Paper Code : 1001CT102116017

ALLEN CAREER INSTITUTE KOTA (RAJASTHAN) path to success

CLASSROOM CONTACT PROGRAMME

(Academic Session : 2016 - 2017)

JEE (Main + Advanced) : ENTHUSIAST COURSE (PHASE : I)

ANSWER KEY : PAPER-1 TEST DATE : 21-08-2016

Test Type : MINOR Test Pattern : JEE-Advanced

PART-1 : PHYSICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	A,B,C	B,C	A,C	A,B,C,D	A,B,C	B,C,D	A,D	A,C	A,C,D	B,C
SECTION-II	Q.1	A	B	C	D	Q.2	A	B	C	D	
		T	Q	S	R		P,Q,S,T	P,Q,S,T	R,S	S,T	
SECTION-IV	Q.	1	2	3	4	5	6	7	8		
	A.	5	4	7	6	6 or 8	7	6	9		

PART-2 : CHEMISTRY

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	A,D	C,D	B,C	B,D	A,B,C,D	A,C,D	A,B	A,B	A,B,C	A,B,C
SECTION-II	Q.1	A	B	C	D	Q.2	A	B	C	D	
		Q,S,T	R	P,Q	P,Q		P,S,T	Q	R,S,T	P,S,T	
SECTION-IV	Q.	1	2	3	4	5	6	7	8		
	A.	5	3	2	3	2	2	4	4		

PART-3 : MATHEMATICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	A,D	A,B,C,D	A,D	A,B,C,D	A,C,D	C	A,B	A,C	A,D	A
SECTION-II	Q.1	A	B	C	D	Q.2	A	B	C	D	
		R	P,S,T	S	T		S,T	Q	Q	S,T	
SECTION-IV	Q.	1	2	3	4	5	6	7	8		
	A.	8	5	0	3	9	2	4	1		

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ANSWER KEY : PAPER-2 TEST DATE : 21-08-2016

Test Type : MINOR Test Pattern : JEE-Advanced

PART-1 : PHYSICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	A,C,D	A,B,D	A,B,C	A,B,D	A,B	C,D	A or D or A,D or B,D	B,C	B,C,D	B,D
	Q.	11	12								
	A.	A,B	A,D								
SECTION-IV	Q.	1	2	3	4	5	6	7	8		
	A.	7	8	2	1	2	5	3	8		

PART-2 : CHEMISTRY

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	A,C,D	A,C	A,B,D	B,D	C	A,B,C	A,B,C,D	B,D	A	B
	Q.	11	12								
	A.	A,C,D	C								
SECTION-IV	Q.	1	2	3	4	5	6	7	8		
	A.	9	6	7	4	6	8	6	5		

PART-3 : MATHEMATICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	A,C	A,B,C	A,B,C,D	A,B,C	B,D	A,B,C,D	B,C	A,C,D	B,D	A,B,C
	Q.	11	12								
	A.	B,D	B								
SECTION-IV	Q.	1	2	3	4	5	6	7	8		
	A.	1	4	3	Bonus	4	4	6	5		

ALLEN CAREER INSTITUTE KOTA (RAJASTHAN)

CLASSROOM CONTACT PROGRAMME
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PHASE : I

Test Type : MINOR   Test Pattern : JEE-Advanced

TEST DATE : 21 - 08 - 2016

PAPER-1

PART-1 : PHYSICS   SOLUTION

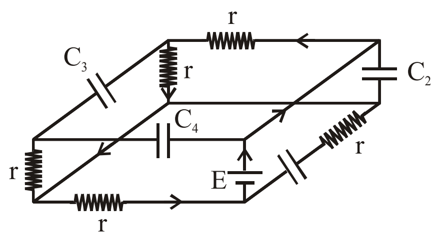
SECTION-I

1. Ans. (A, B, C)

Sol. Rod OA is resistance less, so $\Delta V = \frac{1}{2}B\omega\ell^2$

2. Ans. (B, C)

Sol. In steady state



Charge on $C_1 = \frac{CE}{3}$

Charge on $C_2 = \frac{2CE}{3}$

Charge on $C_3 = \frac{CE}{3}$

Charge on $C_4 = \frac{2CE}{3}$

3. Ans. (A, C)

Sol. $E_{in} = \frac{\mu_0}{2\pi}Iv\ell n2$

$\therefore$ Charge on capacitor at time t,

$Q = \frac{C\mu_0 IV}{2\pi}\ell n2(1-e^{-t/RC})$

Current $I = \frac{d\theta}{dt} = \frac{\mu_0 Iv\ell n2}{2\pi R}e^{-t/RC}$

4. Ans. (A, B, C, D)

Sol. $\phi_B = 0$

5. Ans. (A, B, C)

Sol. $\varepsilon_2 = 0$, ε_1 and $\varepsilon_3 \neq 0$

6. Ans. (B, C, D)

Sol. After closing switch let charge q remains on A

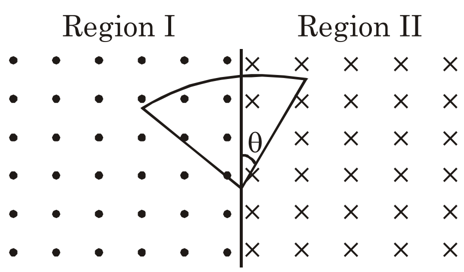
$$V_A = V_C$$

$$\frac{Kq}{R} + \frac{K2\theta}{2R} + \frac{K(4\theta - q)}{3R} = \frac{K6Q}{3R}$$

$$q = -\frac{\theta}{2}$$

7. Ans. (A, D)

Sol.



at the shown moment ϕ of frame is

$\left(\frac{1}{2}a^2\theta\right)B - \left(\frac{\pi a^2}{4} - \frac{1}{2}r^2\theta\right)B$

$\therefore \varepsilon = Ba^2\omega$

$\therefore$ Power $= \frac{(Ba^2\omega)^2}{R}$

Energy dissipated

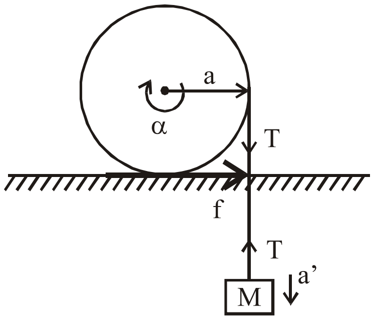
$= \frac{B^2a^4\omega^2}{R} \times \frac{1}{4} \times \frac{2\pi}{\omega} = \frac{B^2\omega\pi a^4}{2R}$

8. Ans. (A, C)

Sol. a' = Rα

a = Rα

$(T - f)R = \frac{MR^2}{2}\alpha$



f = Ma

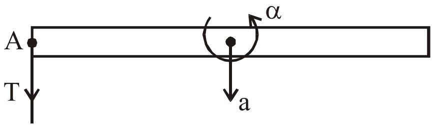
Mg – T = Ma'

Solving $T = \frac{3Mg}{5}$

acc of Block = a' ∴ $\vec{a}' = -\frac{2}{5}g\hat{j}$

9. Ans. (A, C, D)

Sol.



