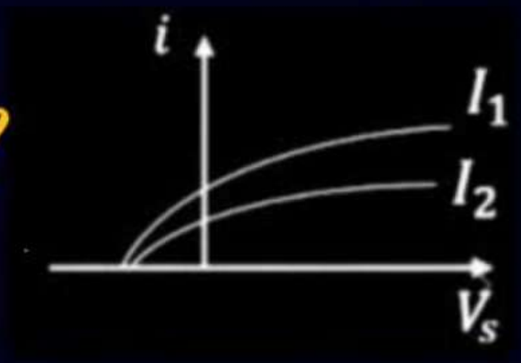
(D) Parabolic path

Which graph correctly represents the photo current (i) vs stopping potential (V_s) for the same frequency but different intensity ? (here, $I_1 > I_2$)

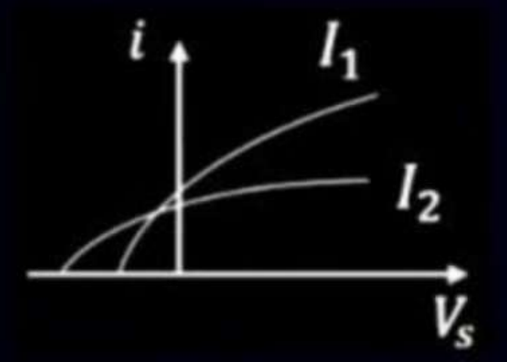
A



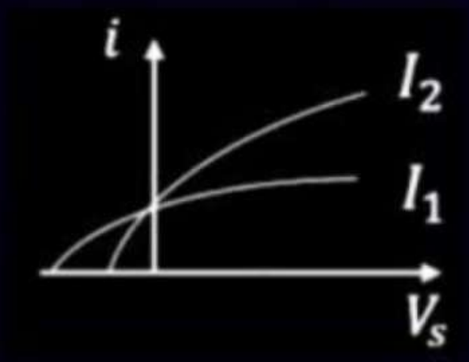
B



C

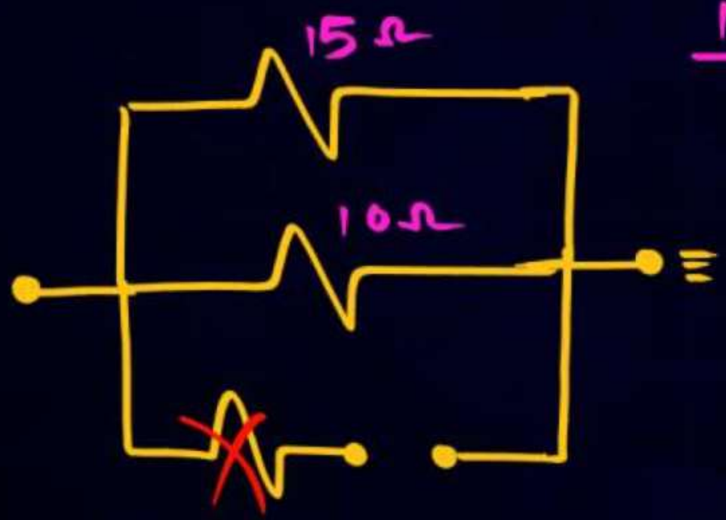


D

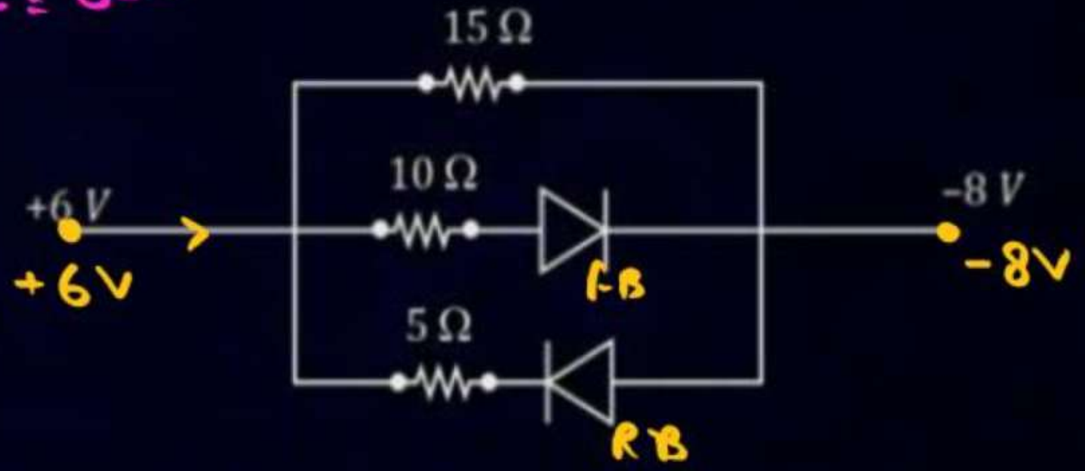


Consider the network shown :

The equivalent resistance of the network is



$\frac{15 \times 10}{25} = 6\Omega$



A. 12 Ω

B. 36 Ω

C. 20 Ω

D. 6 Ω

The Equation of stationary wave is given as $y = 2A\sin\left(\frac{2\pi}{\lambda}nt\right)\cos\left(\frac{2\pi}{\lambda}x\right)$, then which of the following is not correct

