LIVE

JEE MAIN 2024

ATTEMPT – 02 , 05th April 24' , SHIFT – 01

PAPER DISCUSSION

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CHEMISTRY

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ORGANIC CHEMISTRY

Number of σ and π bonds in ethylene respectively

A) 5, 1

B) 4, 2

C) 1, 5

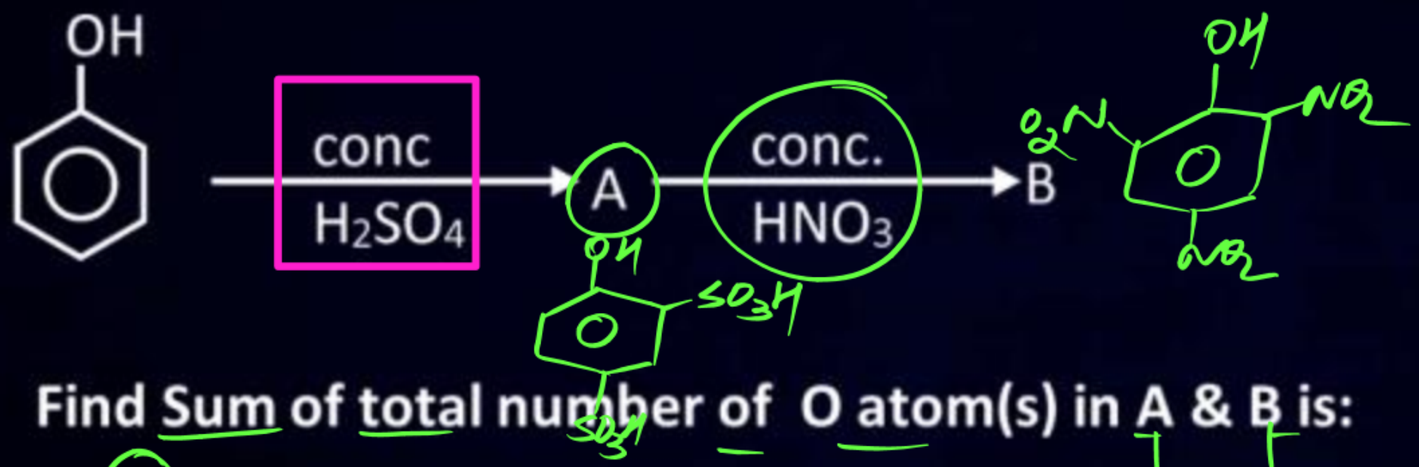
D) 6, 0

(A)

$CH_2 = CH_2$

$HC \equiv CH$

5σ
1π



Find Sum of total number of O atom(s) in A & B is:

14

7 7

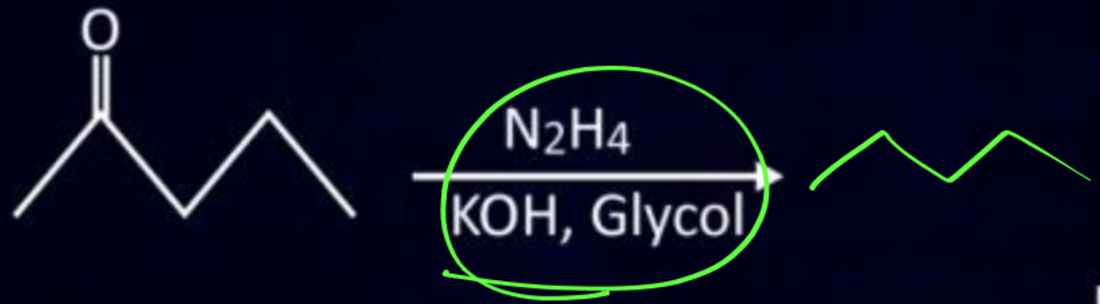
How many of the following can be prepared by Sandmeyer reaction

(2)

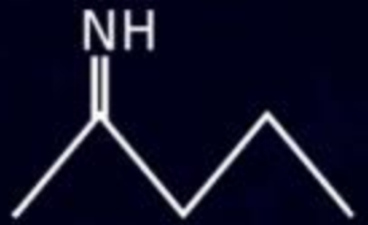
$CuBr/HBr$
$CuCl/HCl$
$CuCN/KCN$

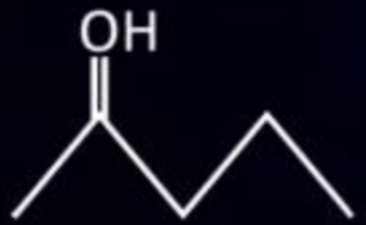
Neet (Part-2)

Which of the following is the correct product for the given reaction



A 

B 

C 

D 

Boiling point

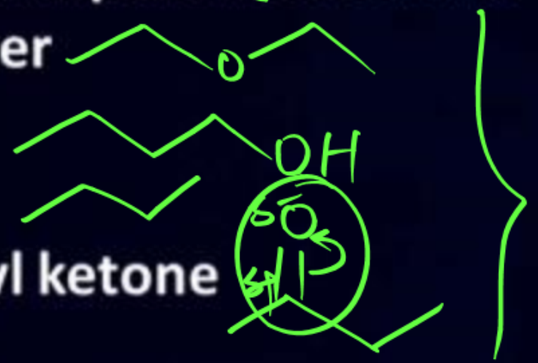
Correct order of dipole moment for

(P) Diethyl ether

(Q) n-butanol

(R) n-butane

(S) ethylmethyl ketone



Q > S > P > R

A P > Q > R > S

B Q > S > P > R

C S > R > Q > P

D S > Q > P > R

Neet (2.0)

Arrange the following carbocations in increasing order of their stability

I) $(CH_3)_3C^{\oplus}$ 9°

II) $(CH_3)_2\overset{\oplus}{C}H$ 6°

iii) $\overset{\oplus}{C}H_3$ 0°

IV) $CH_3-\overset{\oplus}{C}H_2$ 3°

A) I < II < IV < III

B) II < III < IV < I

C) II < I < III < IV

D) III < IV < II < I ✓

D

Which will give +ve Ninhydrin test

A Cellulose

B Starch

C Polyvinyl chloride

D Egg albumin

amino acid

Protein

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PHYSICAL CHEMISTRY

The heat of combustion of solid benzoic acid at constant volume is −321.30 kJ at 27°C. The heat of combustion at constant pressure is (−321.30 − x) kJ. Find the value of x. (Round off to nearest integer)

$$C_6H_5COOH + \frac{15}{2}O_2 \longrightarrow 7CO_2 + 3H_2O$$

(s) (g) (g) (l)

$$\Delta H = \Delta U + \Delta n_g RT$$

$$\Delta n_g = (n_P)_g - (n_R)_g = 7 - \frac{15}{2}$$

$$= -1/2$$

$$= -321.3 - \frac{1}{2}\frac{8.314 \times 300}{1000} \rightarrow x = \frac{8.314 \times 300}{1000 \times 2}$$

Consider the reaction: $Fe_2O_3(s) + 3CO(g) \rightleftharpoons 2Fe(s) + 3CO_2(g)$

Which of the following will not affect the equilibrium state:

(I) Addition of Fe_2O_3 (S)

(II) Addition of CO_2

(III) Decreasing mass of Fe_2O_3 (S)

(IV) Removal of CO

Solid → (No effect)

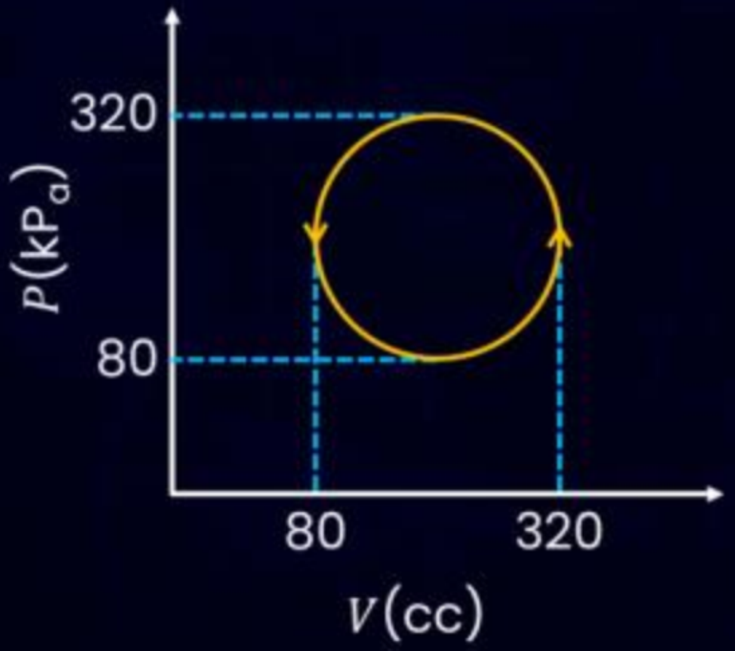
A (II) and (IV)

B (I) and (IV)

C (I) and (III)

D All will affect the equilibrium

An ideal gas undergoes a cyclic process given in the P-V curve. Find work done by gas in the given cyclic process.



Which postulate of Dalton's theory is wrong.

A Matter consist of indivisible atoms

B All atoms of a given element have identical properties but different masses

C Compounds are formed when atoms of different elements combines in a fixed ratio

D Chemical reaction involve reorganisation of atoms

In which of the following compounds Mn has the highest oxidation state?

A MnO_4^- → Mn → +7

B MnO_2 → Mn → +4

C MnO_4^{2-} → Mn ⇒ +6

D Mn_2O_3 → Mn ⇒ +3

An aqueous solution contains 0.2 M glucose and 0.05 M NaCl if osmotic pressure of this solution is x (in bar) at 300 K temperature. Then calculate the value of 2x. (Use R = 0.083 L-bar/K-mol)

$\pi = 0.3 \times 300 \times 0.082$

x

glucose → Non electrolyte → 0.2 M

NaCl → Electrolyte → (100% dissociation)

$\pi = CRT$

$T = 300\ K$

$R = 0.082$

$NaCl \rightarrow Na^+ + Cl^-$ → Final conc = 0.1

0.05 — —

— 0.05 0.05

Total conc → 0.2 + 0.1 = 0.3

$2x \rightarrow 2 \times 0.3 \times 300 \times 0.082$

The molar conductivities of a divalent cation (M^{2+}) and monovalent anion (A^-) are 57 S cm^{-1} mol^{-1} and 73 S cm^{-1} mol^{-1} respectively. Then find the total molar conductivity shown by their compound in S cm^{-1} mol^{-1}.