$a = \frac{T}{2m}$

$T\ell = \frac{2m(2\ell)^2}{12}\alpha$

acc. of point A = a + ℓα = $\frac{T}{2m} + \frac{3T}{2m} = \frac{2T}{m}$

w.r.t. A particle m moves in circle

∴ from frame of A

$T + m \times \frac{2T}{m} = \frac{mv_0^2}{\ell}$

$\therefore\ T = \frac{mv_0^2}{3\ell}$

$a = \frac{v_0^2}{6\ell}$

$\alpha = \frac{2v_0^2}{3\ell^2}$

10. Ans. (B, C)

SECTION-II

1. Ans. (A) → (T); (B) → (Q); (C) → (S); (D) → (R)

Sol. Use vectors

2. Ans. (A) → (P, Q, S, T); (B) → (P, Q, S, T); (C) → (R, S); (D) → (S, T)

Sol. Do yourself

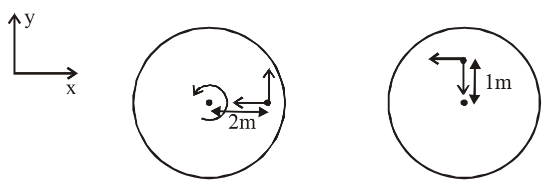
SECTION-IV

1. Ans. 5

Sol. $\overrightarrow{\text{Im pulse}} = \overrightarrow{\Delta p} = m\overrightarrow{v_f} - m\overrightarrow{v_i}$

time to reach r = 1m from r = 2m is 1s

∴ angular displacement of disk is $\frac{\pi}{2}$



Initial

Final

$\overrightarrow{v_i} = -1\hat{i} + \pi\hat{j}$ $\qquad$ $\overrightarrow{v_f} = -\frac{\pi}{2}\hat{i} - \hat{j}$

2. Ans. 4

Sol. Restoring force only given by spring

$\therefore\ T = 2\pi\sqrt{\frac{m}{K}} = 2\pi\sqrt{\frac{8}{2}} = 4\pi$

3. Ans. 7

Sol. $\phi_{net} = 0$

$\phi_{DCGH} = \phi_{EFGH} = \phi_{BCGF} = \frac{q}{24\varepsilon_0}$

$\phi_{ABCD} = \phi_{ADHE} = \phi_{ABFE} = \frac{-q}{24\varepsilon_0}$

4. Ans. 6

Sol.

Collision   after Collision

I = –mv + 20 m

$$I\times\frac{1}{2}=\frac{m(1)^2}{12}\omega$$

$$20=\frac{1}{2}\omega-v$$

solving ω = 60 rad/s

5. Ans. 6 or 8

Sol. The sphere will not roll.

∴ point A moves in a horizontal circle of radius L + 2r

∴ distance in rotation = 2π(L + 2r)

= 2π(2 + 2) = 8π cm

6. Ans. 7

Sol. Speed of sphere at top point = $\sqrt{g(R-r)}$

Total KE = $\frac{1}{2}mv^2+\frac{1}{2}\times\frac{2}{5}mr^2\times\frac{v^2}{r^2}=\frac{7}{10}mv^2$

∴ By energy conservation b/w top and bottom position.

$$\frac{7}{10}mg(R-r)+2mg(R-r)=\frac{7}{10}mv^2$$

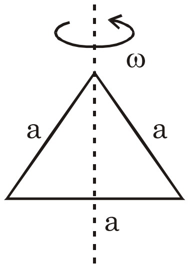
v is speed at bottomest point

$$N-mg=\frac{mv^2}{(R-r)}$$

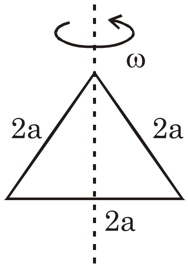
solving N = $\frac{34}{7}$ mg

7. Ans. 6

Sol.

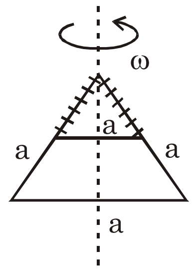


Dipole Moment M



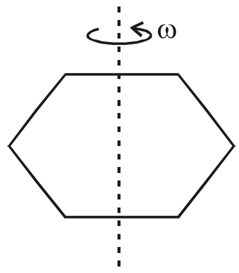
Dipole Moment 16 M

∴



Dipole Momemt 15 M

∴



for hexagon 30 M

8. Ans. 9

Sol. $\tan\theta=\frac{a_n}{a_t}=\frac{R\omega^2}{R\beta}=\frac{\omega^2}{\beta}=\frac{\left(\frac{at^3}{3}\right)^2}{at^2}=\frac{at^4}{9}$

$$\therefore\ t=\left(\frac{9\tan\theta}{a}\right)^{1/4}$$

PART–2 : CHEMISTRY SOLUTION

SECTION - I

1. **Ans. (A, D)**

2. **Ans. (C,D)**

$$\frac{d[RX]}{dt} = k_4[R^{\bullet}][X_2] \quad ....(1)$$

$$\Rightarrow \frac{d[RX]}{dt} = k_3\sqrt{\frac{k_1}{k_2}} \cdot [RH][X_2]^{1/2}$$

3. **Ans. (B,C)**

t = 0

$$R \rightleftharpoons 2P$$

t = 0	2	–	
t = 10	2-x	2x	2–x = 2x

$\Rightarrow$ x = 2/3

=4/3 = 4/3

$\Delta_r G^0 = -$ RTlnK

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

$= -$ RTln4

$= -$ ve

At t = 10 min $\Delta_r G = \Delta_r G^0 +$ RT lnQ

= = RTln $\frac{Q}{K}$

= RTln $\frac{(4/3)^2(1)}{(4/3)\times(2)^2}$

= RTln $\frac{1}{3}$

$= -$ ve

4. **Ans. (B,D)**

5. **Ans. (A, B, C, D)**

6. **Ans. (A, C, D)**

7. **Ans. (A, B)**

8. **Ans. (A,B)**

9. **Ans. (A,B,C)**

10. **Ans. (A,B,C)**

SECTION - II

1. **Ans. (A)→(Q,S,T); (B)→(R); (C)→(P,Q); (D)→(P,Q)**

2. **Ans. (A) → (P,S,T); (B) → (Q); (C) → (R,S,T); (D) → (P,S,T)**

SECTION - IV

1. **Ans. (5)**

$$\frac{30/4}{V} = \frac{0.015}{10}$$

V = 5000 ml = 5 l

2. **Ans. (3)**

Slope = $-\frac{E_a}{R}$

$$\frac{(-8.8)-(5.2)}{3.8\times10^{-3}-3.2\times10^{-3}} = -\frac{E_a}{R}$$

E_a = 12 kcal

$$\frac{12}{400} = \frac{E_a'}{300}$$

$E_a' = 9 = E_a - x$

x = 3 kcal

3. **Ans. (2)**

4. **Ans. (3)**

5. **Ans. (2)**

6. **Ans. (2)**

7. **Ans. (4)**

8. **Ans. (4)**

PART-3 : MATHEMATICS — SOLUTION

SECTION-I

1. Ans. (A,D)

It is linear differention equation

$\therefore$ solution $ye^{\int 1dx} = \int e^{\int 1dx}.e^{x}dx$

$$e^{x}y = \frac{e^{2x}}{2} + c$$

$$\because y(0) = 1 \Rightarrow c = \frac{1}{2}$$

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

$$y(\ell n2) = \frac{1}{2}\left[2 + \frac{1}{2}\right] = \frac{5}{4}$$

minimum value 1 at x = 0

$$\int_{0}^{\ell n2}\left(\frac{e^{x} + e^{-x}}{2}\right)dx = \left[\frac{e^{x} - e^{-x}}{2}\right]_{0}^{\ell n2} = \frac{3}{4}$$