$\frac{2\pi}{\lambda} \cdot nt$

$\frac{[LT^{-1}]T}{L}$

$\frac{2\pi}{\lambda} \cdot x$

$\frac{[L]}{[L]}$

A Dimension of x is $[L]$

B Dimension of n is $[LT^{-1}]$

C Dimension of $\frac{n}{\lambda}$ is $[T]$

D Dimension of nt is $[L]$

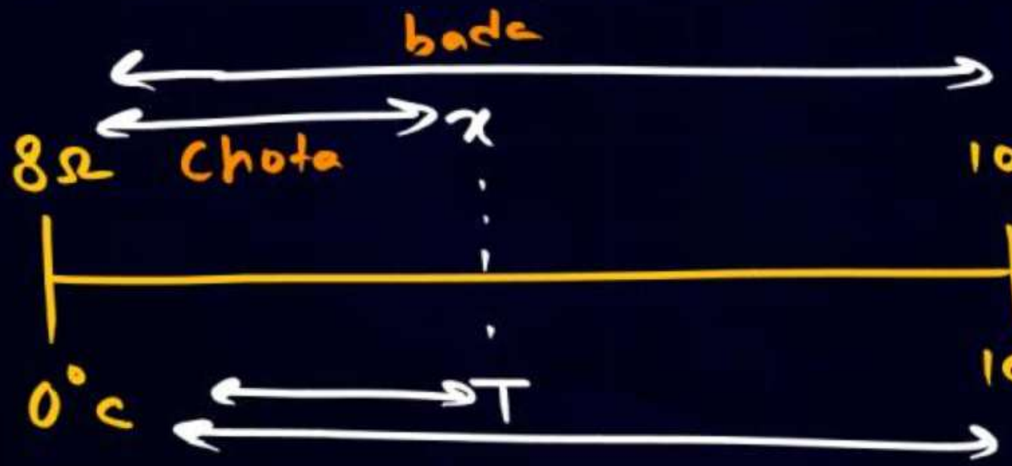
Because of force (separately) of 3 N & 2 N, elongation in spring are found to be 'a' and 'b' unit respectively then (2a – 3b) is

$3 = k\,a \Rightarrow a = \frac{3}{k}$

$2 = k\,b \Rightarrow b = \frac{2}{k}$

$2 \times \frac{3}{k} - 3 \times \frac{2}{k} = 0$ Ans

The resistance of the platinum of a platinum resistance thermometer at the ice point and Steam point are 8 ohm and 10 ohm respectively. After inserting in a hot bath of temperature 400°C the resistance of platinum wire is



$$\frac{R-8}{10-8} = \frac{400-0}{100-0}$$

R 400°c

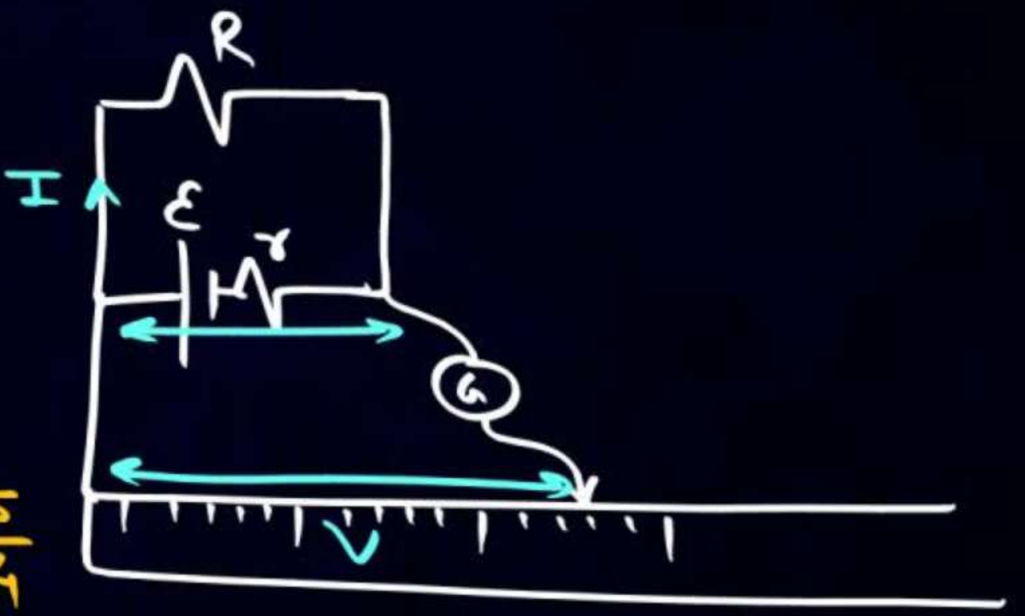
$$\Rightarrow \frac{R-8}{2} = 4$$

$$R = 16\Omega$$

In potentiometer experiment , find the internal resistance of battery when R=10 ohm and the balancing length is 500 m and when R=1 ohm length is 400m?

$$IR = V$$

$$\frac{\mathcal{E}}{R+r} \times R = \lambda \ell$$



$$\frac{\frac{\mathcal{E}\times 10}{10+r}}{\frac{\mathcal{E}\times 1}{1+r}} = \frac{\times 50}{\times 400} \Rightarrow \frac{10(1+r)}{10+r} = \frac{5}{4}$$

$$40+40r = 50+5r$$

$$35r = 10 \Rightarrow r = \frac{2}{7}$$ Ans

For a moving particle in x–y plane the coordinates of the particle is given

$X = 2 + 4t,\ Y = 2t + 4t^2$

$v_x = 4 \quad v_y = 2 + 8t \quad a_x = 0,\ a_y = 8\ m/s^2$

A particle is moving in a straight line with uniform acceleration

B particle is moving in a straight line with non uniform acceleration

C particle is moving in parabolic path with uniform acceleration

D none of these

For two forces vectors F_1 and F_2 the magnitude of F_2 is 3 times F_1 and the resultant magnitude is equal to F_2 then the angle between F_1 and F_2 is $\cos^{-1}(1/n)$ then $|n|$ is ?