M^{2+} A^{2-}

↓

MA Comp.

→ $M^{2+} + A^{2-}$

→ 57 + 73 = 130 $S cm^{-1} mol^{-1}$

M^{2+} A^-

↓

MA_2

→ 57 + 2×73 = 57 + 146 ⇒ 203 $S cm^{-1} mol^{-1}$

Identify the change occurring in oxidation state of Mn in cell reaction of dry cell of clock during its use

A $+3 \rightarrow +4$ ✗

B $+2 \rightarrow +7$ ✗

C $+4 \rightarrow +3$

D $+7 \rightarrow +2$

Anode → Oxid^n → $Zn \longrightarrow Zn^{2+} + 2e^-$

Cathode → Red^n $\overset{+4}{MnO_2} + NH_4^+ + e^- \longrightarrow \overset{+3}{MnO(OH)} + NH_3$

Assertion: Enthalpy of neutralization of acid & base is −57.1 kJ/mol.

Reason: $H^+(aq) + OH^-(aq) \longrightarrow H_2O(aq); + 57.1\ kJ$

A. Assertion and reason both are correct and reason is correct explanation of assertion.

B. Assertion and reason both are correct and reason is not correct explanation of assertion.

C. Assertion is correct but reason is not correct.

D. Assertion is not correct but reason is correct.

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INORGANIC CHEMISTRY

Field Strength comparison of Ligands.

CN^-, F^-, Br^-, I^-, H_2O, NH_3

A $CN^- > NH_3 > H_2O > F^- > Br^- > I^-$

B $CN^- > H_2O > NH_3 > F^- > I^- > Br^-$

C $H_2O > CN^- > NH_3 > F^- > Br^- > I^-$

D $CN^- > NH_3 > I^- > H_2O > F^- > Br^-$

$I^- < Br^- < F^- < H_2O < NH_3 < CN^-$

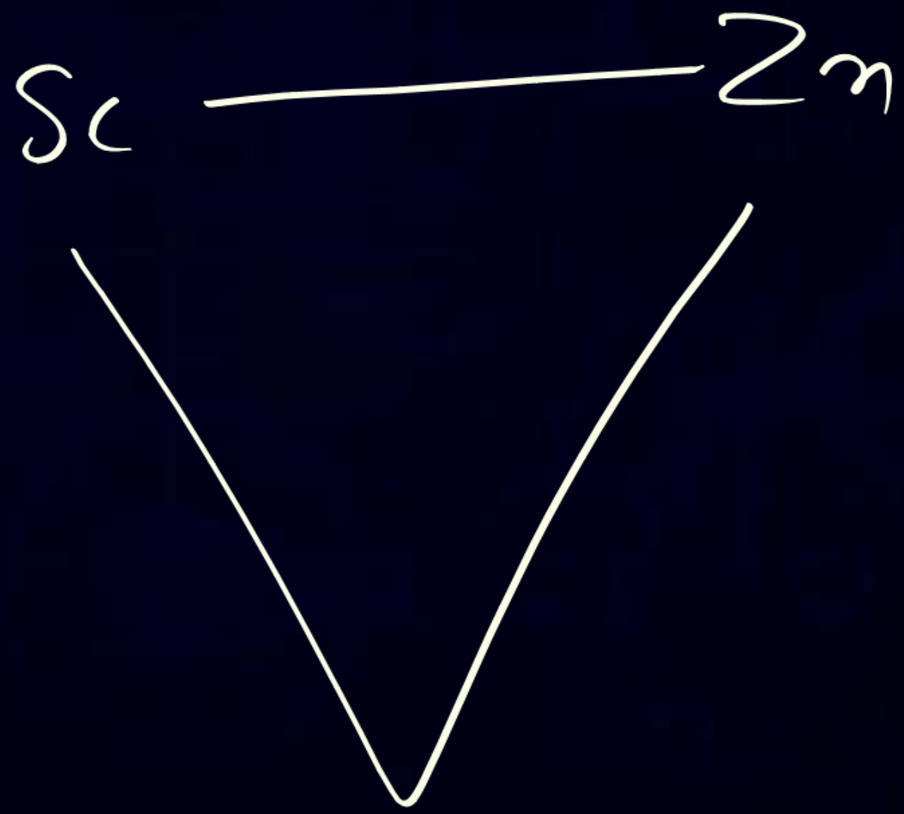
Which metal shows highest and maximum number of oxidation state?

A Mn → +7

B Fe → +6

C Co → +4

D Cr → +6



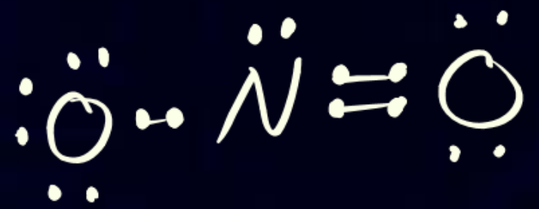
Identify the correct Lewis dot structure of NO_2^-.

A $[:\ddot{O} = N = \ddot{O}:]^-$

B $[:\ddot{O} - \ddot{N} = \ddot{O}\ ]^-$

C $[:\ddot{O} - N - \ddot{O}:]^-$

D $[:\ddot{O} = \ddot{N} = \ddot{O}:]^-$



Which of the following complex is least paramagnetic.

'd^n'

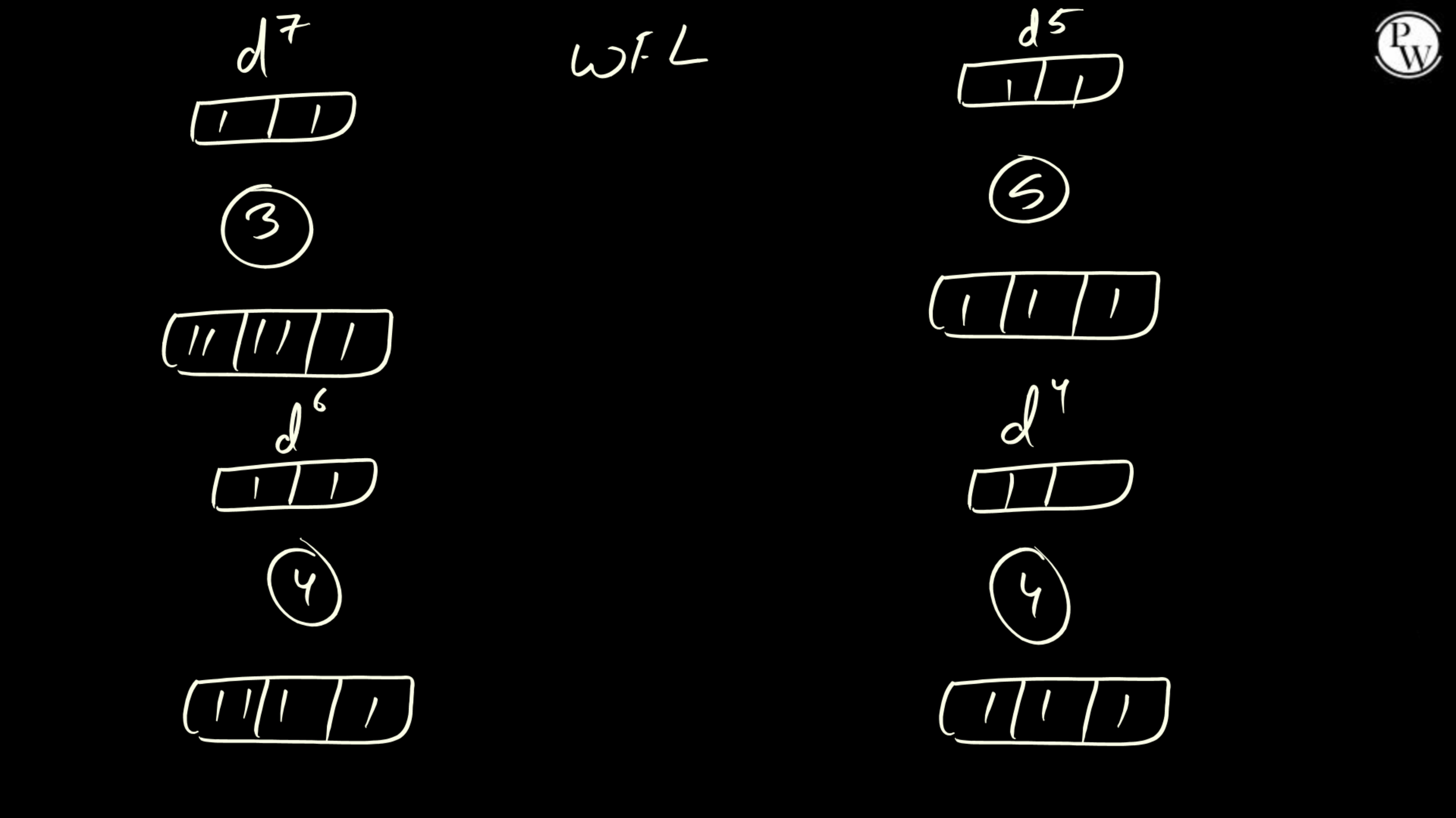
(A) $[Co(H_2O)_6]^{+2}$ ⟶ d^7

(B) $[Mn(H_2O)_6]^{+2}$ ⟶ d^5

(C) $[Fe(H_2O)_6]^{+2}$ ⟶ d^6

(D) $[Cr(H_2O)_6]^{+2}$ ⟶ d^4

$L \rightarrow H_2O \rightarrow WFL$


d7
WFL
d5
3
5
d6
d4
4
4

Statement-I: As we move down the group in Boron family the stability of +1 oxidation state is decreases.

Statement-II: Atomic radii of Ga is greater than Al.

A Both statement are correct

B Both statement are incorrect

C Statement-I is correct while statement-II is incorrect

D Statement-I is incorrect while statement-II is correct

If the number of neutrons in the most abundant isotope of boron is 'x' and its highest oxidation state in unsaturated compounds is 'y', then find the value of $(x + y)$.

A 6

B 4

C 3

D 9

'BN'

$_5B^{11}$

6

$x \Rightarrow 6$

$y \Rightarrow 3$

Which of the following cation will give green colour in Borax bead test?

