JEE-Mains-06-04-2023 [Memory Based] [Evening Shift]

Physics

Question: If initial velocity 30 m/s and acc is 2 m/s^2 after how much time vel will be 60 m/s
Options:
(a) 5 sec
(b) 10 sec
(c) 15 sec
(d) 20 sec
Answer: (c)

Question: If a_0 is bohr radius, find de broglie wavelength of electron in 3rd orbit of hydrogen atom
Options:
(a) $6\pi a_0$
(b) $3\pi a_0$
(c) $9\pi a_0$
(d) πa_0
Answer: (a)
Solution:

$$r = a_0 \frac{n^2}{2} = a_0 n^2$$

$$\lambda = \frac{h}{mv} = \frac{h}{nh} = 2\pi a_0 n^2$$

$$mvr = \frac{nh}{2\pi} = 2\lambda a_0 n = 6\pi a_0$$

Question: If in 7 minutes body cools from 60°C to 40°C. Surrounding temperature is 10°C then what will be the temperature of body in next 7 minutes?
Options:
(a) 16°
(b) 20°
(c) 28°
(d) 36°
Answer: (c)
Solution:

$$-\frac{d\theta}{dt} = b\left(\theta_{av} - \theta_0\right)$$

$$\Rightarrow \frac{20}{7} = b\left[50 - 10\right]....(i)$$

$$\Rightarrow \frac{40 - T}{7} = b\left[\frac{40 + T}{2} - 10\right]...(ii)$$

Question: In circular motion M = 5 kg, T = π seconds, R = 2 m. Find centrifugal force.
Answer: 40.00

Question: Minimum amplitude is 3 V, modulation index is 60% Find maximum amplitude
Options:
(a) 5 V
(b) 10 V
(c) 12 V
(d) 15 V
Answer: (c)
Solution:

Question: Planet is moving in elliptical path which is incorrect?
Options:
(a) Areal velocity is constant
(b) Total energy is constant
(c) Velocity is constant
(d) none of these
Answer: (c)
Solution:

Question: A body is dropped from a height of h_1 and after falling it rises to a height of h_2, such that the ratio of speed before and after collision is 4. Find percentage loss in KE.
Options:
(a) 6.25%
(b) 4.34%
(c) 10.00%
(d) 20.00%
Answer: 93.75%
Solution:

$$u \downarrow \quad \uparrow \left(\frac{u}{4}\right)$$

$KE_i = \frac{1}{2}mu^2$

$KE_f = \frac{1}{2}m\left(\frac{u}{4}\right)^2$

$$\%\Delta KE = \frac{KE_f - KE_i}{KE_i} = \frac{\frac{1}{2}m\frac{u^2}{16} - \frac{1}{2}mu^2}{\frac{1}{2}mu^2} = \left(\frac{1}{16} - 1\right) = \frac{-15}{16}$$

or 93.75%

Question: A body weighs 100N on surface of earth find weight of body at height H = R/4 from surface of earth (R = radius of earth)

Options:
(a) 50 N
(b) 64 N
(c) 25 N
(d) 80 N

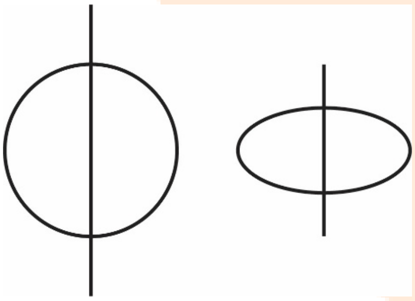
Answer: (b)

Solution:

Question: A solid sphere and a ring have equal masses and equal radii of gyration. If sphere is rotating about its diameter and ring about an axis passing through centre and perpendicular to its plane, then the ratio of radius is $\sqrt{\left(\frac{x}{2}\right)}$ then find the value of x.

Answer: 5.00

Solution:



$m_1 = m_2$

$K_1 = K_2$

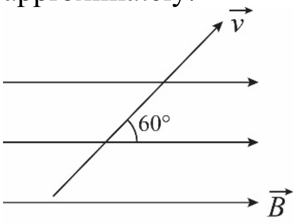
$\sqrt{\frac{2}{5}\frac{m_1 R_1^2}{m_1}} = \sqrt{\frac{m_2 R_2^2}{m_2}}$

$\sqrt{\frac{2}{5}}R_1 = R_2$

$\frac{R_1}{R_2} = \sqrt{\frac{5}{2}}$

So $x = 5$

Question: A proton is projected with speed v in magnetic field B of magnitude 1T. If angle between velocity and magnetic field is 60° as shown below. Kinetic energy of proton is 2 eV (mass of proton = 1.67×10^{-27} kg, e = 1.6×10^{-19} C). The pitch of the path of proton is approximately.