$F_2 = 3F_1$

$F_1^2 + F_2^2 + 2F_1F_2\cos\theta = F_2^2$

$F_1^2 = -2F_1F_2\cos\theta$

$F_1 = -2 \times 3F_1\cos\theta$

$\cos\theta = -\frac{1}{6}$

$\theta = \cos^{-1}\left(-\frac{1}{6}\right)$

$|n| = 6$

JEE MAIN 2024 LIVE PAPER DISCUSSION


THANK
YOU

LIVE

JEE MAIN 2024

ATTEMPT – 02 , 04th April 24' , SHIFT - 01

PAPER DISCUSSION

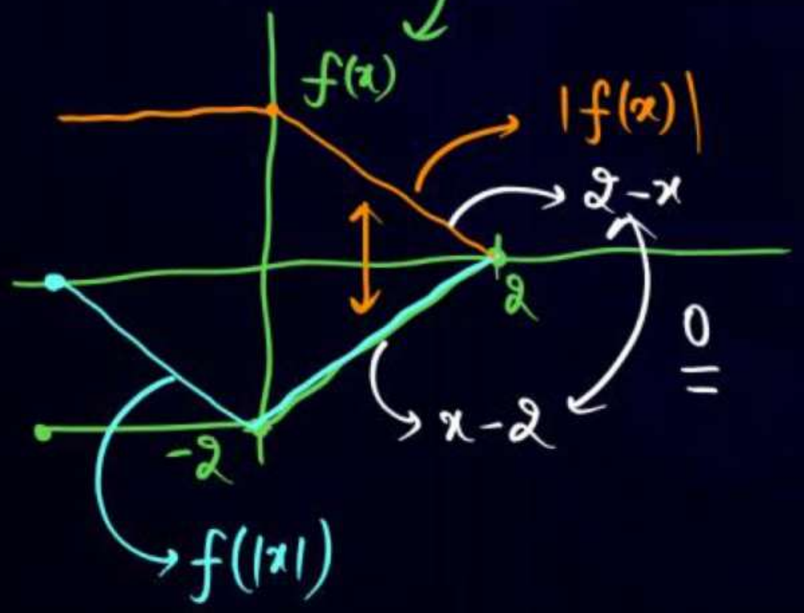
JEE MAIN 2024 LIVE PAPER DISCUSSION

Mathematics

If $f(x)=\begin{cases}x-2, & 0\le x\le 2\\ -2, & -2\le x\le 0\end{cases}$ and $h(x)=f(|x|)+|f(x)|$, then $\int_0^k h(x)dx$ is equal to _____. $(k>0)$

Easy

Zero



A. 0

B. $\frac{k}{2}$

C. $2k$

D. k

Find the number of rational numbers in the expansion of $\left(2^{\frac{1}{5}}+5^{\frac{1}{3}}\right)^{15}$.

(A) 0

(B) 2

(C) 4

(D) 6

Easy

Terms

Jee-Mains ↓ Repeating

$T_{r+1} = {}^{15}C_r \left(2^{\frac{1}{5}}\right)^{15-r} \left(5^{\frac{1}{3}}\right)^{r}$

$r = 0, 15$

0 — 15

${}^{15}C_r \, 2^{3} \cdot 2^{-\frac{r}{5}} \, 5^{\frac{r}{3}}$

$r \to 3n$

$r \to 5m$

$3 - \frac{r}{5} = \frac{15-r}{5}$

15 + 82 = 97

If the domain of the function $\sin^{-1}\left(\frac{3x-22}{2x-19}\right) + \log_e\left(\frac{3x^2-8x+5}{x^2-3x-10}\right)$ is $(\alpha, \beta]$, then $3\alpha + 10\beta$ is equal to

Lengthy

(A) 100

(B) 95

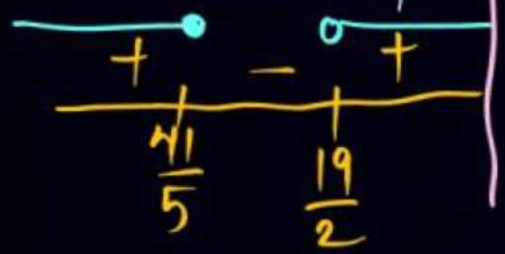
(C) 97

(D) 98

$-1 \le \frac{3x-22}{2x-19} \le 1$

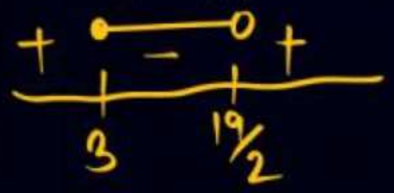
$0 \le \frac{3x-22}{2x-19} + 1$

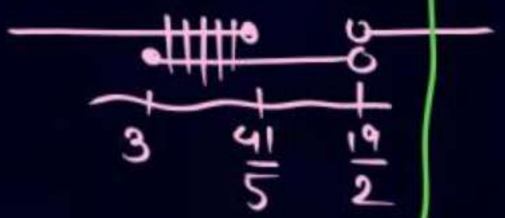
$0 \le \frac{5x-41}{2x-19}$



$\frac{3x-22}{2x-19} - 1 \le 0$

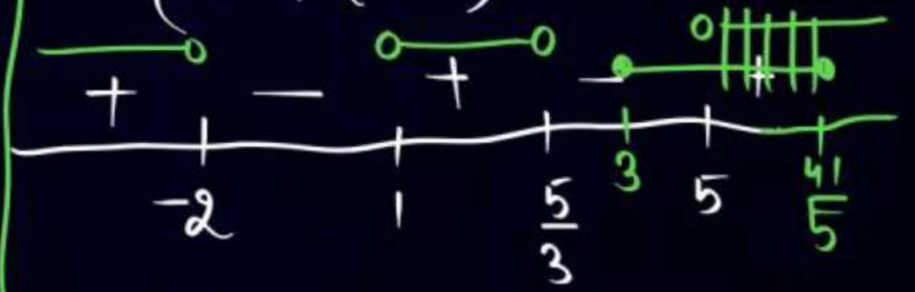
$\frac{x-3}{2x-19} \le 0$





$\frac{3x^2-8x+5}{x^2-3x-10} > 0$

$\frac{(3x-5)(x-1)}{(x+2)(x-5)} > 0$



$(5, \frac{41}{5}]$

Let $f(x) = x^5 + 2e^{x/4}$ for all $x \in R$. Consider a function $g(x)$ such that $(gof)(x) = x$ for all $x \in R$. Then the value of $8g'(2)$ is

A 4

B 16

C 8

D 2

$g(f(x)) = x$

$g'(f(x)) \cdot f'(x) = 1$

$g'(f(x)) = \frac{1}{f'(x)} = \frac{1}{5x^4 + 2 \cdot e^{x/4} \cdot \frac{1}{4}}$

$f(x) = 2$

$x^5 + 2e^{x/4} = 2$

$x = 0$

$= 2$

$x = 2$ ✗

$x = 0$ ✓

Diff of Inv. funcⁿ.