A Iron

B Cobalt

C Manganese

D Nickel

Which of the following are correct statement(s) for given species.

$O^{2-}, F^{-}, Na^{+}, Mg^{2+}$

(a) O^{2-} is largest in size

(b) Mg^{2+} is smallest in size

(c) All have same effective nuclear charge

(d) All are isoelectronic

A (a), (b) and (c)

B (a), (b) and (d)

C (b), (c) and (d)

D (a), (c) and (d)

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Mathematics

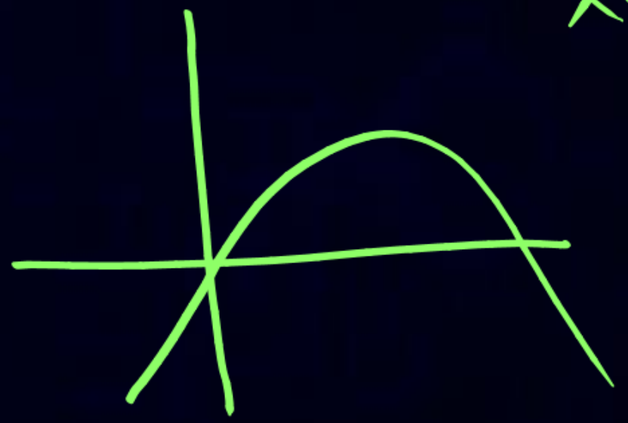
The area enclosed by curves $y = x^2 - 5x$ and $y = 7x - x^2$ is-

$x^2 - 5x = 0$

$x = 0, 5$

$7x - x^2 = 0$

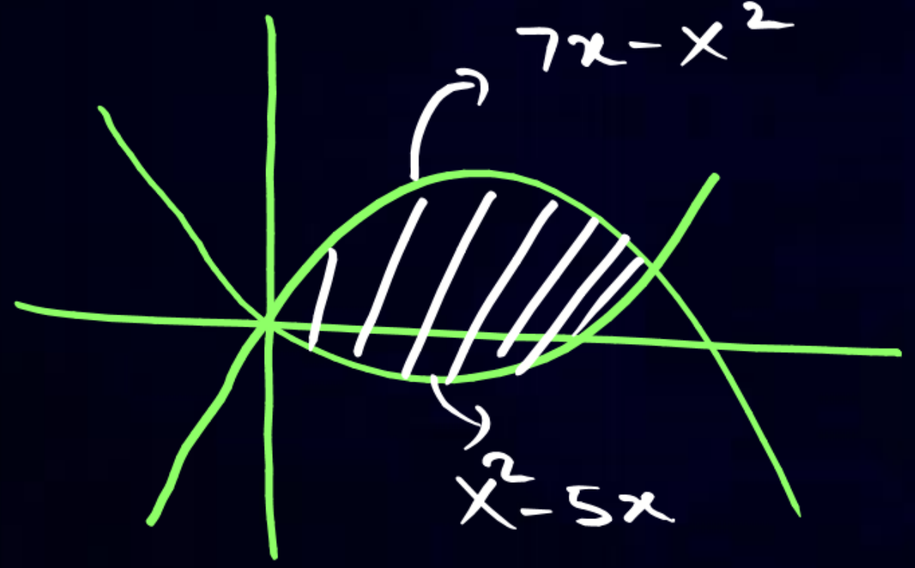
$x = 0, 7$



$x^2 - 5x = 7x - x^2$

$2x^2 - 12x = 0$

$x = 0, 6$



$$\int_0^6 (7x - x^2) - (x^2 - 5x)\, dx$$

$$\int_0^6 (12x - 2x^2)\, dx$$

$$2\left[\frac{6x^2}{2} - \frac{x^3}{3}\right]_0^6$$

$$2\left[6^2(3) - \frac{6^3}{3}\right]$$

$$2 \cdot 6^2[1] = 72$$

If $\frac{dy}{dx} + 2y = \sin 2x$ and $y(0) = \frac{3}{4}$, then $y\left(\frac{\pi}{8}\right)$ is equal to

A $e^{\frac{\pi}{8}}$

B $e^{\frac{\pi}{6}}$

C $e^{\frac{-\pi}{4}}$

D None

$$I.F = e^{\int 2dx} = e^{2x}$$

$$y(e^{2x}) = \int e^{2x} \sin 2x\, dx$$

$$\int e^{ax} \sin bx\, dx = \frac{e^{ax}[a\sin bx - b\cos bx]}{a^2+b^2} + c$$

$$y(e^{2x}) = \frac{1}{8} e^{2x}[2\sin 2x - 2\cos 2x] + c$$

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

$$3/4 = \frac{1}{4}(-1) + c, \quad c = 1$$

$$y = c\, e^{-2x}$$

$$= 1\, e^{-\pi/4}$$

Given that $\frac{1}{1.2}+\frac{1}{2.3}+\ldots+\frac{1}{99.100}=n$ and $\frac{1}{\sqrt{1}+\sqrt{2}}+\frac{1}{\sqrt{2}+\sqrt{3}}+\ldots+\frac{1}{\sqrt{99}+\sqrt{100}}=m$, find (m, n)

$\frac{1}{1\cdot2}=\frac{2-1}{1\cdot2}=\left(1-\frac{1}{2}\right)$

$\frac{1}{2\cdot3}=\frac{3-2}{2\cdot3}=\left(\frac{1}{2}-\frac{1}{3}\right)$

$\frac{1}{99\cdot100}=\left(\frac{1}{99}-\frac{1}{100}\right)$

$n=1-\frac{1}{100}=\frac{99}{100}$

$(\sqrt{2}-1)+(\sqrt{3}-\sqrt{2})+\ldots+(\sqrt{100}-\sqrt{99})$

$m=9$

$\left(\frac{99}{100}, 9\right)$

Let $f(x) = x^5 + x^4 + x^3 + 3x + 1$ and $f(g(x)) = x$, then value of $\frac{g(7)}{g'(7)}$ is 14

$2x^3$

$2x^3$

$x^5 + x^4 + x^3 + 3x + 1 = 7$

$x^5 + x^4 + x^3 + 3x = 6$

$2x^3$

$f'(x) = 5x^4 + 6x^2 + 3$

$f'(1) = 14$

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

$f'g(7)\ g'(7) = 1$

$g'(7) = \frac{1}{f'(1)} = \frac{1}{14}$

$\cos\theta\left[\frac{1}{\sqrt{2}}, 1\right]$

Suppose $\theta \in \left[0, \frac{\pi}{4}\right]$ is a solution of $4\cos\theta - 3\sin\theta = 1$, then $\cos\theta$ is equal to

A $\frac{6-\sqrt{6}}{(3\sqrt{6}-2)}$

B $\frac{4}{(3\sqrt{6}+2)}$

C ✓ $\frac{4}{(3\sqrt{6}-2)}$

D $\frac{6-\sqrt{6}}{(3\sqrt{6}+2)}$

$(4\cos\theta - 1) = 3\sin\theta$

$16\cos^2\theta - 8\cos\theta + 1 = 9(1-\cos^2\theta)\sin^2\theta$

$25\cos^2\theta - 8\cos\theta - 8 = 0$

$\cos\theta = \frac{8 \pm \sqrt{64+800}}{50} = \frac{8 \pm \sqrt{864}}{50}$

$= \frac{8 \pm 12\sqrt{6}}{50} = \frac{4 \pm 6\sqrt{6}}{25}$

$864 = 4 \times 216$

$= 4 \times 24 \times 9$

$36 \times 8 \times 3$

$36 \times 4 \times 12$

$$\text{Coso} = \frac{4+6\sqrt{6}}{25}\,\frac{(6\sqrt{6}-4)}{(6\sqrt{6}-4)}$$

$$= \frac{216-16}{25(6\sqrt{6}-4)}$$

$$= \frac{8}{6\sqrt{6}-4}$$

$$= \frac{4}{3\sqrt{6}-2}$$

$$\int_{-\pi}^{\pi} \frac{2x(1+\sin x)}{(1+\cos^2 x)}\,dx \text{ is equal to}$$

A π^2 ✓

B 2π

C $\frac{3\pi}{2}$

D $\frac{\pi^2}{2}$

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

$$I = 2\int_{0}^{\pi} \frac{2x\sin x}{1+\cos^2 x}$$

$$I = 4\int_{0}^{\pi} \frac{x\sin x}{1+\cos^2 x} \Rightarrow 2I = 4\int_{0}^{\pi} \frac{\pi\sin x}{1+\cos^2 x}$$

$$I = 4\int_{0}^{\pi} \frac{(\pi-x)\sin x}{1+\cos^2 x} \quad I = 2\pi\int_{0}^{\pi} \frac{\sin x\,dx}{1+\cos^2 x}$$

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

$\cos x = t$

$-\sin x dx = dt$

$$I = 2\pi \int_{1}^{-1} \frac{-dt}{1+t^2}$$

$$I = 2\pi \int_{-1}^{1} \frac{dt}{1+t^2}$$

$$I = 2\pi \left[\tan^{-1} t \right]_{-1}^{1}$$

$$I = 2\pi \left[\pi/4 - (-\pi/4) \right]$$

$$I = \pi^2$$

If the function $f(x) = \frac{\sin 3x + \alpha \sin x - \beta \cos 3x}{x^3}$, $x \in R$, is continuous at $x = 0$, then $f(0)$ is