Options:

(a) 6.28×10^{-2} m
(b) 6.28×10^{-4} m
(c) 3.14×10^{-2} m
(d) 3.14×10^{-4} m

Answer: (b)

Solution:

$$\text{Pitch} = V''T = v\cos 60° \frac{2\pi m}{9\beta}$$

$$\Rightarrow \frac{1}{2}mv^2 = kE \Rightarrow v = \sqrt{\frac{2KE}{m}}$$

$$\Rightarrow P = \sqrt{\frac{2KE}{m}} \cdot \frac{1}{2} \cdot \frac{2\pi m}{9\beta}$$

$$= \left(\sqrt{2kEm}\right)\frac{\pi}{9B} = \frac{\pi\sqrt{2\times 2\times 1.6\times 10^{-19}\times 1.67\times 10^{-27}}}{1.6\times 10^{-19}\times 1} = 6.3\times 10^{-4}$$

Question: Find the ratio of RMS speed of oxygen molecules to that of Hydrogen molecules at same temperature

Options:

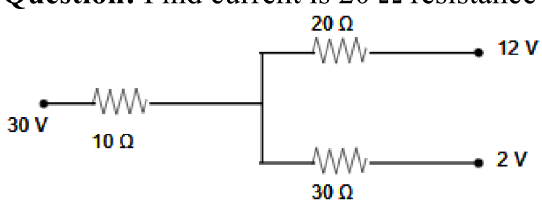
(a) 1/4
(b) 1/8
(c) 1/16
(d) 1/32

Answer: (a)

Solution:

$$\frac{V_{rms}O_2}{V_{rms}H_2} = \frac{\sqrt{\frac{3RT}{32\times 10^{-3}}}}{\sqrt{\frac{3RT}{2\times 10^{-3}}}} = \sqrt{\frac{2}{32}} = \frac{1}{4}$$

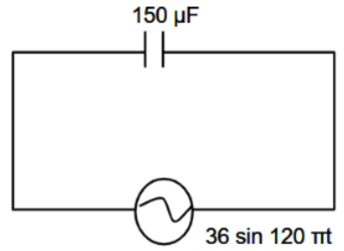
Question: Find current is 20 Ω resistance



Answer: 0.4
Solution:

Question: Assertion : Phase diff of two lightwave changes when 2 medium of same thickness and different RI are used.
Reason : Wavelength of wave depends upon RI of medium.
Options:
(a) Assertion is true reason is true and reason is correct explanation of assertion
(b) Assertion is true reason is true but reason is not correct explanation of assertion
(c) Assertion is true reason is false
(d) Assertion is false reason is true
Answer: (a)
Solution:

Question: Find peak value of current



Answer: 2.00
Solution:

$c = 150\mu F$

$V_0 = 36$

$\omega = 120\pi$

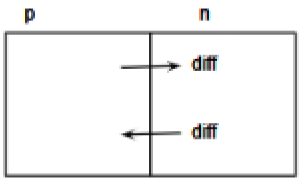
$i_0 = \frac{V_0}{\chi_C} = \frac{V_0}{1/\omega C} = (\omega C V_0)$

$i_0 = 120\pi \times 150 \times 10^{-6} \times 36 = 2.03$

$i_0 = 2A$

Question: The temperature of an ideal gas is increased from 200K to 800K. If r.m.s. Speed of gas at 200K is V_0, r.m.s. Speed at 800K is
Options:
(a) $v_0/2$
(b) v_0
(c) $4v_0$
(d) $2v_0$
Answer: (d)
Solution:

Question: S1: Diffusion current is more in magnitude than drift in forward bias
S2: Diffusion current is from n to p is forward bias



Options:
(a) S1 - True, S2 - False
(b) S1 - false, S2 - False
(c) S1 - True, S2 - True
(d) S1 - false, S2 - True
Answer: (a)
Solution:

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Chemistry

Question: Which of the following is not included in electrolysis of brine solutions?
Options:
(a) NaOH
(b) H_2
(c) HCl
(d) Cl_2
Answer: (c)
Solution: When electricity is passed through brine solution it forms NaOH Cl_2 at anode H_2 at cathode.