Easy

Let $\alpha, \beta \in R$. Let the mean and the variance of 6 observations $-3, 4, 7, -6, \alpha, \beta$ be 2 and 23 respectively. The mean deviation about the mean of these 6 observations is

(A) $\frac{11}{3}$

(B) $\frac{16}{3}$

(C) $\frac{13}{3}$

(D) $\frac{14}{3}$

$-3, 4, 7, -6, \alpha, \beta$

Mean $(\bar{x}) = 2$

$\sigma^2 = 23$.

Stats | 3-4 min | Easy

$\frac{2+\alpha+\beta}{6} = 2$

$\alpha+\beta = 10$

$\frac{9+16+49+36+\alpha^2+\beta^2}{6} - (2)^2 = 23$.

$\alpha^2+\beta^2 = 27\times 6 - 110$.

$= 162 - 110$

$\alpha^2+\beta^2 = 52$

$(\alpha+\beta)^2 - 2\alpha\beta = 52$.

$\alpha = 4$

$\beta = 6$

$-3, 4, 7, -6, 6, 4$

$+5+2+5, +8+4+2$.

$6 \hookrightarrow \frac{26}{6} = \frac{13}{3}$.

$\alpha = 0, \quad \beta = +1$

Let α and β be the sum and the product of all the non-zero solutions of the equation $(\bar{z})^2 + |z| = 0$, $z \in C$. Then $4(\alpha^2 + \beta^2)$ is equal to

(A) 6

(B) 2

(C) 4

(D) 8

$④ = 4(0^2 + 1^2)$

Med. – Easy — Complex no.

$z = x + iy$

$z^2 = x^2 - y^2 + 2xyi$

$x^2 - y^2 - 2xyi + \sqrt{x^2+y^2} = 0$

$-2xy = 0 \Rightarrow x = 0$ OR $y = 0$

$x^2 - y^2 + \sqrt{x^2+y^2} = 0$

$x = 0 \Rightarrow -y^2 + |y| = 0$

$y = 0 \Rightarrow x^2 + |x| = 0 \Rightarrow x = 0$

$|y| = |y|^2$

$|y| = 0, 1$

$x = 0, y = 0, 1, -1$

$(0,0) \rightarrow 0$ ✗

$(0,1) \rightarrow i$

$(0,-1) \rightarrow -i$

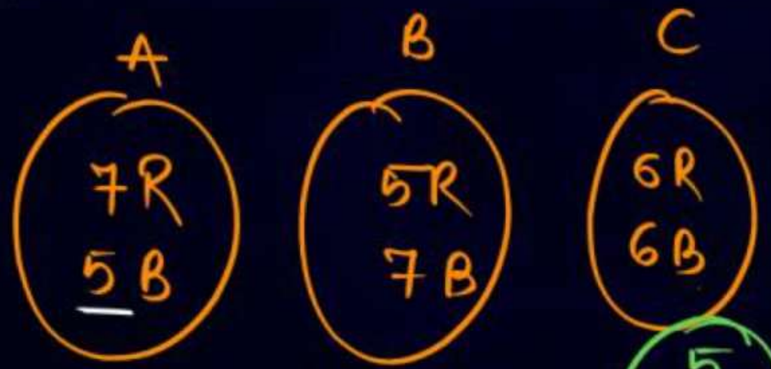
Three urn A, B, C, A has 7 red and 5 black balls, B has 5 red and 7 black balls, C has 6 red and 6 black balls. One urn is selected and black ball is taken out. Find probability that the selected urn is A.

(A) $\frac{7}{18}$

(B) $\frac{5}{17}$

(C) $\frac{7}{19}$

(D) $\frac{5}{18}$



Probability

Easy

$$\frac{5}{18} = \frac{\frac{1}{3}\times\frac{5}{12}}{\frac{1}{3}\times\frac{5}{12}+\frac{1}{3}\times\frac{7}{12}+\frac{1}{3}\times\frac{6}{12}}$$

Integration

Medium

Find value of $\int_0^{\pi/2} \frac{\sin^2 x}{1+\sin x\cos x}\,dx$.

(A)

(B)

(C)

(D)

$$I = \int_0^{\pi/2} \frac{\sin^2 x}{1+\sin x\cos x}\,dx$$

KP's

$$I = \int_0^{\pi/2} \frac{\cos^2 x}{1+\cos x\cdot\sin x}\,dx$$

$$\Rightarrow 2I = \int_0^{\pi/2} \frac{\frac{1}{\cos^2 x}}{\frac{1}{\cos^2 x}+\frac{\sin x\cos x}{\cos^2 x}}\,dx = \int_0^{\pi/2} \frac{\sec^2 x\,dx}{\sec^2 x+\tan x}$$

$\sec^2 x = 1+\tan^2 x$

$\tan x = t$

$\sec^2 x\,dx = dt$

$$I = \frac{1}{2}\int_0^{\infty} \frac{dt}{t^2+t+1}$$

$$t^2+t+1 \equiv \left(t+\frac{1}{2}\right)^2+\left(\frac{\sqrt{3}}{2}\right)^2$$