A 4

B 2

C -4

D -2

$0 + \alpha(0) - \beta = 0$

$\beta = 0$

$\frac{3\cos 3x + \alpha \cos x + \beta \sin 3x 3}{3x^2}$

$\alpha + 3 = 0$

$\alpha = -3$

$f(x) = \frac{\sin 3x - 3\sin x}{x^3}$

$f(x) = \frac{3\sin x - 4\sin^3 x - 3\sin x}{x^3}$

$= -4$

$$\int_0^{\pi/4} \frac{136\sin x}{3\sin x+5\cos x}\,dx \text{ is equal to}$$

A $3\pi - 10\log_e(2\sqrt{2}) + \log_e 5$

B $3\pi - 25\log_e 2 + 10\log_e 5$

C $3\pi - 30\log_e 2 + 20\log_e 5$ ✗

D $3\pi - 50\log_e^2 + 20\log_e 5$ ✓

$$\sin x = A(3\sin x + 5\cos x) + B(3\cos x - 5\sin x)$$

$3A - 5B = 1$

$5A + 3B = 0$

$A = -\frac{3B}{5}$

$3\left(-\frac{3B}{5}\right) - 5B = 1$

$B = -\frac{5}{34}$, $A = \frac{3}{34}$

$\frac{136}{34}$ 4

$$\int_0^{\pi/4} 12(1) + (-20)\left(\frac{3\cos x - 5\sin x}{3\sin x + 5\cos x}\right)$$

$$12(x) - 20\ln(3\sin x + 5\cos x)\Big]_0^{\pi/4}$$

$$3\pi - 20\left[\ln(4\sqrt{2}) - \ln 5\right]$$

$$3\pi - 20\ln(4\sqrt{2}) + 20\ln 5$$

$$3\pi - 20\left(\frac{5}{2}\right)\ln 2 + 20\ln 5$$

$$2\sqrt{2} = 2^{3/2}$$

The value of $\int_0^{\pi//4} \frac{dx}{1+\tan x}$ equals to

(A) $\frac{\pi}{8} + \ln 2$

(B) $\frac{\pi}{4} + \ln 2$

(C) $\frac{\pi}{8} + \frac{1}{2}\ln 2$

(D) $\frac{\pi}{8} + \frac{1}{4}\ln 2$

$$I = \int_0^{\pi/4} \frac{dx}{1+\tan(\pi/4 - x)}$$

$$I = \int_0^{\pi/4} \frac{dx}{1+\left(\frac{1-\tan x}{1+\tan x}\right)}$$

$$I = \frac{1}{2}\int_0^{\pi/4} (1+\tan x)\,dx$$

$$x + \ln\sec x \cdot \int_0^{\pi/4}$$

x^0

Find term independent of x in $\left(1 - x + 2x^2\right)\left(3x^2 + \frac{1}{x^3}\right)^9$

x x

$${}^9C_q (3x^2)^{9-q} \left(\frac{1}{x^3}\right)^q$$

$$x^{18-2q-3q}$$

$$x^{18-5q}$$

$18 - 5q = -1$

$q = 19/5$

$18 - 5q = -2$

$q = 4$

② ${}^9C_4 3^5$

Ans

Let $f(x) = \sin 2x + C + \frac{2}{\pi}(x^2 + x), x \in \left[0, \frac{\pi}{2}\right]$, then

Statement-I : $f(x)$ is increasing in $(0, \pi/2)$.

Statement-II : $f'(x)$ is decreasing in $(0, \pi/2)$

(A) Statement-I and Statement-II both are correct

(B) Statement-I and Statement-II both are incorrect

(C) Statement-I is correct and Statement-II is wrong

(D) Statement-I incorrect and Statement-II is correct

$2x$

$2 \setminus [0, \pi]$

$f'(x) = \cos(2x) + 2 + \frac{2}{\pi}(2x+1)$

$f''(x) = -4\sin 2x + \frac{4}{\pi}$

$1.( )$

If the system

$11x + y + \lambda z = -5$

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

$8x - 19y - 39z = \mu$ has infinite solutions, then find $\lambda^4 - \mu$.

$\Delta, \Delta_1, \Delta_2, \Delta_3 = 0$

$$\begin{vmatrix} 11 & 1 & \lambda \\ 2 & 3 & 5 \\ 8 & -19 & -39 \end{vmatrix} = 0$$

$11(-39 \times 3 + 95) + (40 + 78) + \lambda(-38 - 24) = 0$

$62\lambda = 11(-22) + 118$

$62\lambda = -242 + 118$

$62\lambda = -124$

$\lambda = -2$

$(-2)^4 - (-31) = 16 + 31 = 47$

$\lambda^M - M$

$$\begin{vmatrix} 1 & 1 & -5 \\ 2 & 3 & 3 \\ 8 & -19 & M \end{vmatrix} = 0$$

$$11(3M+57)+(24-2M)$$
$$-5(-38-24)=0$$

$$M=-3$$

$f(x) = \lim_{t \to x} \frac{t^2 f(x) - x^2 f(t)}{t - x}$, $f(1) = 1$, find the value of $2f(2) + 3f(3)$.

$$\frac{(2t)f(x) - x^2 f'(t)}{1}$$

$$(2x)f(x) - x^2 f'(x) = f(x)$$

$$f(x)(2x-1) = x^2 f'(x)$$

$$\int \frac{2}{x} - \frac{1}{x^2} = \int \frac{f'(x)}{f(x)}$$

$$2\ln(x) + \frac{1}{x} = \ln f(x) + C$$

$$C = 1$$

$$2\ln x + \frac{1}{x} = \ln f(x) + 1$$

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

$$\ln\left(\frac{f(x)}{x^2}\right) = \frac{1}{x} - 1, \quad f(x) = x^2 e^{\frac{1}{x}-1}$$

Find the value of $\left|AA^T(\text{adj}4A)^{-1}(\text{adj}4B)(\text{adj}AB)^{-1}\right|$. If $|A| = 2$, $|B| = 3$

(Given A is 3×3 matrix)

$|B| = 2$ $\quad \left(\frac{1}{9}\right)$

$\frac{1}{|A|^2}$

$\Rightarrow |\text{Adj}A| = |A|^{n-1}$

$\Rightarrow \text{adj}kA = k^{n-1}\text{adj}A$

$|A^{-1}| = \frac{1}{|A|}$

$|A^T| = |A|$

$|A||A| \frac{1}{|\text{adj}4A|} |\text{adj}4B| \frac{1}{|\text{adj}AB|}$

$|A|^2 \frac{1}{|16\,\text{adj}A|} |16\,\text{adj}3| \frac{1}{|AB|^2}$

$\frac{|A|^2 \; 16^3 |B|^2}{16^3 |A|^2} \frac{1}{|A|^2 |B|^2}$

$|x||x-2| - 5|x-1| - 6 = 0$ and sum of real solution of x.

$|x(x-2)| = 5|x-1| + 6$

$(x^2 - 2x) = 5(x-1) + 6$

$x^2 - 2x = 5x - 5 + 6$

$x^2 - 7x - 1 = 0$

$x^2 - 2x = -5(x-1) + 6$

$x^2 - 2x = -5x + 11$

$x^2 + 3x - 11 = 0$

$-x^2 + 2x = 5(x-1) + 6$

$-x^2 - 3x = 1$

$x^2 + 3x + 1 = 0$

$-x^2 + 2x = -5(x-1) + 6$

$-x^2 + 7x = 11$

$x^2 - 7x + 11 = 0$

Let set $S = \{1, 2, 3, \ldots 8\}$ and there are multiple quadratic equation of the form of $ax^2 + bx + c = 0$ where $a, b, c \in S$. Find the probability such that a randomly chosen quadratic equation have equal roots.

$b^2 = 4ac$

$b=1 \quad ac = \frac{1}{4} \quad \times$

$b=2 \quad ac=1 \quad (1,1)$

$b=3 \quad (\times)$

Total $= 8^3$

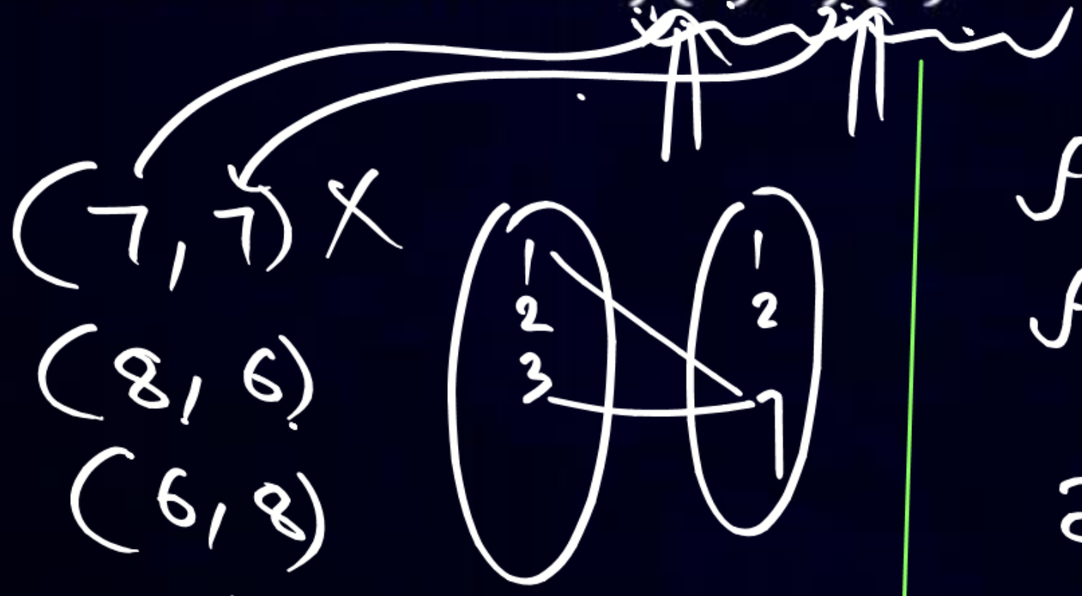
$b=4 \quad ac=4 \quad (4,1)/(1,4)/(2,2)$

$b=6 \quad ac=9 \quad (3,3)$

$b=8 \quad ac=16 \quad (4,4),(2,8)/(8,2)$

$\frac{8}{8^3} = \frac{1}{64}$

$f : A \to B$, $A = \{1, 2, 3, ..., 8\}$, $B = \{1, 2, ..., 8\}$, find the number of one-one function from A to B such that $f(1) + f(3) = 14$.