2. Ans. (A,B,C,D)

x,y,z are roots of $t^3 - 3t^2 + t - 1 = 0$

x + y + z = 3

xy + yz + zx = 1

xyz = 1

$$\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix} = (x-y)(y-z)(z-x)$$

$$\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix} = (x-y)(y-z)(z-x)(x+y+z) = 3(x-y)(y-z)(z-x)$$

$$\begin{vmatrix} 1 & x & x^3 \\ 1 & y & y^3 \\ 1 & z & z^3 \end{vmatrix} = (x-y)(y-z)(z-x)(xy+yz+zx) = (x-y)(y-z)(z-x)$$

$$\begin{vmatrix} 1+x & 1 & 1 \\ 1 & 1+y & 1 \\ 1 & 1 & 1+z \end{vmatrix} = xyz + xy + yz + zx = 2$$

3. Ans. (A,D)

On addition, we get

$$\left[x\sin3\theta - y + z - 1 \quad x\cos2\theta + 4y + 3z - 2 \quad 2x + 7y + 7z\right]$$

$$= \left[-1 \quad -2 \quad 0\right]$$

α,β,γ are non zero

$$\therefore \begin{vmatrix} \sin 3\theta & -1 & 1 \\ \cos 2\theta & -4 & 3 \\ 2 & 7 & 7 \end{vmatrix} = 0$$

$-7\sin\theta(2\sin\theta - 1)(2\sin\theta + 3) = 0$

$\sin\theta = 0$ or $\sin\theta = \frac{1}{2}$

There are 9 solutions and sum of solution 16π

4. Ans. (A,B,C,D)

$$M^2 = \begin{bmatrix} 1 & 0 & 0 \\ 4 & 1 & 0 \\ 12 & 4 & 1 \end{bmatrix}$$

$$M^3 = \begin{bmatrix} 1 & 0 & 0 \\ 6 & 1 & 0 \\ 24 & 6 & 1 \end{bmatrix}$$

$$\therefore M^{100} = \begin{bmatrix} 1 & 0 & 0 \\ 6 & 1 & 0 \\ 24 & 6 & 1 \end{bmatrix}$$

$$Q = M^{100} - I = \begin{bmatrix} 0 & 0 & 0 \\ 200 & 0 & 0 \\ 20200 & 200 & 0 \end{bmatrix}$$

$$Q^2 = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ (200)^2 & 0 & 0 \end{bmatrix}$$

$\therefore Q^3 = 0$

$\therefore$ Q is triangular matrix and nilpotent matrix of order 3.

5. Ans. (A,C,D)

Q is mid point of BC

$\therefore \Delta BPC$ is right angle at point P

$\therefore \underline{|A} = 45°$ or $135°$

case : $\angle A = 45°$ $\cos 45° = \dfrac{9+2-a^2}{2.3.\sqrt{2}}$

$\Rightarrow a = \sqrt{5}$

$2R_{\Delta ABC} = \dfrac{a}{\sin A} \Rightarrow R = \sqrt{\dfrac{5}{2}}$

& $S = a + b + c = 3 + \sqrt{2} + \sqrt{5}$

Case : $\angle A = 135°$ in this case $a = \sqrt{17}$

$S = 3 + \sqrt{2} + \sqrt{17}$

$R_{\Delta ABC} = \sqrt{\dfrac{17}{2}}$

6. **Ans. (C)**

$\log(1+x) = x - \dfrac{x^2}{2} + \dfrac{x^3}{3} - \dfrac{x^4}{4} + ...$

$\int_0^1 \log(1+x)\,dx = \int_0^1 \left(x - \dfrac{x^2}{2} + \dfrac{x^3}{3} ....\right)dx$

$\left[x\log(x+1) - x + \log(1+x)\right]_0^1 = \dfrac{1}{1.2} - \dfrac{1}{2.3} + \dfrac{1}{3.4} - \dfrac{1}{4.5} + ...$

$2\log 2 - 1 = 2\left(\dfrac{1}{1.2.3} + \dfrac{1}{3.4.5} + \dfrac{1}{5.6.7} + ...\right)$

$\therefore P = \dfrac{2\log 2 - 1}{2}$

7. **Ans. (A,B)**

Put $\alpha = \gamma$, $\beta = 0$ then we get $g(\gamma) = 0$ ...(i)

put $\alpha = \gamma$, $\beta = \alpha - \gamma$ then we get

$g(2\gamma - t) = -g(t)$ ...(ii)

$I = \int_{-\gamma-1}^{3\gamma+1} g(2\gamma - t)\,dt$ ...(iii)

apply king property

$I = \int_{-\gamma-1}^{3\gamma+1} g(t)\,dt$ ....(iv)

on (iii) + (iv)

$2I = \int_{-\gamma-1}^{3\gamma+1} 0\,dt = 0$

8. **Ans. (A,C)**

$y\dfrac{d^2y}{dx^2} = 2\left(\dfrac{dy}{dx}\right)^2$

$\dfrac{\left(\dfrac{d^2y}{dx^2}\right)}{\left(\dfrac{dy}{dx}\right)} = \dfrac{2\left(\dfrac{dy}{dx}\right)}{y}$

on integrate we get $\dfrac{dy}{dx} = ky^2$

$\dfrac{dy}{y^2} = k\,dx$

$\therefore y = -\dfrac{1}{kx + c}$

given $f(1) = 1 \therefore c = -1 - k$ ...(i)

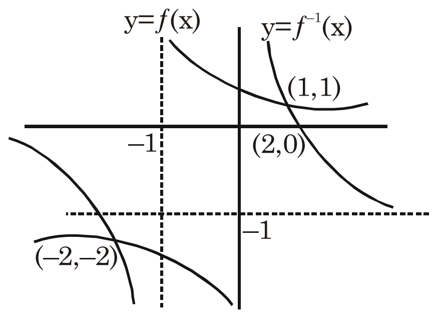
given $f^{-1}(2) = 0 \Rightarrow f(0) = 2$

$\therefore 2 = -\dfrac{1}{c}$ ...(ii)

from (i) & (ii) $c = k = -\dfrac{1}{2}$

$\therefore f(x) = y = \dfrac{2}{x+1}$

$f^{-1}(x) = \dfrac{2}{x} - 1$



$S = \int_0^1 \dfrac{2}{x+1}dx + \int_1^2 \left(\dfrac{2}{x} - 1\right)dx$

$= 4\ell n2 - 1$

Angle of intersection at (1,1) :

$f'(x) = \dfrac{-2}{(x+1)^2}, \left(f^{-1}(x)\right)' = -\dfrac{2}{x^2}$

$m_1 = \left(\dfrac{dy}{dx}\right)_{(1,1)} = -\dfrac{1}{2}$

$m_2 = \left(\dfrac{dy}{dx}\right)_{(1,1)} = -2$

$\therefore$ angle $\theta = \tan^{-1}\left|\dfrac{m_1 - m_2}{1 + m_1 m_2}\right| = \tan^{-1}\dfrac{3}{4}$

similiarly we get $\theta = \tan^{-1}\left(\dfrac{3}{4}\right)$ at (–2,–2)