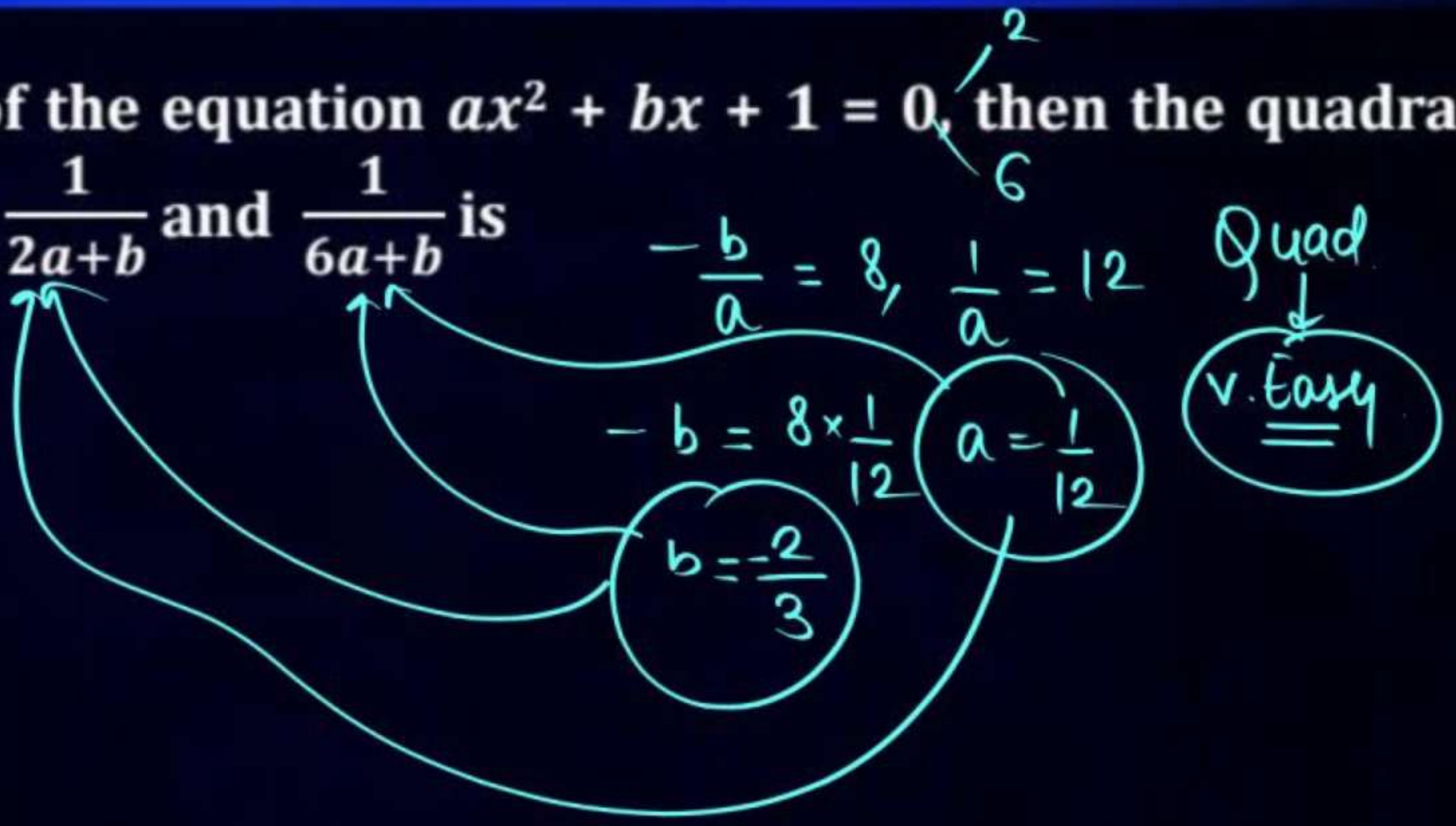
If 2 and 6 are the roots of the equation $ax^2 + bx + 1 = 0$, then the quadratic equation whose roots are $\frac{1}{2a+b}$ and $\frac{1}{6a+b}$ is

(A) $4x^2 + 14x + 12 = 0$

(B) $2x^2 + 11x + 12 = 0$

(C) $x^2 + 10x + 16 = 0$

(D) $x^2 + 8x + 12 = 0$



146/53 / 201

Let the sum of the maximum and the minimum values of the function $f(x) = \frac{2x^2-3x+8}{2x^2+3x+8}$ be $\frac{m}{n}$ where $gcd(m, n) = 1$, then $m + n$ is equal to

(A) 182

(B) 195

(C) 201

(D) 217

$y = \frac{2x^2-3x+8}{2x^2+3x+8}$

$\Downarrow$

Quad.

$\Downarrow$

$\Delta \geq 0$

$y = \frac{2x^2+3x+8}{2x^2+3x+8} - \frac{6x}{2x^2+3x+8}$

$y = 1 - \frac{6}{\frac{2x^2+3x+8}{x}}$

$\# \quad y = 1 - \frac{6}{\left(2x+\frac{8}{x}\right)+3}$

$2x+\frac{8}{x} \in (-\infty, -8] \cup [8, \infty)$

$\# \%$ ← Range!! → Medium

$2x, \frac{8}{x}$, $x > 0$

$\frac{2x+\frac{8}{x}}{2} \geq (16)^{\frac{1}{2}}$

$2x+\frac{8}{x} \geq 8.$

$$3+2x+\frac{8}{x}\in(-\infty,-5]\cup[11,\infty)$$

$$\frac{1}{2x+\frac{8}{x}+3}\in\left[-\frac{1}{5},0\right)\cup\left(0,\frac{1}{11}\right] \xrightarrow{x=0} \left[-\frac{1}{5},\frac{1}{11}\right]$$