$f(1)=8, f(3)=6$ $(6!)$

$f(3)=8, f(1)=6$ $6!$

$2(6!) = 1440$

If lines $\frac{x-3}{3}=\frac{2y-1}{4\lambda+1}=\frac{4-z}{1}$ & $\frac{x-3}{3\mu}=\frac{1-2y}{-4}=\frac{z-4}{7}$ are perpendicular, then find the value of $9\mu + 4\lambda$.

$$\frac{x-3}{3}=\frac{y-\frac{1}{2}}{2\lambda+\frac{1}{2}}=\frac{z-4}{-1}$$

$$\frac{x-3}{3\mu}=\frac{y-\frac{1}{2}}{2}=\frac{z-4}{7}$$

$$3(3\mu)+2\left(2\lambda+\frac{1}{2}\right)-7=0$$

$$9\mu+4\lambda=6$$

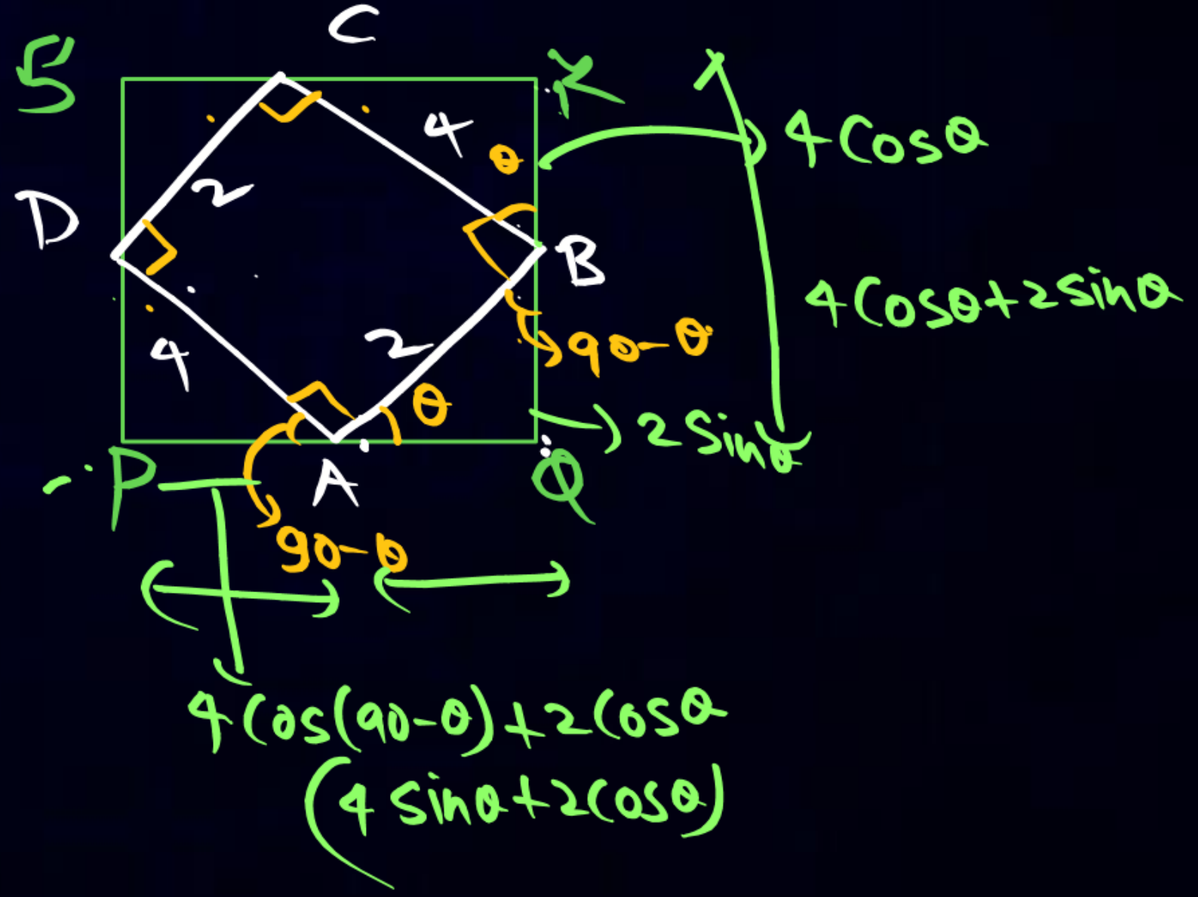
A rectangle $ABCD$ with $ABCD$ with $AB = 2$ and $BC = 4$ is inscribed in rectangle $PQRS$ such that vertices of $ABCD$ lie on sides of $PQRS$, then maximum possible area (in sq. unit) of rectangle $PQRS$ is

A 9

B 20

C 18 ✓ (Ans)

D 12



$(4\cos\theta + 2\sin\theta)(4\sin\theta + 2\cos\theta)$

$8\cos^2\theta + 8\sin^2\theta + 20\cos\theta\sin\theta$

$8 + 10\sin 2\theta$

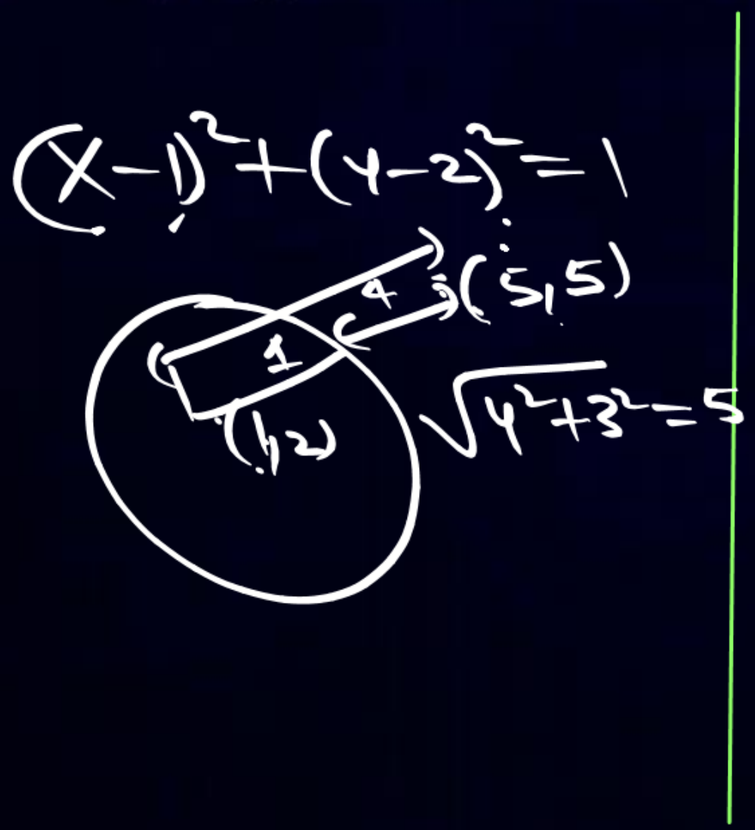
Two lines passing through (2, 3) parallel to coordinate axes. A circle of unit radius touches both the lines and lie on the origin side. Then the shortest distance of point (5, 5) from the circle is

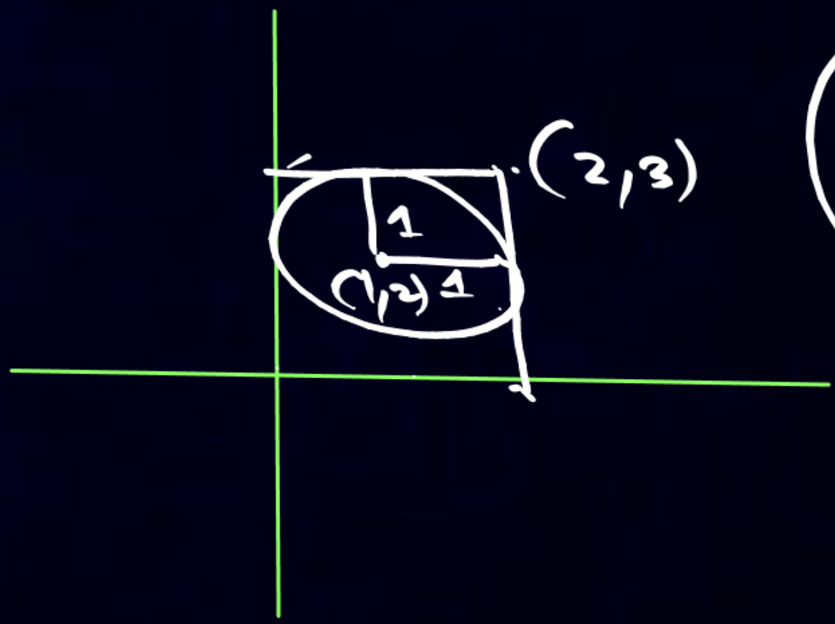
A 2

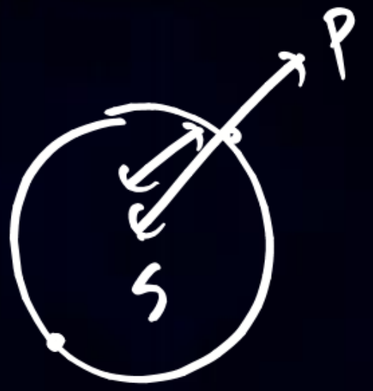
B 3

C 4 ✓

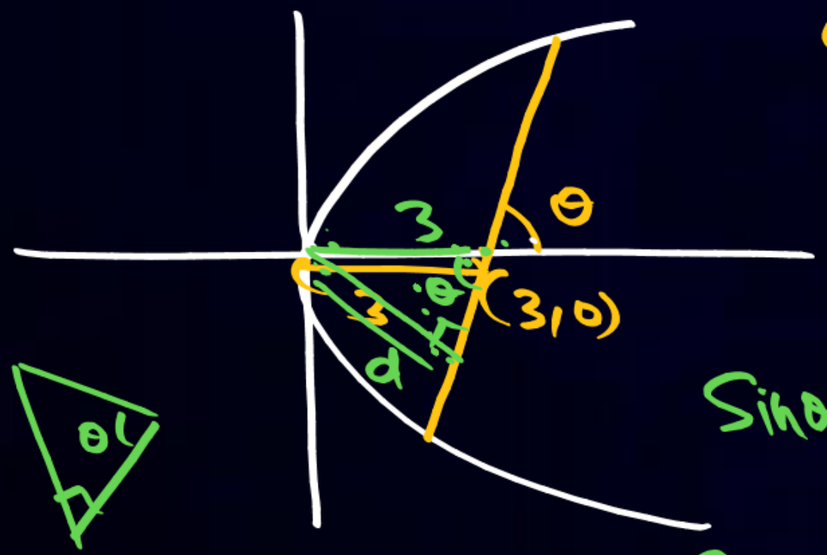
D $\sqrt{13}$







If the length of focal chord of $y^2 = 12x$ is "l" and if the distance of the focal chord from origin is d, then ld^2?