9. Ans. (A,D)

Let $y=\left|\frac{t^2+(3+m)t+2+3m}{3+t}\right|$

$=\left|t+m+\frac{2}{3+t}\right|$

let $t+\frac{2}{3+t}=a \Rightarrow \frac{da}{dt}=1-\frac{2}{(3+t)^2}>0$,

$\therefore$ a is $\uparrow f_n$

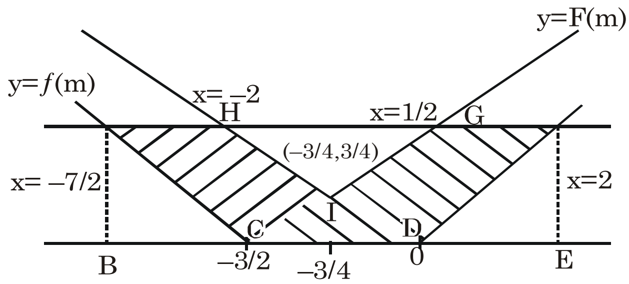
$\because \ a \in \left[0,\frac{3}{2}\right]$, $t \in [-1,1]$

$y = |a + m|$, $a \in \left[0,\frac{3}{2}\right]$

$$F(m)=\begin{cases} m+\frac{3}{2}, & m \ge -\frac{3}{4}, \quad a=\frac{3}{2} \\ -m, & m<-\frac{3}{4}, \quad a=0 \end{cases}$$

$$f(m)=\begin{cases} m, & m \ge 0, \quad a=0 \\ 0, & -\frac{3}{2}<m<0, \quad a=-m \\ -\frac{3}{2}-m, & m<-\frac{3}{2}, \quad a=\frac{3}{2} \end{cases}$$

$\therefore f(m)$ is not differentiable at two points at $x=0,-\frac{3}{2}$



required area = area of reactangle ABEF –area of ΔABC – area of ΔDEF – area of ΔHIG

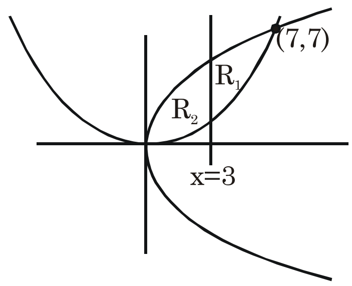
$=11-2-2-\frac{1}{2}.\frac{5}{2}.\frac{5}{4}=\frac{87}{16}$ sq. unit

$\because f(F(m)) = F(m)$

so area bounded by $y = f(F(m))$ and $y = f(m)$ and $y = 2$ is $\frac{87}{16}$ sq. units

minimum distance between $y = F(m)$ and $y = f(m)$ is equal to distance of I from x-axis which is $\frac{3}{4}$

10. Ans. (A)



N = 3
$C_1 : y^2 = 7x$
$C_2 : x^2 = 7y$

area of $R_2=\int_0^3\left(\sqrt{7x}-\frac{x^2}{2}\right)dx=\frac{14\sqrt{21}-9}{7}$ sq. units

area of $R_1=\int_3^7\left(\sqrt{7x}-\frac{x^2}{2}\right)dx=\frac{370-42\sqrt{21}}{21}$

$\therefore$ Total area of region R_1 and R_2 is $\frac{49}{3}$ sq. units

SECTION – II

1. Ans. (A)→(R); (B)→(P,S,T); (C)→(S); (D)→(T)

(A) $-17 < 8\sin\theta + 15\cos\theta < 17$

$-17-18 \le 8\sin\theta + 15\cos\theta < 17-18$

$\therefore$ maximum value = –1

(B) $f(-1) > 1 \Rightarrow k - 1 + 3 > 1$

$\Rightarrow k > -1$

(C) $I=\int_2^4\frac{\log(x+1)}{\log(x+1)+\log(7-x)}dx$

apply king

$$I=\int_2^4 \frac{\log(7-x)}{\log(1+x)+\log(7-x)}dx$$

on add $2I=\int_2^4 1dx$

$I = 1$

(D) $\int_0^{\sin x} tf(t)dt = 6x^2$

differentiation w.r.t x

$\sin x\, f(\sin x)\cos x = 12x$

$\therefore f(\sin x)\sin 2x = 24x$

2. Ans. (A)→(S,T); (B)→(Q); (C)→(Q); (D)→(S,T)

$f(x) = x^3 - 6x^2 - 36x + 2$

$f'(x) = 3x^2 - 12x - 36 = 3(x + 2)(x - 6)$

$f''(x) = 6x - 12 = 6(x - 2)$

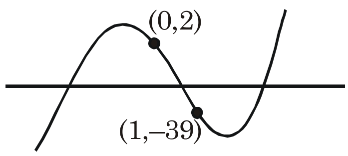
(A) $f'(x) > 0 \therefore x \in (-\infty,-2)\cup(6,\infty)$

(B) $f''(x)=0 \therefore x=2 \Rightarrow c=2$

(C) $f(x) = 0 \Rightarrow x^3 - 6x^2 - 36x + 2 = 0$

$\because f(0) = 2$ and $f(1) = -39$

$\Rightarrow$ three real roots



(D) for rolles theorem $f(a) = f(0)$

$a^3 - 6a^2 - 36a + 2 = 2$

$\therefore a=0,\frac{6+\sqrt{180}}{2},\frac{6-\sqrt{180}}{2}$

$\because a > 2 \Rightarrow k=\frac{6+\sqrt{180}}{2}$

SECTION-IV

1. Ans. 8

$a = 4, c = 3, b = 1$

$\int_1^3 4dx = [4x]_1^3 = 8$

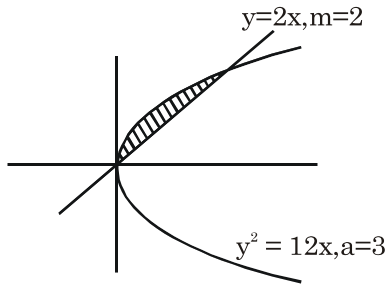
2. Ans. 5

Area of ellipse = πab

$k\pi = \pi(4)(5) \Rightarrow \frac{k}{5}=4$

3. Ans. 0

4. Ans. 3



Area $=\left|\frac{8}{3}\frac{a^2}{m^3}\right|=3$

5. Ans. 9

$$\begin{vmatrix} -a+b & c+3b-a & b+c \\ a-b & c-3b+a & -b+c \\ a+b & a+3b-c & b-c \end{vmatrix}=6$$

$c_2 \to c_2 - c_1$

$$\begin{vmatrix} -a+b & c+2b & b+c \\ a-b & c-2b & -b+c \\ a+b & 2b-c & b-c \end{vmatrix}=6$$

$c_2 \to c_2 - c_3$

$$\begin{vmatrix} -a+b & b & b+c \\ a-b & -b & -b+c \\ a+b & b & b-c \end{vmatrix}=6$$

$R_1 \to R_1 + R_2$

$$\begin{vmatrix} 0 & 0 & 2c \\ a-b & -b & -b+c \\ a+b & b & b-c \end{vmatrix}=6$$