$\times 6$

$$\left[-\frac{6}{5},\frac{6}{11}\right]$$

$-1\times$

$$\left[-\frac{6}{11},\frac{6}{5}\right]$$

$+1$

$$y\in\left[\frac{5}{11},\frac{11}{5}\right]$$

$$\frac{5}{11}+\frac{11}{5}=\frac{25+121}{55}$$

$$=\frac{146}{55}$$

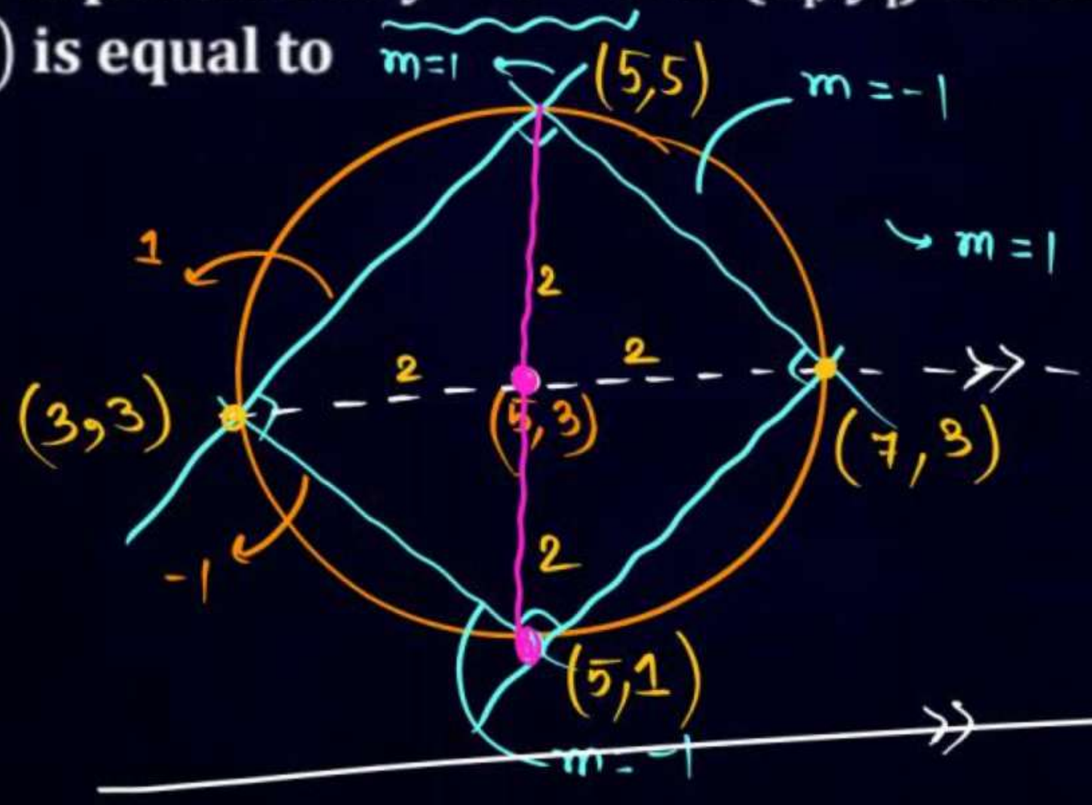
A square is inscribed in the circle $x^2 + y^2 - 10x - 6y + 30 = 0$. One side of this square is parallel to $y = x + 3$. If (x_i, y_i) are the vertices of the square, then $\sum(x_i^2 + y_i^2)$ is equal to

(A) 148

(B) 156

(C) 152

(D) 160

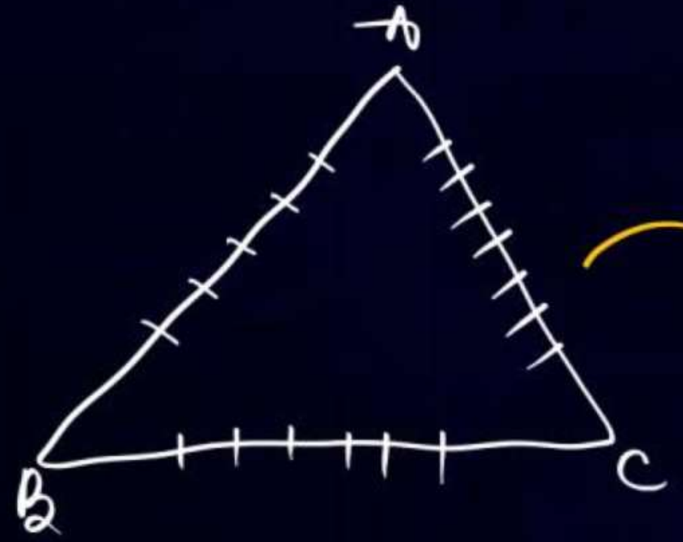


Circles → Good Ques

Req ans = $5^2 + 7^2 + 5^2 + 3^2 + 5^2 + 3^2 + 3^2 + 1^2$

= 152

In triangle ABC, 5 points are on side AB, 6 points on BC & 7 points on CA. Find the number of triangles formed with these points.



N.O.T. = ${}^{18}C_3 - ({}^5C_3 + {}^6C_3 + {}^7C_3)$

P & C

eeasy

extra

for

751

Find $\int_{-\pi/2}^{\pi/2} \frac{\sin^2 x}{1+2^x}\,dx$. — (1)

easy — Integration

kP.

$$I = \int_{-\pi/2}^{\pi/2} \frac{2^x \sin^2 x}{2^x+1}\,dx \quad \text{— (2)}$$

(A) $\frac{\pi}{4}$

(B) $\frac{\pi}{8}$

(C) 4π

(D) $\frac{\pi}{2}$

$$2I = \int_{-\pi/2}^{\pi/2} \frac{\sin^2 x\,(2^x+1)}{2^x+1}\,dx = 2\int_0^{\pi/2} \sin^2 x$$

$$= \frac{2}{2}\int (1-\cos 2x) = \left\{x - \frac{\sin 2x}{2}\right\}_0^{\pi/2}$$

$$2I = \left(\frac{\pi}{2}-0\right) - (0)$$

The coefficient of x^7 in $(1-x-x^2+x^3)^6$.