$4a = 12$

$a = 3$

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

$\text{Cosec}\,\theta = \frac{3}{d}$

$l = 4a\,\text{Cosec}^2\theta$

$l = 12\,\text{Cosec}^2\theta$

$l = 12\left(\frac{9}{d^2}\right)$

$ld^2 = 12(9) = 108$

$2[a]+[a]$

If $a \in R$ and $|2a - 1| \leq 3[a] + 2\{a\}$, here $[x]$ represents greatest integer value of x and $\{x\}$ represents fractional of x, then find the value of $72a_{min}$ $72\left(\frac{1}{4}\right) = 18$

$[a]+\{a\} = a$

$|2a-1| \leq 2a + [a]$

$|x| \begin{cases} x, x \geq 0 \\ -x, x < 0 \end{cases}$

$a > \frac{1}{2}$ ✓ $\quad a \in \left(\frac{1}{2}, \infty\right)$

$(2a-1) \leq 2a + [a]$

$[a] \geq -1$

$a \geq -1 \quad 1 - 4($

$a \in [1/4, 1/2)$

$a \leq \frac{1}{2}$

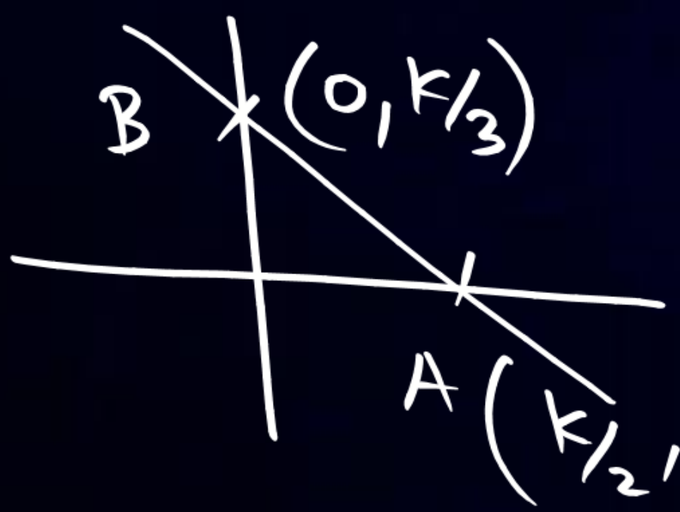
$-2a+1 \leq 2a + [a] \quad a \geq 1/4$

$[a] \geq 1 - 4a$

If the $2x + 3y - k = 0$ is a curve which intersects axis at points A and B. A circle is drawn through A and B as diameter has equation $x^2 + y^2 - 3x - 2y = 0$. Then the latus rectum of ellipse $x^2 + 9y^2 = k^2$ is L, then $3L$ is equal to ____.

(4)

CNF



$(x-0)(x-k/2)+(y-0)(y-k/3)$

$x^2+y^2-\frac{k}{2}x-\frac{k}{3}y=0$

$k/2=3,\ k=6$

$x^2+9y^2=36$

$\frac{x^2}{36}+\frac{y^2}{4}=1$

$\frac{2(4)}{6_3}$

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THANK
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LIVE

JEE MAIN 2024

ATTEMPT – 02 , 05th April 24' , SHIFT – 01

PAPER DISCUSSION

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PHYSICS

If the time period of a pendulum at height R (where R is radius of earth) from surface of earth is T_1 and at height 2R it is T_2, then

A $3T_1 = 2T_2$

B $2T_1 = 3T_2$

C $T_1 = 3T_2$

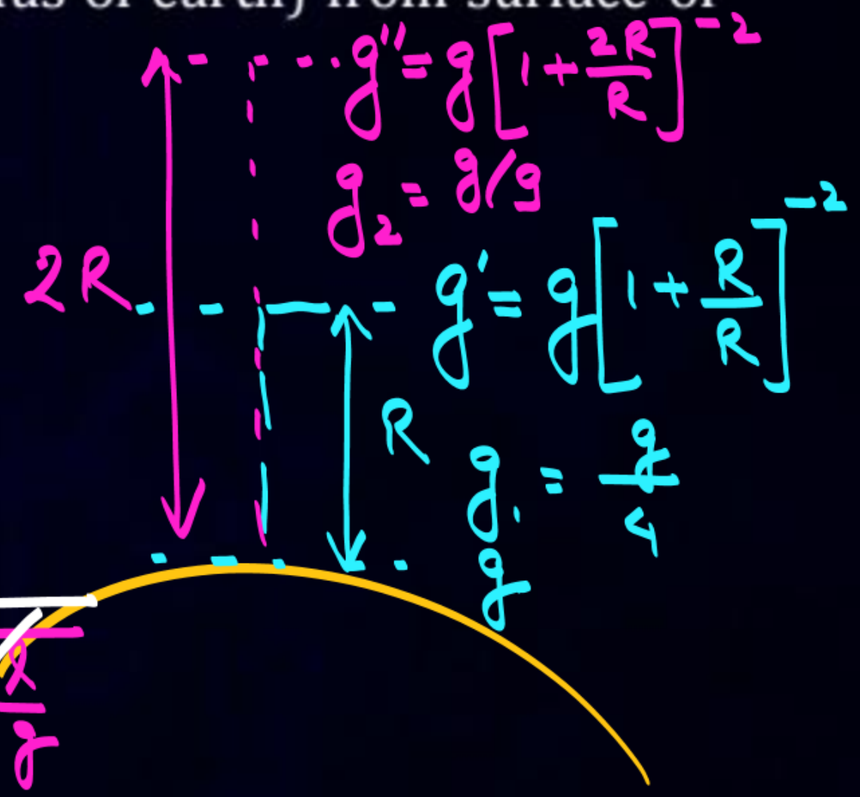
D $3T_1 = 4T_2$

$$T_1 = 2\pi\sqrt{\frac{\ell}{g_1}} = 2\pi\sqrt{\frac{\ell}{g/4}}$$

$$T_1 = 2 \times 2\pi\sqrt{\frac{\ell}{g}}$$

$$T_2 = 2\pi\sqrt{\frac{\ell}{g_2}} = 2\pi\sqrt{\frac{\ell}{g/9}} = 3 \times 2\pi\sqrt{\frac{\ell}{g}}$$

$$\frac{T_1}{T_2} = \frac{2}{3}$$ Ans.



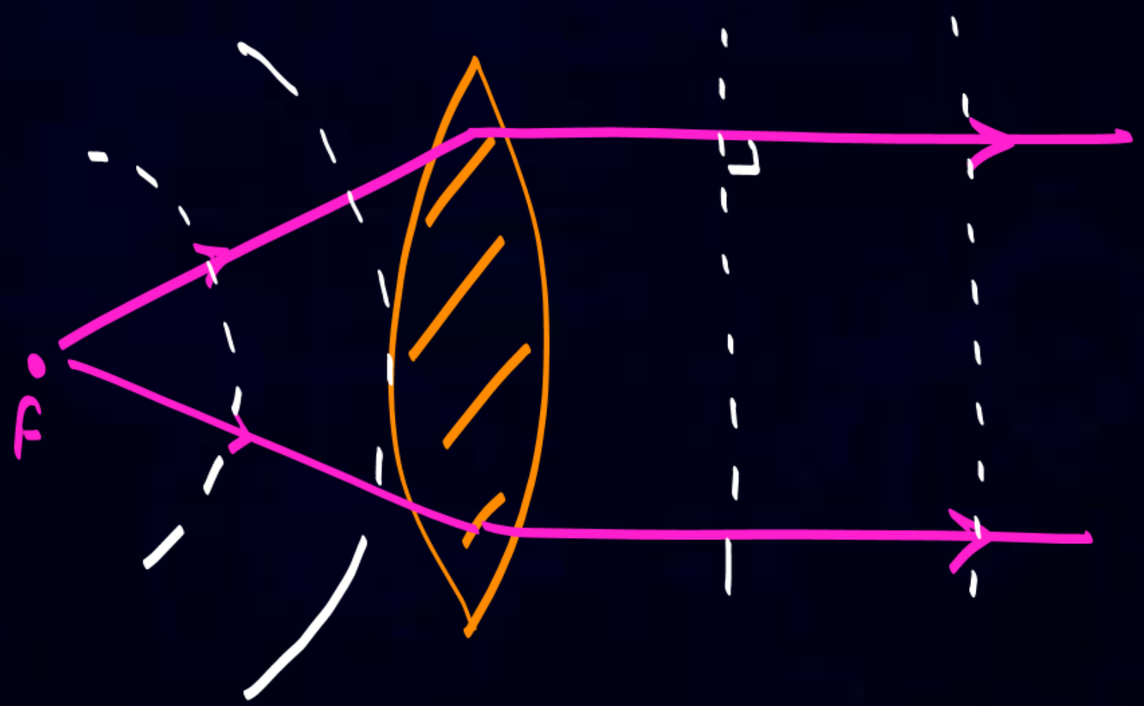
A point source of light is placed at focus of converx lens, then what is the shape of wavefront after passing through the lens

(A) Planer

(B) Cylindrical

(C) Spherical

(D) elliptical



Match the columns.

Column I	Column II
(i) Escape Velocity	(a) $\sqrt{gr}$
(ii) Orbital Velocity	(b) $\sqrt{2gr}$
(iii) Gravitation PE	(c) $-\frac{GM_1M_2}{r}$
(iv) Total Energy	(d) $-\frac{GM_1M_2}{2r}$

$v_e = \sqrt{\frac{2GM}{R}} = \sqrt{2gR}$

$v_o = \sqrt{\frac{GM}{r}} = \sqrt{2gr}$

A (i) - (a); (ii) - (c); (iii) - (d); (iv) - (b)

B (i) - (b); (ii) - (a); (iii) - (c); (iv) - (d)

C (i) - (c); (ii) - (d); (iii) - (a); (iv) - (b)

D (i) - (b); (ii) - (d); (iii) - (c); (iv) - (a)

Find the current through the battery.