$\therefore 4abc = 6 \Rightarrow abc=\frac{3}{2}$

$$\frac{1}{\Gamma}=\frac{1}{s(s-a)(s-b)(s-c)}=\frac{1}{\Delta^2}=\frac{4}{a^2b^2\sin^2 c}$$

$$=\frac{4c^2}{\left(\frac{9}{4}\right)\sin^2 c}$$

$$= \frac{16}{9}\frac{c^2}{\sin^2 c}$$

$\because \frac{c}{\sin c}$ is increasing function in $c \in \left(0, \frac{\pi}{2}\right]$

$$\Rightarrow 1 < \frac{c}{\sin c} \le \frac{\pi}{2}$$

$$\therefore \frac{1}{\Gamma} \in \left(\frac{16}{9}, \frac{4\pi^2}{9}\right]$$

$\therefore$ integral values 2,3,4

6. Ans. 2

$$f(x) = \int_0^x \frac{2\sin 2x(-\sin x)(\tan\alpha - 1)^2 + 2\sin 2x\cos(1-\sin\beta)^2 + \cos x(-\sin x)(\tan\alpha - \sin\beta)^2}{\cos x\sin^2\beta - \sin x\tan^2\alpha + 2\sin 2x}dx,$$

$$= \int_0^x \frac{(\cos x\sin^2\beta - \sin x\tan^2\alpha + 2\sin x)(\cos x - \sin x + 2\sin 2x) - (\sin\beta\cos x - \tan\alpha\sin x + 2\sin 2x)^2}{\cos x\sin^2\beta - \sin x\tan^2\alpha + 2\sin 2x}dx$$

$$= \int_0^x (\cos x - \sin x + 2\sin 2x)dx = \sin x + \cos x - \cos 2x$$

$\therefore (f(x) + \cos 2x)^2 = (\sin x + \cos x)^2$
$= 1 + \sin 2x$

maximum value M = 2

7. Ans. 4

8. Ans. 1

we know

$$(\sin x)^{\tan x} < \left(\frac{1}{\sqrt{2}}\right)^{\tan x} \quad \text{...(i) in } x \in \left(0, \frac{\pi}{4}\right)$$

$$\left(\frac{1}{\sqrt{2}}\right)^{\tan x} < \left(\frac{1}{\sqrt{2}}\right)^{x}, x \in \left(0, \frac{\pi}{4}\right)$$

$$\left(\frac{1}{\sqrt{2}}\right)^{x} < \cos x, x \in \left(0, \frac{\pi}{4}\right)$$

$\therefore (\sin x)^{\tan x} < \cos x$

$\Rightarrow (\sin x)^{\sin x} < (\cos x)^{\cos x}, \ x \in \left(0, \frac{\pi}{4}\right)$

given equation is $(\sin x)^{\sec x} = (\cos x)^{\operatorname{cosec} x}$

$\Rightarrow (\sin x)^{\sin x} = (\cos x)^{\cos x}$

given equation has no solution in

$$\left(0, \frac{\pi}{4}\right) \cup \left(\frac{\pi}{4}, \frac{\pi}{2}\right)$$

$\therefore$ given equation has only one solution

$$x = \frac{\pi}{4}$$

JEE (Main + Advanced) : ENTHUSIAST COURSE
PHASE : I

Test Type : MINOR Test Pattern : JEE-Advanced

TEST DATE : 21 - 08 - 2016

PAPER-2

PART-1 : PHYSICS SOLUTION

SECTION-I

1. **Ans. (A,C,D)**

Sol. Induced current = $\frac{\text{induced emf}}{\text{resistance}}$

$$= \frac{\varepsilon}{R} = \frac{d\phi}{dtR} = \frac{d(BA)}{dt \times R} = \frac{d\left(0.4t \times \pi r^2\right)}{dt \times R}$$

$$= \frac{0.4 \times \pi r^2}{R} = \frac{0.4 \times \pi \times \left(\frac{1}{5}\right)^2}{0.04}$$

$$= \frac{0.4 \times \pi}{0.04} \times \frac{1}{25} = \frac{10\pi}{25} = \frac{2\pi}{5}$$

According len'z law field due to ring at center will be in direction opposite to the external magnetic field.

2. **Ans. (A, B, D)**

Sol. (A) Potential difference between A & B is O because AB is parrallel to velocity of compartment.

(B) Potential difference between B & C

$\varepsilon = 0.03 \times 4 \times 25$

$\varepsilon = 3$ volt

(D) Potential difference between B & G

$\varepsilon = 0.04 \times 2 \times 25 = 2$ volt

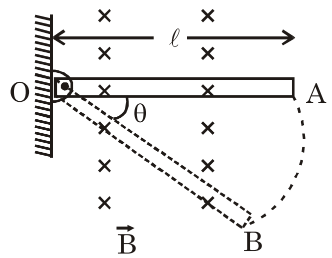
horizontal earth's magnetic field = 0.04 T

vertical earth's magnetic field = 0.03 T

3. **Ans. (A, B, C)**

4. **Ans. (A, B, D)**

Sol.



WET from A to B

$\omega_{mg} = \Delta$ K.E.

$$mg\frac{L}{2}\sin\theta = \frac{1}{2}I\omega^2$$

$$mg\frac{L}{2}\sin\theta = \frac{1}{2} \times \frac{mL^2}{3}\omega^2$$

$$\frac{3g}{L}\sin\theta = \omega^2$$

Induced emf produced in rod is

$$\varepsilon = \frac{1}{2}\left(B\omega L^2\right) = \frac{1}{2}B \times \sqrt{\frac{3g\sin\theta}{L}} \times L^2$$

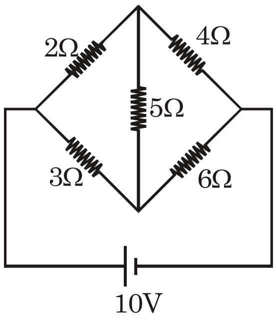
$$\varepsilon = \frac{1}{2} \times B \times \sqrt{\frac{3g\sin\theta \times L^4}{L}}$$

$$\varepsilon = \frac{1}{2}B\sqrt{3g\sin\theta L^3}$$

$$\varepsilon \propto L^{3/2},\ \varepsilon \alpha \sqrt{\sin\theta}$$

5. Ans. (A, B)

Sol.



Initially R_{eq} of circuit $= \frac{6}{5}+\frac{24}{10} = \frac{36}{10} = 3.6\Omega$

(A) When 4Ω is shorted

$$R_{eq} = \frac{2\times\left(3+\frac{30}{11}\right)}{2+\left(3+\frac{30}{11}\right)} = \frac{63\times 2}{85} = 1.48\ \Omega$$

R_{eq} circuit decrease so current through battery increase.

(B) Initially current through 5Ω is zero after short circuit to 4Ω, some current will passs through 5Ω.

(C) If 5Ω is shorted, then there is no change in circuit.

(D) on shorted 3Ω, R_{eq} will decreases so current through battery will increase.