(A) 132

(B) 144

(C) -132

(D) -144

Binomial

easy

$$\left((1-x)-x^2(1-x)\right)^6$$

$x^7 \rightarrow (1-x)^6(1-x^2)^6$

$(1-x)^6 \rightarrow {}^6C_r(-1)^r x^r$

$(1-x^2)^6 \rightarrow {}^6C_r(-1)^r x^{2r}$

$(-{}^6C_5)x^5(-{}^6C_1)x^2$

$({}^6C_3)x^3({}^6C_2)x^4$

$(-{}^6C_1)x^1(-{}^6C_3)x^6$

$${}^6C_1{}^6C_5 - {}^6C_3{}^6C_2 + {}^6C_1{}^6C_3 = \text{Int}$$

$6 \times 6 = 36$

20×15

6×20

DIBY!

$a = 3$

If the length of focal chord of $y^2 = 12x$ is 15 and if the distance of the focal chord from origin is p, then $10p^2$ is equal to

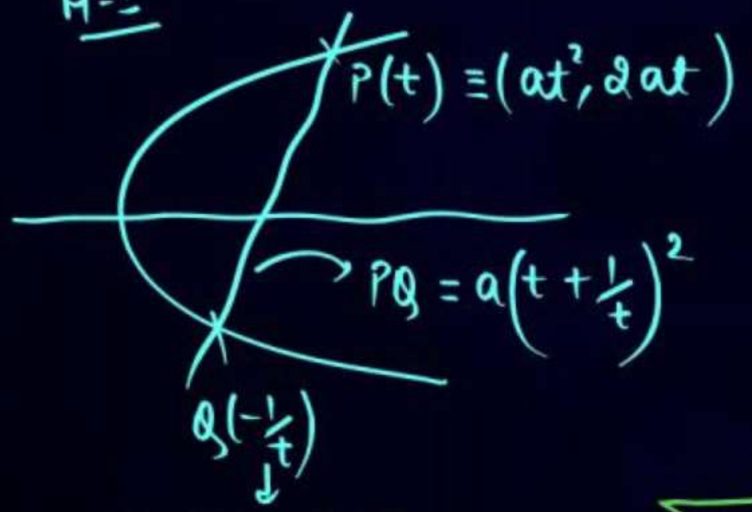
(A) 36

(B) 25

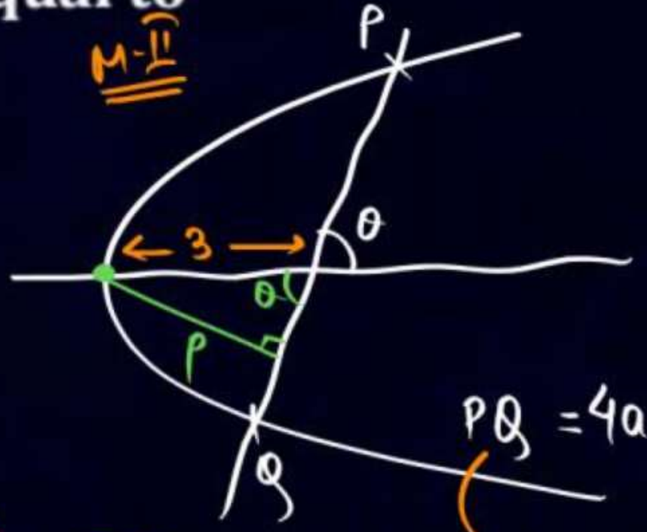
(C) 72

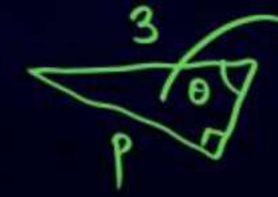
(D) 144

M-I



M-II





$\sin\theta = \frac{p}{3}$

$PQ = 4a\,\text{cosec}^2\theta$

$15 = 4 \times 3 \times \text{cosec}^2\theta$

$15 = 4 \times 3 \times \frac{9}{p^2}$

$10p^2 = \frac{4 \times 3 \times 9}{3 \times 3} \times 10 = 72$

Parabola

→ Calculation

→ Result!!

If $\lim\limits_{x\to 1}\frac{(5x+1)^{1/3}-(x+5)^{1/3}}{(2x+3)^{1/2}-(x+4)^{1/2}}=\frac{m(5)^{1/2}}{n(2n)^{2/3}}$. Then $8m+12n$ is

$8m+12n$ → $64+36=100$

limit

Medium

$$\frac{\frac{1}{3}(5x+1)^{-2/3}\cdot 5-\frac{1}{3}(x+5)^{-2/3}\cdot 1}{\frac{1}{2}(2x+3)^{-1/2}\cdot 2-\frac{1}{2}(x+4)^{-1/2}\cdot 1}$$

$x=1$

$$\frac{\frac{5}{3}(6)^{-2/3}-\frac{1}{3}(6)^{-2/3}}{(5)^{-1/2}-\frac{1}{2}(5)^{-1/2}}=\frac{(6)^{-2/3}\left\{\frac{4}{3}\right\}}{(5)^{-1/2}\left(\frac{1}{2}\right)}$$

$$m=\frac{2\times 2(5)^{1/2}}{3\times(2\times 3)^{2/3}}$$

n

#Med — A.P.