$R_{eq} = 12 + 2 = 14\Omega$

$H = \frac{V}{R_{eq}} = \frac{14}{14} = 1A$

A. 1 amp ✓

B. 3 amp

C. 4 amp

D. 2 amp

Find dimension of $\sqrt{G\mu}$, where G is universal gravitational constant and μ is energy density.

$$\sqrt{G\mu} = \sqrt{[M^{-1}L^3T^{-2}][ML^{-1}T^{-2}]}$$

$$= \sqrt{L^2T^{-4}}$$

$$= LT^{-2}$$ Ans

$$\mu = \frac{\text{Energy}}{\text{Vol.}}$$

$$[\mu] = \frac{[ML^2T^{-2}]}{[L^3]}$$

$$= [ML^{-1}T^{-2}]$$

$$F = \frac{Gm_1m_2}{r^2}$$

$$G = \frac{F \cdot r^2}{m_1m_2}$$

$$[G] = [M^{-1}L^3T^{-2}]$$

In YDSE setup, wavelength = 5000Å, d = 3 ~~cm~~ mm, D = 20 cm then position of 3 maxima ?

λ

$$y_n = \frac{n\lambda D}{d} = \frac{3 \times 5000 \times 10^{-10} \times 20 \times 10^{-2}}{3 \times 10^{-3}}$$

$y = 10^{-4}$ m Ans

There is a pulley mass system, find tension in the string as shown in figure,

A 144 N

B 62 N

C 120 N

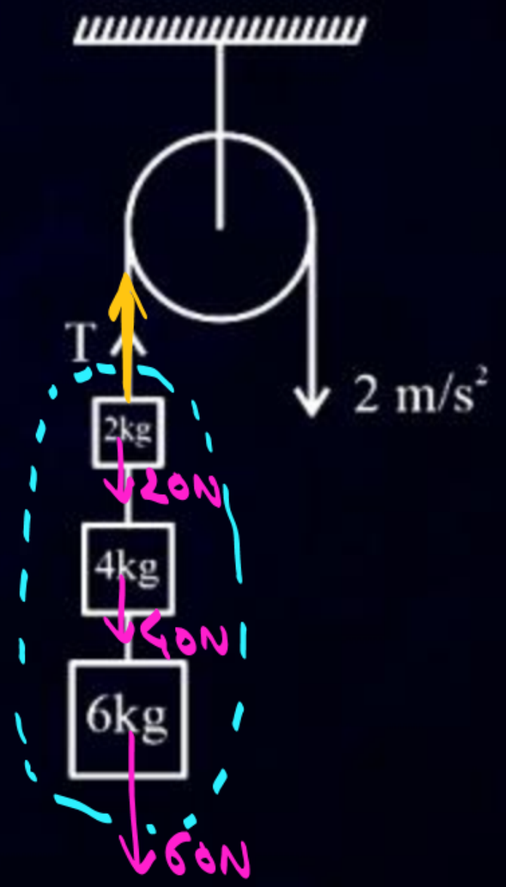
D 100 N

$T - m_{total} \cdot g = m_{total} \cdot a$

$T - 120 = 12 \times 2$

$T = 120 + 24$

$T = 144\,N$ Ans



Find effective voltage across capacitor

$$Z = \sqrt{300^2 + (500 - 100)^2}$$

$$Z = 500\,\Omega$$

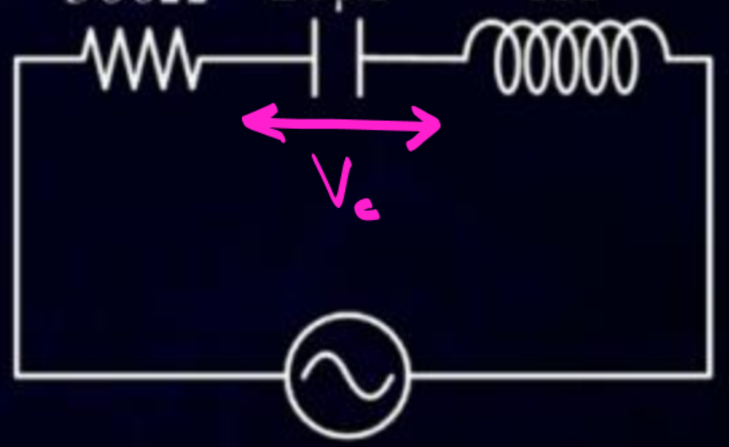
$$I_{rms} = \frac{V_{rms}}{Z} = \frac{40}{500} = \frac{2}{25}\,A$$

$$V_c = I_{rms} X_c = \frac{2}{25} \times 500$$

$$= 40\,V \quad \text{Ans}$$

$$X_c = \frac{1}{100 \times 20 \times 10^{-6}} = 500\,\Omega$$

$$X_L = 100 \times 1 = 100\,\Omega$$



$$V = \underbrace{40\sqrt{2}}_{V_{max}} \sin(100t)$$

Find ratio of electrostatics force and gravitational force between electron and proton.

A 10^{39}

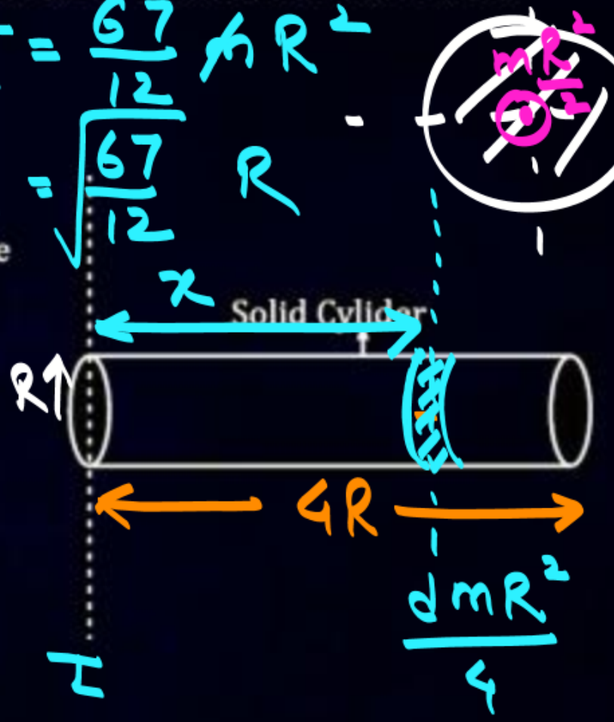
B 10^{34}

C 10^{25}

D 10^{36}

$$\frac{f_e}{f_g} = \frac{\frac{ke^2}{r^2}}{\frac{Gm_e m_p}{r^2}} = \times 10^{39}$$

If the ratio of radius of gyration of hollow sphere and solid cylinder about the axis as shown in the figure is $\sqrt{\frac{8}{x}}$. Then value of x is:



$$I = \int \frac{dm R^2}{4} + dm x^2$$

$$= \frac{mR^2}{4} + \int_0^{4R} \lambda dx \cdot x^2$$

$$= \frac{mR^2}{4} + \frac{\lambda (4R)^3}{3}$$

$$= \frac{mR^2}{4} + \frac{\frac{m}{4R} \times (4R)^3}{3}$$

$$\frac{mR^2}{4} + \frac{16 mR^2}{3}$$

$$\frac{(3+64)mR^2}{12}$$

$$\boxed{\frac{67}{12} mR^2}$$

$$I_1 = \frac{2}{3} mR^2$$

$$I_1 = m R_1^2$$

$$R_1 = \sqrt{\frac{2}{3}} R$$

$$I_2 = \frac{67}{12} mR^2$$

$$R_2 = \sqrt{\frac{67}{12}} R$$

$\frac{mR^2}{4}$

$\frac{mR^2}{4}$

$$\frac{R_1}{R_2} = \frac{\sqrt{\frac{2}{\cancel{K}}}}{\sqrt{\frac{67}{\cancel{K}_4}}}$$

$$= \sqrt{\frac{8}{67}}$$ Ans

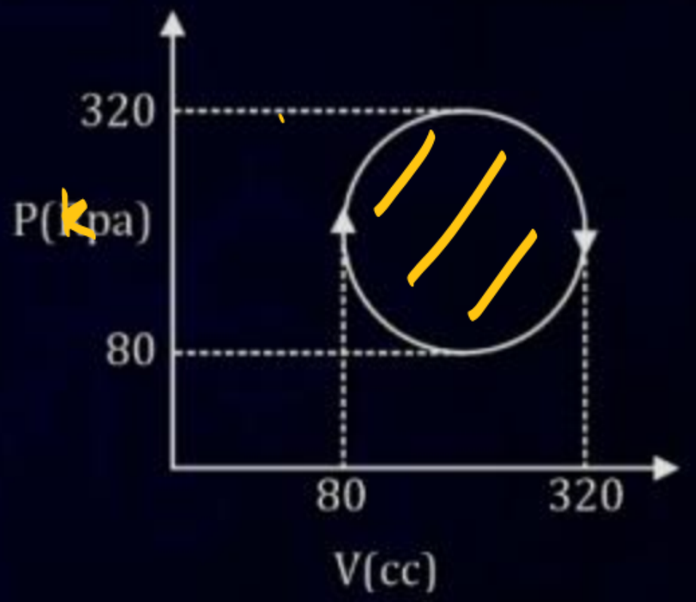
An ideal gas undergoes a cyclic process given in the P- V curve. Find work done by gas in the given cyclic process.

$$= \pi \times \left[\frac{320-80}{2}\right]^2$$

$$= \pi (120)^2 \times 10^3 \times 10^{-6}$$

$$= \pi \times 144 \times 10^{-1}$$

$$= 14.4\pi \text{ Ans}$$



For the given two graphs between stopping potential and frequency of incident light.

Statement-1: Slope is given by $\frac{h}{e}$.

Statement-2: Comparison of kinetic energy $(K_1 > K_2)$ at constant frequency.

$hf - \phi = eV_s$

$V_s = \frac{h}{e} f - \frac{\phi}{e}$

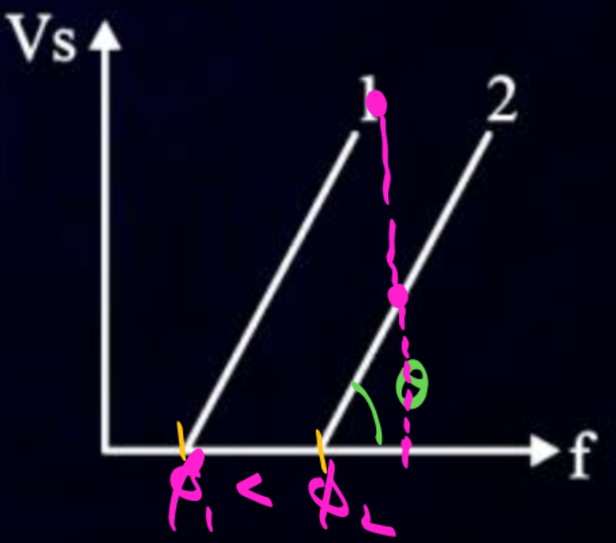
$mx + c$

(A) Both statements are correct.