Question: Nessler reagent doesn't have
Options:
(a) K
(b) N
(c) Hg
(d) I
Answer: (b)
Solution: $K_2[HgI_4] \Rightarrow$ Nessler reagent

Question: Statement-1: Morphine and many of its homologues, when administered in medicinal doses, relieve pain and produce sleep
Statement-2: Morphine narcotics are sometimes referred to as opiates, since they are obtained from the opium poppy.
Options:
(a) Statement-1 is true but Statement-2 is false.
(b) Statement-1 is false but Statement-2 is true.
(c) Both Statement-1 and Statement-2 are true.
(d) Both Statement-1 and Statement-2 are false.
Answer: (c)
Solution: Narcotic analgesics: Morphine and many of its homologues, when administered in medicinal doses, relieve pain and produce sleep. In poisonous doses, these produce stupor, coma, convulsions and ultimately death. Morphine narcotics are sometimes referred to as opiates, since they are obtained from the opium poppy.

These analgesics are chiefly used for the relief of postoperative pain, cardiac pain and pains of terminal cancer, and in childbirth.

Question: Which one doesn't gives Pb^{+2} test?
Options:

(a) Iodite
(b) Chromate
(c) Sulfate
(d) Nitrate
Answer: (d)
Solution:

$$Pb^{+2} + 2KI \rightarrow \underset{\text{dark yellow}}{PbI_2}$$

$$Pb^{+2} + H_2SO_4 \rightarrow PbSO_4 + H^+$$

$$Pb^{+2} + Na_2SO_4 \rightarrow PbSO_4 + Na^+$$

$$Pb^{+2} + K_2CrO_4 \rightarrow PbSO_4 + K^+$$

Question: Medium used in This reactions

$$8MnO_4^- + 3S_2O_3^{2-} + H_2O \rightarrow 8MnO_2 + 6SO_4^{2-} + 2OH^-$$

Options:
(a) Neutral or faintly alkaline solutions
(b) Acidic
(c) Basic
(d) None of these
Answer: (a)
Solution: In neutral or faintly alkaline solutions:

Thiosulphate is oxidised almost quantitatively to sulphate

$$8MnO_4^- + 3S_2O_3^{2-} + H_2O \rightarrow 8MnO_2 + 6SO_4^{2-} + 2OH^-$$

Question: If a_0 is the radius of H atom, de-Broglie wavelength of electron in 3rd orbit of Li^{2+} ion is $x\pi a_0$. Find out x.
Options:
(a) 1
(b) 2
(c) 3
(d) 4
Answer: (b)
Solution:

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

$$MVr = \frac{nh}{2\pi} \Rightarrow \frac{h}{MV}$$

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

$$r = a_0 \times \frac{n^2}{Z}$$

$$\lambda = \frac{2\pi}{n} a_0 \times \frac{n^2}{Z}$$

$$= 2\pi a_0 \times \frac{n}{Z}$$

$$= 2\pi a_0 \frac{3}{3}$$

$$= 2\pi a_0$$

$$x = 2$$

Question: Which of the following has highest hydration energy?
Options:
(a) Be^{+2}
(b) Mg^{+2}
(c) Ca^{+2}
(d) Ba^{+2}
Answer: (a)
Solution:

$$\text{H.E} \propto Z_+ \times Z_-$$

$$\text{H.E} \propto \frac{1}{r_{(+)}} + \frac{1}{r_{(-)}}$$

Increase in ionic size down the group.

$Be^{2+} > Mg^{2+} > Ca^{2+} > Sr^{2+} > Ba^{2+}$

Question: IUPAC name of the compound $K_3[Co(C_2O_4)_3]$ is
Options:
(a) Potassium trioxalatocobaltate (III)
(b) Potassium trioxalatocobaltate (II)
(c) Potassium cobalttrioxalate (II)
(d) Potassium oxalatocobaltate (III)
Answer: (a)
Solution: IUPAC name of the compound $K_3[Co(C_2O_4)_3]$ is Potassium trioxalatocobaltate (III)

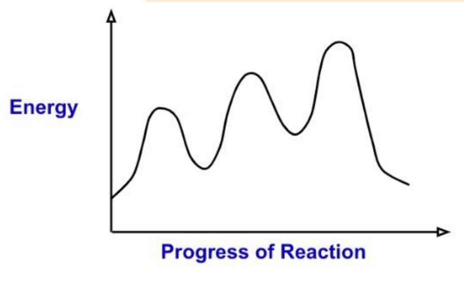
Question: Most basic Oxide
Options:
(a) Tl_2O
(b) Al_2O_3

(c) B_2O_3
(d) Cr_2O_3
Answer: (a)
Solution:

$Tl_2O \Rightarrow$ Basic
$Al_2O_3 \Rightarrow$ Amphoteric
$B_2O_3 \Rightarrow$ Acidic
$Cr_2O_3 \Rightarrow$ Amphoteric

Question: Assertion: $[Ni(CO)_4]$ & $[Fe(CO)_5]$ have zero oxidation state.
Reason: Low OS is observed due to presence of π-donor ligand in addition to sigma bonding.
Options:
(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(b) Both A and R are true, but Reason is not the correct explanation of Assertion.
(c) Assertion is true, but Reason is false.
(d) Assertion is false, but Reason is true.
Answer: (c)
Solution: Assertion is true, and reason is false

Question: Statement-1: Number of transition state is 3
Statement-2: Number of intermediate is 2
Statement-3: Reaction is endothermic
Number of correct statements are:



Options:
(a) 1
(b) 2
(c) 3
(d) 0
Answer: (c)
Solution: All the given statements are correct.

Question: Matching of Amino acids with letter code

Column I (Amino acid)	**Column-II** (Letter code)
(A) Alanine	**(P)** N
(B) Asparagine	**(Q)** A
(C) Aspartic acid	**(R)** R
(D) Arginine	**(S)** D

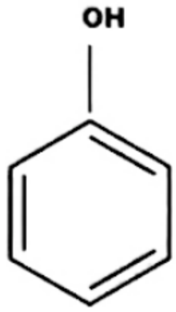
Options:

(a) A – P; B – R; C – Q; D – S
(b) A – Q; B – P; C – R; D – S
(c) A – S; B – P; C – Q; D – R
(d) A – Q; B – P; C – S; D – R

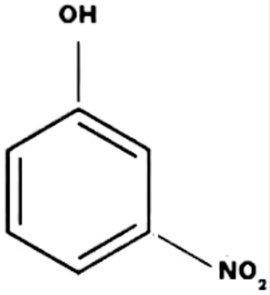
Answer: (d)
Solution: A – Q; B – P; C – S; D – R

Question: Most Acidic compound among the following is

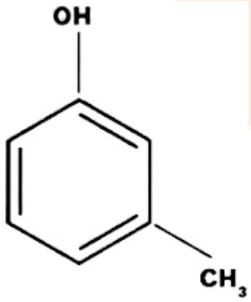
(a)



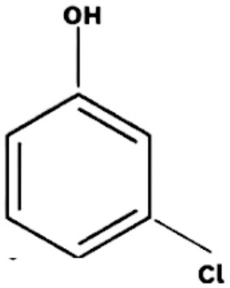
(b)



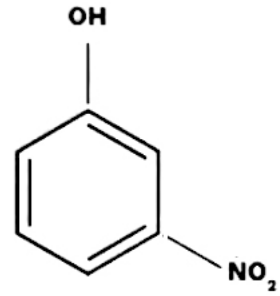
(c)



(d)



Answer: (b)
Solution:

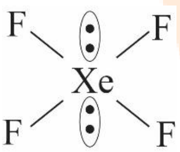


Because of more –I

Question: How many of these are pesticides?
(i) D.D.T. (ii) Aldrin (iii) Sodium arsenite (iv) Sodium chlorate
Options:
(a) 1
(b) 2
(c) 3
(d) 4
Answer: (b)
Solution: DDT and Aldrin are the pesticides

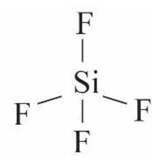
Question: Number of Square Planar Species is/are :
XeF_4, SiF_4, SF_4, $B(OH)_4^{\ominus}$, $[Co(NH_3)_6]^{+2}$, $[CoCl_4]^{2-}$
Answer: 1
Solution:

$XeF_4 \Rightarrow$ Hybridization is sp^3d^2



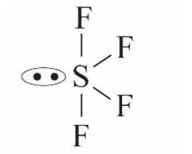
Sq. Planar

$SiF_4 \Rightarrow$ Hybridization is sp^3



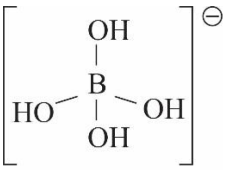
Tetrahedral

$SF_4 \Rightarrow$ Hybridization is sp^3d



Sea saw shape

$B(OH)_4^{\ominus} \Rightarrow$ Hybridization is sp^3



Tetrahedral

$[Co(NH_3)_6]^{+2} \Rightarrow$ Hybridization is sp^3d^2

Octahedral

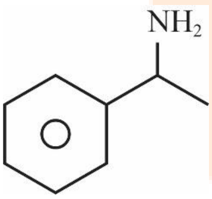
$[CoCl_4]^{2-} \Rightarrow$ Hybridization is sp^3