Let the first three term 2, p and q with $q \neq 2$, of a G.P. be respectively the 7^{th}, 8^{th} and 13^{th} terms of an A.P. If the 5^{th} term of the G.P. is the n^{th} term of the A.P., then n is equal to

A 169

B 177

C 163

D 151

$2, p, q$

$\downarrow \quad \downarrow$

$2r \quad 2r^2$

$a = 2 - 6d = -46$

$a + 6d = 2$

$a + 7d = 2r$

$a + 12d = 2r^2$

$d = 2r - 2$

$d = 8$

$5d = 2r^2 - 2r$

$5(2r-2) = 2r^2 - 2r$

$10r - 10 = 2r^2 - 2r$

$2r^2 - 12r + 10 = 0$

$r^2 - 6r + 5 = 0$

$(r-5)(r-1) = 0$

$r = 1, 5$ (1 ×, 5 ✓)

$2r^4 = a + (n-1)d$??

$2(5)^4 = -46 + (n-1)8$

$1250 + 46 + 8 = 8n$

$163 = n$

$$\lim_{x\to 0}\left(\frac{1-\cos x}{x^2}\right)=\frac{1}{2}$$

Continuity & Diff

If $f(x)=\begin{cases}\frac{1-\cos x}{x^2}, & x<0\\ 2, & x=0\\ \frac{\beta\sqrt{1-\cos x}}{x}, & x>0\end{cases}$ $x=0$ is continuous at $x=0$, then $\alpha^2+\beta^2$ equals to

Easy

$4+8=12$

A 10

B 12

C 13

D 9

$$\lim_{x\to 0^+}\beta\sqrt{\frac{1-\cos x}{x^2}}=\beta\frac{1}{\sqrt{2}}$$

$$\frac{\beta}{\sqrt{2}}=2 \quad\Rightarrow\quad \beta=2\sqrt{2}$$

$$\lim_{x\to 0^-}\left(\frac{1-\cos\alpha x}{(\alpha x)^2}\right)\alpha^2=\frac{\alpha^2}{2}$$

$$\frac{\alpha^2}{2}=2 \quad\Rightarrow\quad \alpha^2=4$$

$\frac{1}{2}$

Check!

LDE — Med.

If $\frac{dy}{dx} - y = 1 + 4\sin x$ and $y(0) = 1$, then $y\left(\frac{\pi}{2}\right) + 10$ is equals to

$\int e^{ax} \sin bx \, dx$

$= \frac{e^{ax}}{a^2+b^2}(a\sin bx - b\cos bx)$

$IF = e^{-\int dx} = e^{-x}$

Sol $e^{-x} \cdot y = \int e^{-x}(1 + 4\sin x)\, dx$

$e^{-x} y = -e^{-x} + 4\int e^{-x}\sin x \, dx$

$e^{-x} y = -e^{-x} - 4\frac{e^{-x}}{2}(\sin x + \cos x) + C$

$a = -1, b = 1$

$x = 0$, $y = 1$

$1 = -1 - 2(1) + C$

$4 = C$

$\frac{e^{-x}}{2}\{-\sin x - \cos x\}$

$x = \frac{\pi}{2}$

$e^{-\frac{\pi}{2}} y = -e^{-\frac{\pi}{2}} - 2e^{-\frac{\pi}{2}}(1) + 4$

$$I = \int e^{-x} \sin x$$

(II) (I)

$$= (-\sin x\, e^{-x}) + \int \cos x\, e^{-x}\, dx$$

(I) (II)

$$= -e^{-x}\sin x + (-\cos x\, e^{-x}) - \int \sin x\, e^{-x}$$

$$I = \frac{e^{-x}(-\sin x - \cos x)}{2}$$

If $\frac{dy}{dx}=\frac{2x^2+2x+3}{x^4+2x^3+3x^2+2x+2}$ & $y(-1)=-\frac{\pi}{4}$, then $y(0)$ is

D.E. — Tough!!

(A) $\frac{\pi}{3}$

(B) $\frac{\pi}{4}$

(C) $\frac{\pi}{2}$

(D) $\frac{\pi}{6}$

$x^4+3x^2+2+2x^3+2x$

$(x^2+1)(x^2+2)+2x(x^2+1)$

$(x^2+1)(x^2+2x+2)$

$\frac{dy}{dx}=\frac{(x^2+1)+(x^2+2x+2)}{(x^2+1)(x^2+2x+2)}=\frac{\alpha+\beta}{\alpha\beta}$

$\int dy=\int\frac{1}{(x+1)^2+1^2}dx+\int\frac{1}{x^2+1}dx$

$y=\tan^{-1}(x+1)+\tan^{-1}x+c$

$x=0$

$y=\tan^{-1}1$

$c=0$

If $\vec{c}$ is a variable unit vector and $\vec{c}$ makes angle of $45°$ with $\vec{b}$ and $60°$ with $\vec{a}$, where $\vec{b} = \hat{i} - \hat{k}$ and $\vec{a} = 2\hat{i} + 2\hat{j} - \hat{k}$, then $|\vec{c} + 2\vec{a} - 3\vec{b}|$ is

(A) 19

(B) 20

(C) $\sqrt{19}$

(D) $\sqrt{20}$

$|\vec{b}| = \sqrt{2}$

$|\vec{a}| = 3$

$\vec{b} \cdot \vec{c} = |\vec{b}||\vec{c}|\cos 45°$

$= \sqrt{2} \times 1 \times \frac{1}{\sqrt{2}} = 1$

$\vec{a} \cdot \vec{c} = |\vec{a}||\vec{c}|\cos 60°$

$= 3 \times 1 \times \frac{1}{2}$

$|\vec{c} + 2\vec{a} - 3\vec{b}|^2 = |\vec{c}|^2 + 4|\vec{a}|^2 + 9|\vec{b}|^2 + 2 \times 2\,\vec{a}\cdot\vec{c} - 2 \times 6\,\vec{a}\cdot\vec{b} - 2 \cdot 3\,\vec{b}\cdot\vec{c}$

$= 1 + 4(9) + 9(2) + 4 \times \frac{3}{2} - 12 \times 3 - 6(1)$

$= 1 + 36 + 18 + 6 - 36 - 6$

$= 19$


THANK
YOU