(B) Both statements are incorrect.

(C) Statement-1 is correct, Statement-2 is incorrect.

(D) Statement-2 is correct, Statement-1 is incorrect.



Q. maybe wrong

30 μF, 25 μF and 45 μF capacitance are in parallel then energy is E and when they are in series energy it xE then x ?

V = Const.

$C_{||} = 100\mu F \qquad U = \frac{1}{2} C_{||} V^2$

$$\frac{1}{C_{series}} = \frac{1}{30} + \frac{1}{25} + \frac{1}{45}$$

$$= \frac{15 + 18 + 10}{450}$$

$$C_{series} = \frac{450}{43}$$

$$\frac{U_{||}}{U_s} = \frac{C_{||}}{C_s} = \frac{100}{\frac{450}{43}}$$

$$= \frac{43}{4.5} = \frac{86}{9}$$

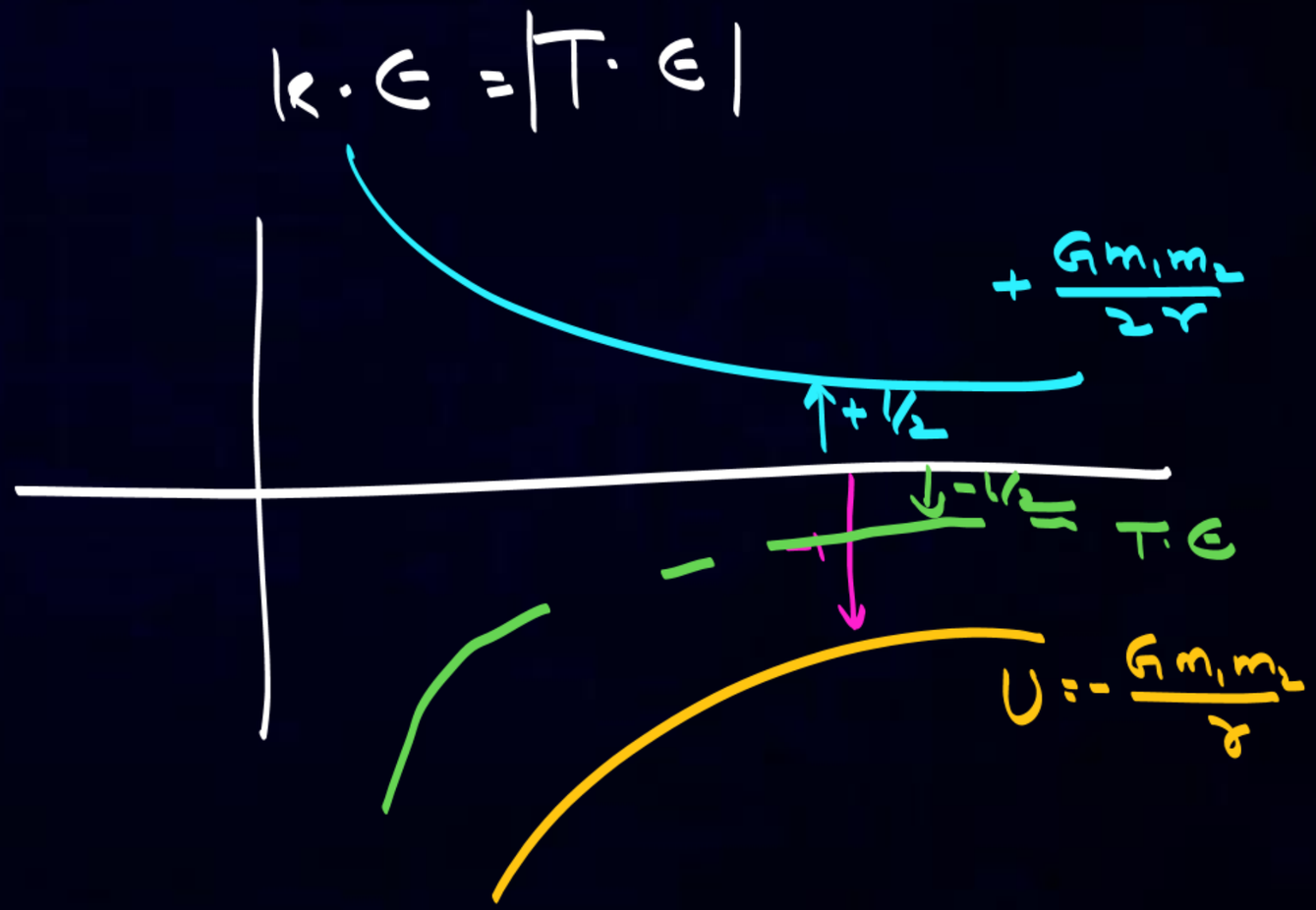
The correct relation between kinetic energy (K.E) and total energy (T.E) of satellite orbiting around the planet is

A K.E = |T.E|

B K.E = 2 |T.E|

C K.E = |T.E|/2

D |T.E| = 3 K.E



Two concentric conducting rings of radius a and b are placed as shown in diagram ($a << b$). Find coefficient of mutual inductance of rings.

A. $\frac{\mu_0 \pi b^2}{a}$

B. $\frac{\mu_0 \pi a^2}{2b}$

C. $\frac{\mu_0 a^2}{2b}$

D. $\frac{\mu_0 a^3}{2\pi b^2}$

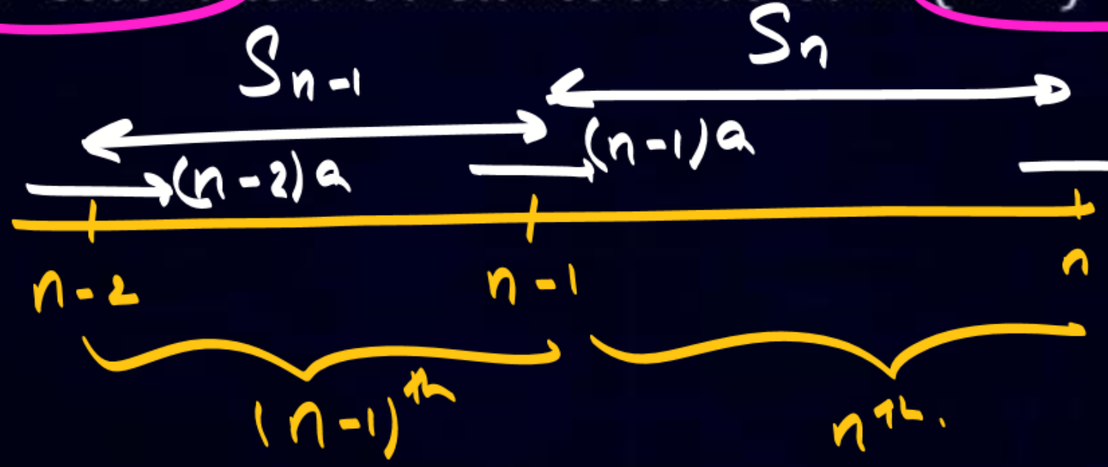
$$B = \frac{\mu_0 I}{2b}$$

$$\phi = B \cdot \pi a^2$$

$$\phi = \left(\frac{\mu_0 I}{2b}\right) \cdot \pi a^2$$

$$= M \cdot I$$

If a particle starts from rest with constant acceleration, find the ratio of distance covered by particle in n^{th} second to the distance convered in $(n-1)^{th}$ second



$$\frac{S_n}{S_{n-1}} = \frac{\left[\frac{(n-1)a + na}{2}\right] \times 1}{\left[\frac{(n-2)a + (n-1)a}{2}\right] \times 1}$$

$$= \frac{(2n-1)a}{(2n-3)a}$$

$$= \frac{2n-1}{2n-3}$$

There is a conducting wire of radius 4 mm whose resistance is given r = 2Ω. now radius is halved keeping the length of wire same, then find the resistance of new wire.

$\frac{1}{2}$

$A = \pi r^2$

$A \to \frac{1}{4}$, $r \to \frac{1}{2}$

$R = \frac{\rho \ell}{A}$

$\frac{A}{4}$

$4 \times 2 = 8\Omega$

Statement-1: Capillary tube is inserted in liquid and the level of liquid does not rise or fall then contact angle may be 0°.
Statement-2: Contant angle depends on property of liquid and solid.

A. Statement-1 and statement-2 both are correct but 2^{nd} statements is not correct explanation of $1^{"t}$ statement.

B. Statement-1 and Statement- 2 both are correct but 2^{nd} statements is correct explanation of 1^{th} statement.

C. Statement-1 is correct and Statement-2 is wrong.

D. Statement-1 is incorrect and Statement-2 is correct.

Three helium atoms form carbon at high temperature due to fusion. Masses of helium and carbon nuclei a.m.u are 4.0002 and 12 respectively. Find energy released in the process.

$$\Delta U = [m_{He} - m_C]c^2$$

$$= [3 \times 4.0002 - 12]c^2$$

$$= [12.0006 - 12]\,4c^2$$

$$= 0.0006 \times 931.5$$

$$= \underline{\qquad\qquad}$$

There is a two block system placed on a platform which is moving downward with an acceleration of 2 m/s^2 then find the normal force on block by the platform.

$700 - N = 70 \times 2$

$N = 700 - 140$

$N = 560N$ Ans.

In YDSE for wavelength $\lambda = 5000$ Å, slit distance $d = 3$ mm and screen distance of 2 m, the intensity at a point which is 3 cm away from central maxima (assume intensity of light for each source is I_0) is xI_0, then x is 4

Path diff. at $P = \frac{yd}{D} = \frac{3\times10^{-2}\times3\times10^{-3}}{2}$

$= \frac{9}{2}\times10^{-5}$

Ph. diff. →

$\lambda \longrightarrow 2\pi$

$\Delta x \longrightarrow \frac{2\pi}{\lambda}\Delta x = \frac{2\pi}{5000\times10^{-10}} \times 4.5\times10^{-5}$

$= \frac{9\pi}{5}\times10^{2}$

$= 180\pi$

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