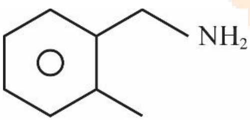
Tetrahedral

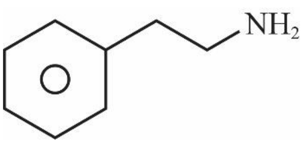
Question: Number of aromatic amines having formula $C_8H_{11}N$ which can be synthesized by gabriel phthalimide synthesis

Answer: 3

Solution:







3 possibilities

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Mathematics

Question: How many 4 letter word can be made from UNIVERSE, such that it has two vowels and two consonants.
Answer: 504.00
Solution:

UNIVERSE
Vowels: U, I, E, E
Consonants: N, V, R, S

$$^3C_2 \times {}^4C_2 \times 4! + {}^4C_2 \times \frac{4!}{2!}$$
$$= 18 \times 24 + 6 \times 12$$
$$= 72[6+1]$$
$$= 504$$

Question: If all the letters of the word PUBLIC are arranged in dictionary, then the rank of PUBLIC is
Answer: 582.00
Solution:

PUBLIC
B, C, I, L, P, U

$$4 \times 5! + 4 \times 4! + 2 \times 2! + 1 + 1$$
$$= 480 + 96 + 4 + 2$$
$$= 582$$

Question: $\tan 9° - \tan 27° - \tan 63° + \tan 81° =$ ___
Answer: 4.00
Solution:

$$\tan 9° - \tan 27° - \tan 63° + \tan 81°$$
$$= \tan 9° + \cot 9° - [\tan 27° + \cot 27°]$$
$$= \frac{2}{\sin 18°} - \frac{2}{\sin 54°}$$
$$= 2\left[\frac{1}{\frac{\sqrt{5}-1}{4}} - \frac{1}{\frac{\sqrt{5}+1}{4}}\right]$$

$= 8\left[\frac{2}{4}\right]$
$= 4$

Question: $1^2 - 2^2 + 3^2 - 4^2 + ...(2022)^2 + (2023)^2 = \_\_\_\_$
Answer: 2023×2012
Solution:

$$(1-2)(1+2)+(3-4)(3+4)+...+(2021-2022)(2021+2022)+(2023)^2$$
$$-(1+2+3+4+....+2021+2022)+(2023)^2$$
$$-\frac{2022 \times 2023}{2}+(2023)^2$$
$$(2023)(1012)$$

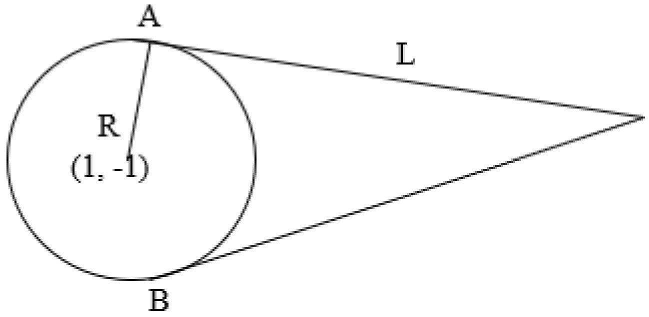
Question: If $f(x)+f(\pi-x)=\pi^2$, then $\int_0^\pi f(x) \times \sin x \, dx = \_\_\_\_$

Answer: π^2
Solution:

$$\int_0^\pi f(x) \times \sin x \, dx$$
$$2I = \int_0^\pi \left(f(x)+f(\pi-x)\right) \sin x \, dx$$
$$2I = \pi^2 \times 2$$
$$I = \pi^2$$

Question: $x^2 + y^2 - 2x + y = 5$. Two tangents are drawn from $\left(\frac{9}{4}, 2\right)$. AB is chord of contact. Find area of ΔPAB.
Answer: $\frac{5}{8}$
Solution:

$$x^2 + y^2 - 2x + y - 5 = 0$$



$P\left(\frac{9}{4}, 2\right)$

Area of $\Delta PAB = \frac{RL^3}{R^2 + L^2}$

$R = \sqrt{g^2 + f^2 - c}$

$= \sqrt{1 + \frac{1}{4} - (-5)}$

$= \sqrt{\frac{25}{4}}$

$= \frac{5}{2}$

$L = \sqrt{S_1}$

$= \sqrt{\frac{81}{16} + 4 - \frac{9}{2} + 2 - 5}$

$= \sqrt{\frac{81}{16} - \frac{9}{2} + 1}$

$= \sqrt{\frac{81 - 72 + 16}{16}}$

$= \sqrt{\frac{25}{16}}$

$= \frac{5}{4}$

Area of $\Delta PAB = \frac{\frac{5}{2} \times \left(\frac{5}{4}\right)^3}{\left(\frac{5}{2}\right)^2 + \left(\frac{5}{4}\right)^2} = \frac{\frac{5^4}{2 \times 2^6}}{5^2\left[\frac{1}{4} + \frac{1}{16}\right]} = \frac{5}{8}$

Question: 3 dice are thrown. Find probability that none of them shows the same number.

Answer: $\frac{5}{9}$

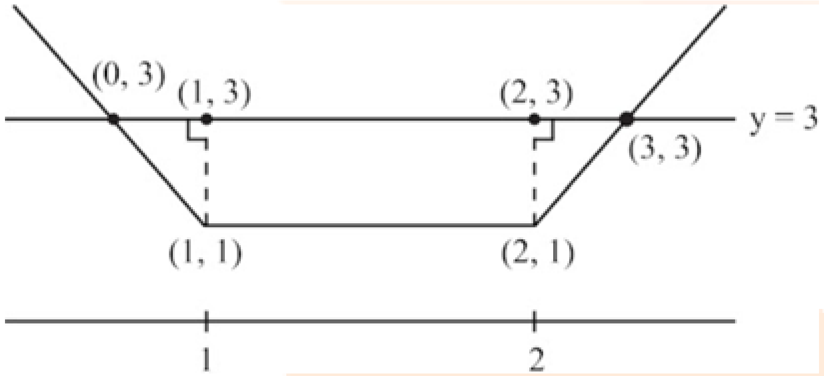
Solution:

$\frac{{}^6C_3 \times 3!}{216} = \frac{20}{36} = \frac{5}{9}$

Question: Find area bounded by the curve $y=|x-1|+|x-2|$ and the line $y=3$

Answer: 4.00

Solution:



$$A=\frac{1}{2}(1+3)\times 2=4$$

Question: $20^{19}+2\times 20^{18}\times 21+3\times 20^{17}\times 21^{2}+\ldots+20\times 21^{19}=k\times 20^{19}$. Find k.

Answer: 400.00

Solution:

$$20^{19}+2\times 20^{18}\times 21+3\times 20^{17}\times 21^{2}+\ldots+20\times 21^{19}$$

$$k=1+2\times\left(\frac{21}{20}\right)^{1}+3\times\left(\frac{21}{20}\right)^{2}+\ldots.20\left(\frac{21}{20}\right)^{19}$$

$$\frac{21}{20}k=\quad 1\times\left(\frac{21}{20}\right)+2\times\left(\frac{21}{20}\right)^{2}+\ldots.+\quad +20\left(\frac{21}{20}\right)^{20}$$

$$\frac{k}{20}=20\times\left(\frac{21}{20}\right)^{20}-\left[1+\frac{21}{20}+\ldots+\left(\frac{21}{20}\right)^{19}\right]$$

$$=20\left(\frac{21}{20}\right)^{20}-\left[\frac{\left(\frac{21}{20}\right)^{20}-1}{\frac{21}{20}-1}\right]$$

$$=20\times\left(\frac{21}{20}\right)^{20}-20\left(\frac{21}{20}\right)^{20}+20$$

$$k=400$$

Question: Eccentricity of $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is e_1 & eccentricity of $2x^2-2y^2=1$ is e_2 such that $e_1=\frac{1}{e_2}$. Ellipse intersect Hyperbola orthogonally. Find $(LR)^2$ of ellipse.

Answer: 2.00

Solution:

They are confocal foci at (1, 0) & (-1, 0)

$e_1=\frac{1}{\sqrt{2}}$

$e_2=\sqrt{2}$

$ae_1=1 \Rightarrow a=\sqrt{2}$

$(LR)^2=\left(\frac{2b^2}{a}\right)^2=\left[2a\left(1-e^2\right)\right]^2$

$=8\times\frac{1}{4}=2$

Question: Solve: $\left(1+\ln x\right)\frac{dx}{dy}-x\ln x=e^y$

Answer: ()

Solution:

$\left(1+\ln x\right)\frac{dx}{dy}-x\ln x=e^y$

$e^{-y}\left(1+\ln x\right)dx-e^{-y}x\ln x\,dy=dy$

$d\left[e^{-y}\left(x\ln x\right)\right]=dy$

$e^{-y}x\ln x=y+C$

Question: Find the square of the distance of (12, 12, 18) from the plane containing the line of intersection of $\vec{r}\cdot\left(\hat{i}+\hat{j}+\hat{k}\right)=6$ & $\vec{r}\cdot\left(2\hat{i}+3\hat{j}+4\hat{k}\right)=-5$ and passing through (0, 2, -2).