6. Ans. (C, D)

7. Ans. (A or D or A,D or B,D)

Sol. $v = ax^2 \Rightarrow E = -\frac{dv}{dx}$

$E = -2ax$	$a_x = kx$
$F = ma$	$v_x\frac{dv}{dx} = kx$
$E \times q = ma_x$	$\int v\times dv = \int kxdx$
$2axq = ma_x$	$\frac{v_x^2}{2} = k\frac{x^2}{2}$
$a_x \propto x$	$v_x = \pm kx$
	$v_x \propto x$

8. Ans. (B, C)

Sol. $e = L\frac{dI}{dt}$

at t = 2 sec

$\int edt = \int LdI$

area under curve is 0

area under curve = $\int LdI$

so $0 = \int LdI$

at t = 1

I = 0

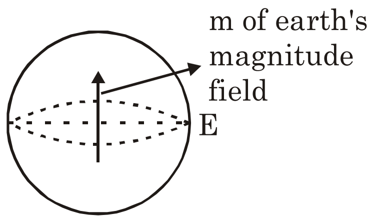
$5 = \int_0^I L\times dI$

$\frac{5}{2} = LI$

$I = \frac{5}{2\times L} = \frac{5}{2\times 10^{-2}} = 250$ A

9. Ans. (B, C, D)

Sol.



Magnitude field at equitorial position

$B_E = \frac{\mu_0}{4\pi}\times\frac{m}{r^3}$

$4\times 10^{-3} = \frac{10^{-7}\times m}{\left(6\times 10^6\right)^3}$

$m = 4\times 216\times 10^{18}\times 10^{-3}\times 10^{7}$

$m = 864\times 10^{22}$ J/T

field at pole $B_P = 2\times B_E = 8\times 10^{-3}$ T

10. Ans. (B, D)

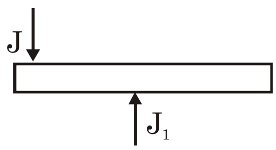
Sol. $\tau = mB\sin\theta$

$= 864\times 10^{22}\times 10^{-2}\times\frac{4}{5}$

$= 6.9\times 10^{22}$ Nm

11. Ans. (A, B)

Sol. Gulli gets impulse due to danda and ground.
impulse momentum theorem on gulli



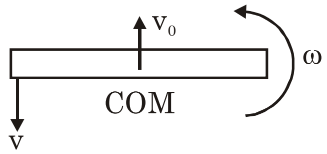
impulse due to danda is J & impulse due to ground is J_1

$-J + J_1 = m\,(v_f - mv_i)$

$-J + J_1 = m(v_0 - 0)$

$J_1 = J + mv_0$

after first impulse



$v = \frac{L}{2}\omega - v_0$ ......(i)

$J \times \frac{L}{2} = I\omega$

$J \times \frac{L}{2} = \frac{ML^2}{12} \times \omega$

$\omega = \frac{6J}{mL}$ ....(ii)

from (i) & (ii)

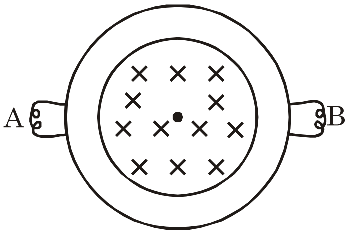
$J_1 = 4J - mv$

12. Ans. (A, D)

SECTION-IV

1. Ans. 7

Sol.



Resistance of bulb A $= \frac{v^2}{P} = \frac{4}{10} = 0.4$

Resistance of bulb B $= \frac{v^2}{P} = 0.2$

$\text{emf} = \frac{d\phi}{dt} = \frac{d}{dt}(\mu_0 nI \times A)$

$= \mu_0 n \times A \times \frac{dI}{dt}$

$= 10^{-7} \times 4\pi \times 1000 \times \pi(1)^2 \times 9$

$v = 36 \times 10^{-3}$

$I = \frac{v}{R_{eq}} = \frac{36 \times 10^{-3}}{0.6} = 6 \times 10^{-2} A$

Power dissipated through bulb B

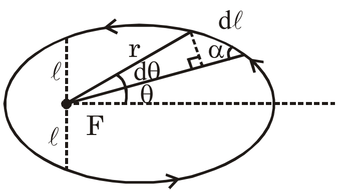
$= I^2R$

$= 36 \times 10^{-4} \times 0.2$

$= 7.2 \times 10^{-4}$ watt

2. Ans. 8

Sol.



$d\ell \sin\alpha = r d\theta$

B due to $d\ell$ element

$dB = \frac{\mu_0}{4\pi} \times \frac{I d\ell \sin\alpha}{r^2}$

$dB = \frac{\mu_0}{4\pi} \times \frac{I r d\theta}{r^2}$

$dB = \frac{\mu_0}{4\pi} \times \frac{I d\theta}{r}$

$\int dB = \frac{\mu_0}{4\pi} \int \frac{I d\theta}{r}$

$B = \frac{\mu_0 I}{4\pi} \int_0^{2\pi} \frac{(1 + e\cos\theta)}{\ell} d\theta$

$B = 8\pi \times 10^{-7}$ T

3. Ans. 2

Sol. Resistance of PQ = 2R

Since equivalent resistance of the circuit is R/2, in static condition current through the battery is

I = 2V/R

The current through CP and CQ is i = I/2 = V/R

Consider the FBD of ring and the blocks

Consider torque about 'C'

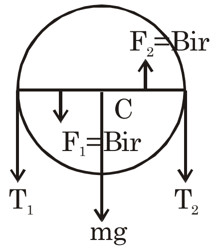
$\tau_N = 0$

$\tau_{mg} = 0, \ \tau_{F_2} = \frac{Bir^2}{2}(\hat{k})$

$\tau_{T_1} = T_1 r \hat{k}$

$\tau_{T_2} = T_2 r(-\hat{k})$

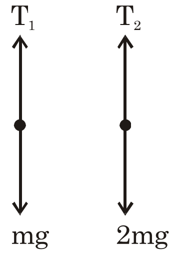
$\because \tau_N + \tau_{mg} + \tau_{F_1} + \tau_{F_2} = 0$



$\tau_{F_1} = \frac{Bir^2}{2}\hat{k} \Rightarrow T_1 r - T_2 r + \frac{Bir^2}{2} + \frac{Bir^2}{2} = 0$ ... (i)

FBD of ring

$T_1 = mg$ ... (i)



and $T_1 = 2mg$ ... (ii)

Putting the values of T_1 and T_2 in equation (i)

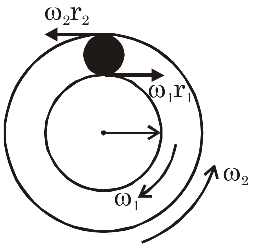
$mgr - 2mgr + Bir^2 = 0$

$\Rightarrow \ i = \frac{mg}{Br} \Rightarrow \frac{V}{R} = \frac{mg}{Br}$

$\Rightarrow \ V = \frac{mg}{Br}$ FBD of blocks

4. Ans. 1

Sol.



$$\omega = \frac{\omega_1 r_1 + \omega_2 r_2}{r_2 - r_1} = \frac{10+30}{0.5} = 80 \text{ rad/s}$$