Answer: 620.00

Solution:

The planes are

$x+y+z-6=0$

$2x+3y+4z+5=0$

Required plane $\left(x+y+z-6\right)+\lambda\left(2x+3y+4z+5\right)=0$

$\left(0,2,-2\right)\Rightarrow -6+\lambda\left(3\right)=0$

$\lambda=2$

$\therefore$ Plane is

$5x+7y+9z+4=0$

Square of distance $=\left|\frac{5(12)+7(12)+9(18)+4}{\sqrt{5^2+7^2+9^2}}\right|^2=620$

Question: Sum of all values of α for which $\hat{i}-2\hat{j}+3\hat{k}, 2\hat{i}-3\hat{j}+4\hat{k}, (\alpha+1)\hat{i}+2\hat{k}$ and $9\hat{i}+(\alpha-8)\hat{j}+6\hat{k}$ are coplanar

Options:
(a) 6
(b) 2
(c) -2
(d) 4
Answer: (b)
Solution:

$\vec{a}=\hat{i}-2\hat{j}+3\hat{k}$

$\vec{b}=2\hat{i}-3\hat{j}+4\hat{k}$

$\vec{c}=(\alpha+1)\hat{i}+2\hat{k}$

$\vec{d}=9\hat{i}+(\alpha-8)\hat{j}+6\hat{k}$

$\overrightarrow{AB}=\hat{i}-\hat{j}+\hat{k}$

$\overrightarrow{AC}=\alpha\hat{i}+2\hat{j}-\hat{k}$

$\overrightarrow{AB}=8\hat{i}+(\alpha-6)\hat{j}+3\hat{k}$

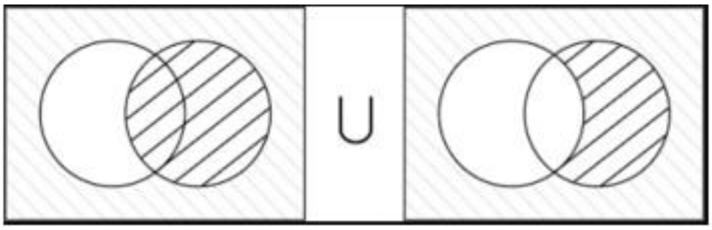
$$\begin{vmatrix} 1 & -1 & 1 \\ \alpha & 2 & -1 \\ 8 & \alpha-6 & 3 \end{vmatrix}=(6+\alpha-6)+(3\alpha+8)+(\alpha^2-6\alpha-16)=0$$

$\Rightarrow \alpha^2-2\alpha-8=0$

Question: $(p\Rightarrow q)\vee(\sim p\wedge q)$: tautology
$(q\Rightarrow p)\Rightarrow(\sim p\wedge q)$: contradiction
Options:
(a) Both are true
(b) Neither true
(c) Only first one is true
(d) Only second is true
Answer: (b)
Solution:

$(p\Rightarrow q)\vee(\sim p\wedge q)$

$(\sim p \vee q) \vee (\sim p \wedge q)$



Not universal set
Hence not tautology

$(q \Rightarrow p) \Rightarrow (\sim p \wedge q)$
$(\sim q \vee p) \Rightarrow (\sim p \wedge q)$
$a \Rightarrow \sim a$
$\sim a \vee \sim a$
Not contradiction

Question: Parallelopiped with coinitial edges $\vec{a}, \vec{b}$ and $\vec{c}$ is V. Then volume of parallelopiped with coinitial edges $\vec{a}, \vec{b}+\vec{c}, \vec{a}+2\vec{b}+3\vec{c}$.
Answer: V
Solution:

$V = [\vec{a} \quad \vec{b} \quad \vec{c}]$
$V' = [\vec{a} \quad \vec{b}+\vec{c} \quad \vec{a}+2\vec{b}+3\vec{c}]$
$= [\vec{a} \quad \vec{b} \quad \vec{a}+2\vec{b}+3\vec{c}] + [\vec{a} \quad \vec{c} \quad \vec{a}+2\vec{b}+3\vec{c}]$
$= [\vec{a} \quad \vec{b} \quad 3\vec{c}] + [\vec{a} \quad \vec{c} \quad 2\vec{b}]$
$= 3[\vec{a} \quad \vec{b} \quad \vec{c}] - 2[\vec{a} \quad \vec{b} \quad \vec{c}]$
$= [\vec{a} \quad \vec{b} \quad \vec{c}] = V$

Question: Coefficient of x^{-7} in $\left(ax - \frac{1}{3bx^2}\right)^{11}$ is equal to coefficient of x^7 in $\left(ax^2 + \frac{1}{2bx}\right)^{11}$.
Find relation in a & b.
Options:
(a) $243ab = 64$
(b) $32ab = 729$
(c) $64ab = 243$
(d) $729ab = 32$
Answer: (d)
Solution:

$x^7 \to \left(ax^2 + \frac{1}{2bx}\right)^{11}$

$T_{r+1} = {}^{11}C_r \left(ax^2\right)^{11-r} \left(\frac{1}{2bx}\right)^r$

$= {}^{11}C_r \frac{a^{11-r}}{(2b)^r} x^{22-3r}$

$22 - 3r = 7$

$\Rightarrow r = 5$

$\frac{{}^{11}C_5 a^6}{32b^5}$ ....(1)

$x^{-7} \to \left(ax - \frac{1}{3bx^2}\right)^{11}$

$r = \frac{np-m}{p+q} = \frac{11(1)-(-7)}{1+2} = 6$

$T_7 = {}^{11}C_6 (a)^{11-6} \left(\frac{-1}{3b}\right)^6$

$= \frac{{}^{11}C_6 a^5}{729b^6}$ ....(2)

Equalising (1) and (2) we will get

$729ab = 32$

Question: $\lim_{n\to\infty} \left(2^{\frac{1}{2}} - 2^{\frac{1}{3}}\right)\left(2^{\frac{1}{2}} - 2^{\frac{1}{5}}\right) \times .... \times \left(2^{\frac{1}{2}} - 2^{\frac{1}{2n+1}}\right) = ?$

Answer: 0.00
Solution:

Zero

Question: The system of the equations: $x+y+z=6;\ x+2y+\alpha z=5$ and $x+2y+6z=\beta$ has
Options:
(a) infinitely many solutions for $\alpha = 6, \beta = 3$
(b) infinitely many solutions for $\alpha = 6, \beta = 5$
(c) unique solution for $\alpha = 6, \beta = 5$
(d) No solution for $\alpha = 6, \beta = 5$
Answer: (b)
Solution:

$x+y+z=6$

$x+2y+\alpha z=5$

$x+2y+6z=\beta$

$$\Delta=\begin{vmatrix}1 & 1 & 1\\1 & 2 & \alpha\\1 & 2 & 6\end{vmatrix}=0$$

$\Rightarrow 12-2\alpha-1(6-\alpha)+0=0$

$6-\alpha=0$

$\alpha=6$

$$\Delta_x=\begin{vmatrix}6 & 1 & 1\\5 & 2 & 6\\\beta & 2 & 6\end{vmatrix}$$

$6(0)-1(30-6\beta)+(10-2\beta)=0$

$4\beta-20=0$

$\beta=5$

Substituting in given system of equations we get,

$x+y+z=6$

$x+2y+6z=5$

Which are non parallel planes

Hence infinitely many solutions.

Question: $S(1)=(2002)^{2023}-(1919)^{2002}$ is divisible by 8.

$S(2):13\times13^n-12n-13$ is divisible by 144 (where $n\in N$), then

Options:

(a) $S(1)$ and $S(2)$ both are true

(b) Only $S(1)$ is true

(c) Only $S(2)$ is true

(d) Neither $S(1)$ and $S(2)$ are true.

Answer: (c)

Solution:

Statement 1:

$\because (2002)^{2023}=8m$

$\because (2002)^{2023}$ is divisible by 8.

Also, $(1919)^{2002}$ is not divisible by 8.

$\therefore (2002)^{2023}-(1919)^{2002}$ is not divisible by 8.

Statement 2:

$13\times13^n-12n-13$

$$=13(1+12)^n-12n-13$$
$$=13\left(1+12n+{}^nC_2 12^2+\ldots\right)-12n-13$$
$$=144n+144\,{}^nC_2+\ldots$$
$$=144\left(n+{}^nC_2+\ldots\right)$$
$$=144k$$