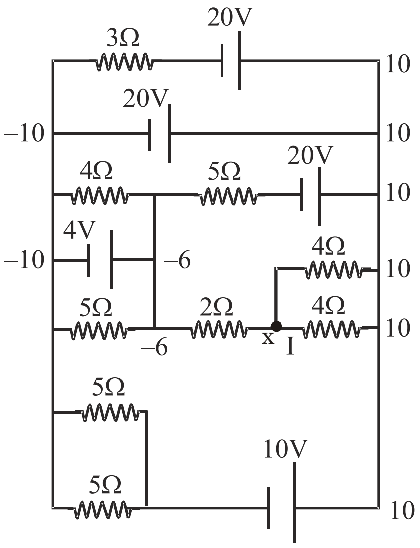
$v_c = 10 - 0.25 \times 80 = -10$ m/s

$$k = \frac{1}{2} \times m \times (10)^2 + \frac{1}{2} \times m \times \left(\frac{1}{4}\right)^2 \times \frac{2}{5} \times 80^2$$

$k = M \times 130$ J

5. Ans. 2

Sol.



$$\frac{x+6}{2} + \frac{x-10}{4} + \frac{x-10}{4} = 0$$

$\Rightarrow x = 2$

6. Ans. 5

7. Ans. 3

Sol. $\vec{B} = \frac{2\sqrt{3}\hat{i} + 2\hat{j}}{\sqrt{16}} \times \frac{\mu_0 I}{2x \times \sqrt{16}}$

$$= \left[\frac{\sqrt{3}\,\hat{i} + \hat{j}}{2} \times 10^{-7}\right]$$

$$\vec{F} = q\left(\vec{V} \times \vec{B}\right) = 10 \times 3 \left(\frac{\hat{k}}{2} \times 10^{-7}\right)$$

$F = 3 \times 10^{-6}$ N

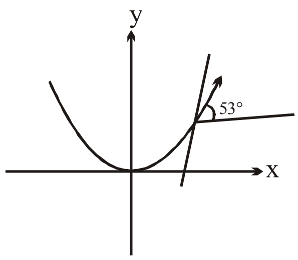
8. Ans. 8

Sol. The direction of velocity is along the tangent hence

$$\frac{dy}{dx} = 2x$$

$\tan 53° = 2x$

$4/3 = 2x$ [x = 2/3 m]



$\therefore \ y = x^2 = (2/3)^2 = 4/9$ m

Hence

$$\vec{L} = \vec{r} \times \vec{P} = M \times \left(\frac{2}{3}\hat{i} + \frac{4}{9}\hat{j}\right) \times \left(15\cos 53\hat{i} + 15\sin 53\hat{j}\right)$$

$$= 2\left(\frac{2}{3}\hat{i} + \frac{4}{9}\hat{j}\right) \times \left(9\hat{i} + 12\hat{j}\right) = 8$$

PART–2 : CHEMISTRY SOLUTION

SECTION - I

1. **Ans.(A,C,D)**
2. **Ans.(A,C)**
3. **Ans.(A,B,D)**

$$\text{P.C.} = \frac{4}{3}\pi\left[\frac{4r_A^3 + 4r_B^3 + 4r_C^3}{a^3}\right]$$

$$= \frac{4}{3}\pi\left[\frac{4(1)^3 + 4(1)^3 + 4(\sqrt{3}-1)^3}{(4)^3}\right]$$

$$\text{P.E.} = \frac{3\sqrt{3}-4}{6}$$

$$d = \frac{4\times30 + 4\times10 + 4\times20}{4^3}$$

$$= \frac{15}{4}\text{amu}/\text{A}^{03}$$

4. **Ans. (B, D)**
5. **Ans. (C)**
6. **Ans. (A, B, C)**
7. **Ans. (A,B,C,D)**
8. **Ans. (B,D)**
9. **Ans. (A)**
10. **Ans. (B)**
11. **Ans. (A,C,D)**
12. **Ans. (C)**

SECTION - IV

1. **Ans. (18000) ; OMR ANS (9)**

$$\frac{\ln 2}{6000}t = \ln\frac{10^{12}\times 4}{5\times10^{11}}$$

$$\frac{\ln 2}{6000}t = \ln 8$$

t = 3 × 6000

= 18000 years.

2. **Ans. (6)**

$A + 2B \rightleftharpoons C$; ; $K_C = 10^{12}$

1-x , 1 – 2x   x

½   ½

$$10^{12} = \frac{1/2}{1/2[B]^2} = [B] = 10^{-6}\text{molar}$$

3. **Ans. (43) ; OMR ANS (7)**

6 (P - P) = $\Delta H^0_{\text{atomisation}}$ $[P_{4(\text{solid})}] - \Delta H^0_{\text{sublimation}}$ $[P_{4(\text{solid})}]$

$$(P = P) = \frac{258}{6} = 43$$

4. **Ans. (4)**
5. **Ans. (6)**
6. **Ans. (8)**
7. **Ans. (6)**
8. **Ans. (5)**

PART–3 : MATHEMATICS SOLUTION

SECTION-I

1. **Ans. (A,C)**

Direct formulae

2. **Ans. (A,B,C)**

$$\int_1^x f(t)dt = \int_x^2 \frac{f(t)}{t}dt + \frac{x^4}{4} + x + \lambda$$

diff. w.r.t. x

$$\Rightarrow f(x) = -\frac{f(x)}{x} + x^3 + 1$$

$$f(x)\left(\frac{1+x}{x}\right) = x^3 + 1 \Rightarrow f(x) = \frac{x(x^3+1)}{x+1}$$

$f(x) \Rightarrow x(x^2 - x + 1) \Rightarrow x^3 - x^2 + x.$

Now check options.

3. **Ans. (A,B,C,D)**

$$f'(x) = \begin{vmatrix} 6x+2 & 10x+4 & 14x+6 \\ 3x+1 & 5x+2 & 7x+3 \\ 3 & 5 & 7 \end{vmatrix} + \begin{vmatrix} 3x^2+2x & 5x^2+4x+3 & 7x^2+6x+5 \\ 3 & 5 & 7 \\ 3 & 5 & 7 \end{vmatrix} + \begin{vmatrix} 3x^2+2x & 5x^2+4x+3 & 7x^2+6x+5 \\ 3x+1 & 5x+2 & 7x+3 \\ 0 & 0 & 0 \end{vmatrix} = 0$$

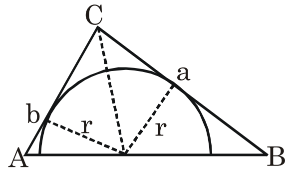
$f'(x) = 0 \Rightarrow f(x) = k$ $f(0) = 1$

$\Rightarrow f(x) = 1$ check options.

4. **Ans. (A,B,C)**

$f(x) = \dfrac{3x-6}{2}$. Check options

5. **Ans. (B,D)**



$\Delta = \frac{1}{2}a.r + \frac{1}{2}.b.r \Rightarrow r = \frac{2\Delta}{a+b}$

Also $\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2} = \sqrt{\frac{s(s-a)}{bc}}.\sqrt{\frac{s(s-b)}{ac}}.\sqrt{\frac{s(s-c)}{ab}}$

$= \frac{s\Delta}{abc}$

6. Ans. (A,B,C,D)

$I = \int \frac{\sec^2 x dx}{a^2\tan^2 x + b^2} = \frac{1}{ab}\tan^{-1}\left(\frac{a\tan x}{b}\right) + C$

$\therefore$ ab =12 ; $\frac{a}{b} = 3 \Rightarrow |a| = 6, |b| = 2$

$\therefore$ a sinx + bcosx $\in \left[-\sqrt{40}, \sqrt{40}\right]$

7. Ans. (B,C)

I.F = $e^{\int e^{\int P(x)}.P(x)dx} = e^{e^{\int P(x)}}$

$\therefore\ ye^{e^{\int P(x)}} = \int\left(Q(x).e^{e^{\int P(x)dx}}\right)dx$

for P(x) = $\frac{1}{x}$ $\Rightarrow$ If $= e^{e^{\ell nx}} = e^x$

Q(x) = e^{-x}

$\Rightarrow\ ye^x = \int e^x.e^{-x}dx \Rightarrow ye^x = x + c, y(1) = 0 \Rightarrow y = e^{-x}(x-1)$

P(x) = 1, Q(x) = e^x

If $= e^{e^x} \Rightarrow y.e^{e^x} = \int e^{e^x}.e^x dx \Rightarrow y.e^{e^x} = e^{e^x} + c$

y(0) = 2 $\Rightarrow$ y = 1 + e^{1-e^x}

8. Ans. (A,C,D)

$g(x) = f_1(f_2(f_3.....f_n(x)))$

$g'(x) = f_1^1(f_2(.....f_n(x))).f_2^1(f_3....f_n(x)).f_3^1....f_n^1(x)$

if g(x) is increasing $\Rightarrow$ g'(x) is positive

$\Rightarrow$ k must be even

if n is odd $\Rightarrow \frac{(n-1)}{2} = k, \frac{n+1}{2} = n - k$

if n is $4\ell \Rightarrow k = 2\ell$, $n - k = 2\ell$

if n is (4m + 2) $\Rightarrow$ k = (2m), (n – k) = (2m + 2)

Paragraph for Question 9 to 10

9. Ans. (B,D)

$\frac{dy}{dx} = x + \frac{y}{x} - \frac{2}{x}$

$\frac{dy}{dx} - \frac{y}{x} = \left(x - \frac{2}{x}\right)$

I.F. = $e^{-\ell nx} = \frac{1}{x}$

$\frac{y}{x} = \int\left(x - \frac{2}{x}\right)\frac{1}{x}.dx$

$\frac{y}{x} = x + \frac{2}{x} + c$

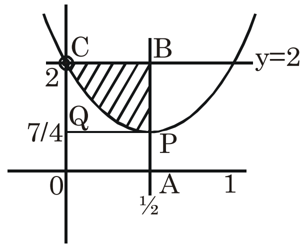
y = x² + 2 + cx

at x = 2 y = 4 = 4 + 2 + 2x

x = –1

y = x² – x + 2

10. Ans. (A,B,C)



(2) required area = $\square OABC - \int_0^{1/2}\left(x^2 - x + 2\right)dx$

$A = \frac{1}{2}(2) - \left(\frac{x^3}{3} - \frac{x^2}{2} + 2x\right)_0^{1/2} = \frac{1}{12}$

11. Ans. (B,D)

$(a_i - 1)^2 + (b_i - 1)^2 + (c_i - 1)^2 \le 0 \Rightarrow a_i = 1, b_i = 1, c_i = 1$

for $d_1 = d_2 = d_3$ infinite solutions and for $d_1 \ne d_2 \ne d_3$ no solution

12. Ans. (B)

$(a_i - b_i)^2 + (b_i - c_i)^2 + (c_i - a_i)^2 \le 0 \Rightarrow a_i = b_i = c_i$

$\therefore$ can never have unique solution

SECTION-IV

1. Ans. 1

Put ℓnx = t $\Rightarrow$ $I = \int_1^{2017} 1 + \frac{1-t}{t(t - \ell nt)}dt$

$\Rightarrow I = 2016 + \int_1^{2017-\ell n2017} -\frac{1}{u}du$

= 2016 – ℓn(2017 – ℓn(2017))

2. Ans. 4

(sin²x + cos²x)² – 2sin²xcos²x = sinx cosx

put sinx cosx = t

$\Rightarrow$ 1 – 2t² = t

$\Rightarrow$ t =–1; $t = \frac{1}{2}$

$\Rightarrow$ sin2x = –2(reject); sin2x = 1

$\Rightarrow\ 2x = 2n\pi + \frac{\pi}{2}$

$\Rightarrow x = (4n+1)\frac{\pi}{4}$

3. Ans. 3

$f(x) = 3^{\alpha x} + 3^{\beta x}$

$f'(x) = \alpha 3^{\alpha x}.\ell n3 + 3^{\beta x}.\beta\ell n3$

$f''(x) = \alpha^2.(\ell n3)^2 3^{\alpha x} + 3^{\beta x}.\beta^2(\ell n3)^2$

Put it in given condition and solve.

4. Ans. Bonus

$\because\ f(0) = 0,\ f(-e) = -f(e),\ g\left(\frac{5\pi}{6}\right) = -g\left(\frac{\pi}{6}\right)$

$h(-\pi) = -h(\pi)$, $h(0) = 0$ $\therefore$ determinant value is zero.

5. Ans.4

$$\lambda = \lim_{x\to 2}\frac{2\sin^2\left\{\frac{(x-1)(x-2)(x-3)}{2}\right\}}{\left\{\frac{(x-1)(x-2)(x-3)}{2}\right\}^2}\left\{\frac{(x-1)(x-3)}{2}\right\}^2$$

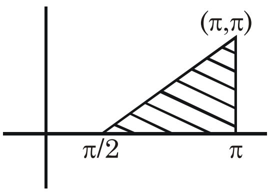
$$\lambda = \frac{1}{2} \Rightarrow 8\lambda = 4$$

6. Ans. 4

$$y = \left|\frac{\pi}{2} - \sin^{-1}(\sin x)\right| + \left|\frac{\pi}{2} - \cos^{-1}(\cos x)\right|$$

$$y = \left|\frac{\pi}{2} - (\pi - x)\right| + \left|\frac{\pi}{2} - x\right|$$

$$y = \left|x - \frac{\pi}{2}\right| + \left|\frac{\pi}{2} - x\right| = 2x - \pi\ \forall x \in \left[\frac{\pi}{2}, \pi\right]$$



Area $= \frac{1}{2}\left(\frac{\pi}{2}\right)\pi = \frac{\pi^2}{4}$

7. Ans. 6

(1,2) lies on y_1

$$2 = a + b + \frac{7}{2} \Rightarrow a + b = -\frac{3}{2} \qquad ...(1)$$

$$\left(\frac{dy_1}{dx}\right)_{(1,2)} = -\frac{1}{\left(\frac{dy}{dx}\right)_{(-2,2)}}$$

$$2a + b = -\frac{1}{2} \qquad ...(2)$$

from (1) & (2) a = 1 and $b = -\frac{5}{2}$

$a - 2b = 6$

8. Ans. 5

$$f(x) = \lim_{t\to x} -\frac{\sqrt{9 - f^2(t)}}{f'(t)}$$

$$f(x) = \frac{-\sqrt{a - f^2(x)}}{f'(x)}$$

$$\int -\frac{f(x)f'(x)}{\sqrt{9 - f^2(x)}}dx = \int +1dx$$

$\Rightarrow (x + 2)^2 + y^2 = 9 \Rightarrow f^2(0) = 5$