SECTION-I

1. Ans. (B)

2. Ans. (B)

Sol. For max. strain position of eye

$$M = \frac{f_o}{f_e}\left(1 + \frac{f_e}{D}\right)$$

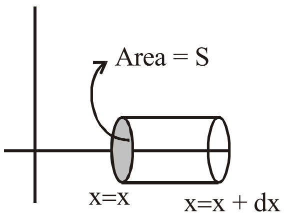
$$f_0 = \frac{R}{2} = \frac{120}{2} = 60 \text{ cm}$$

$$f_e = 1.25\text{cm}$$

$$M = 50.4$$

3. Ans. (D)

Sol.



$$E = -\frac{dv}{dx} = 3\alpha x^2$$

$$\phi_{in} = -(3\alpha x^2)s$$

$$\phi_{out} = \{3\alpha(x+dx)^2\}s = 3\alpha s(2xdx)$$

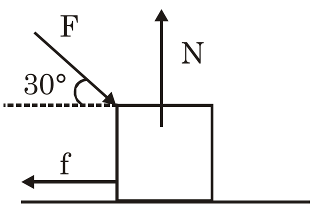
$$\phi_{net} = (6\alpha x)(sdx)$$

$$\phi_{net} = \frac{q}{\varepsilon_0} = (6\alpha x)(sdx)$$

$$\rho = \frac{q}{sd\alpha} = 6\alpha\varepsilon_0 x$$

4. Ans. (A)

Sol.



$\tan\theta = \mu$

$$\mu = \frac{1}{\sqrt{3}}$$

F sin 30 + mg = N

F cos 30 = μ (N)

F cos 30 = μ (F sin 30 + mg)

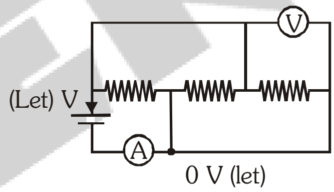
$$F\frac{\sqrt{3}}{2} = \frac{1}{\sqrt{3}}\left(\frac{F}{2} + 100\right)$$

$$F = 100 \text{ N}$$

5. Ans. (A)

Sol. From nodal analysis : $\frac{v-4}{1} + 3\left(\frac{v}{9}\right) = 0$

$\Rightarrow$ V=3 Volt (voltmeter reading)



Ammeter reading = $\left|\frac{v-4}{1}\right|$ = 1 Amp

6. Ans. (A)

Sol. bc is parallal to de

7. Ans. (B)

Sol. $|EMF| = \frac{\partial\phi}{\partial t_0} = av - 2at$

$$\text{Heat} = \int\frac{(EMF)^2 dt}{R} = \frac{1}{R}\int(av-2at)^2 dt$$

$$= \frac{1}{R}\left\{\int(av)^2 + 4a^2t^2 - 4a^2vt\right\}dt$$

$$= \frac{1}{R}\left(a^2v^2v + \frac{4}{3}a^2v^3 - \frac{4a^2v^3}{2}\right)$$

$$= \frac{a^2v^3}{R}\left(1 + \frac{4}{3} - 2\right) = \frac{a^2v^3}{3R}$$

8. Ans. (A)

Sol. time take by stone to reach floor $t = \frac{h}{u}$

To find the speed of Iron man we can use momentum conservation

$$Mv_1 = mu$$

$$v_1 = \frac{mu}{M}$$

distance of Iron man moved above platform is $y = \left(\frac{mu}{M}\right)\left(\frac{h}{u}\right) = \frac{mh}{M}$

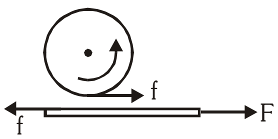
Total height $= h\left(1 + \frac{m}{M}\right)$

9. Ans. (D)

10. Ans. (A)

11. Ans. (B)

Sol.



$\Rightarrow$ The ball moves to the right and rotates anti clockwise.

12. Ans. (C)

Sol. Angle of incidence on lens-liquid interface.

$i = 53°$

Now critical angle by snell's law for condition

$1.5 \sin i = \mu \sin 90$

$$\sin i = \frac{\mu}{1.5}$$

$i = 53° \Rightarrow \frac{4}{5} = \frac{\mu}{1.5}$

$\mu = 1.2$

Now for all value of $\mu \le 1.2$

it will show "TIR"

13. Ans. (C)

Sol. In 1st case $q_\infty = C_1 \times 20$

In 2nd case $q_\infty = C_1 \times 20$

$\Rightarrow$ Ratio = 1 : 1

14. Ans. (A)

Sol. $mv = mv' + \frac{h}{\lambda}$

$$v' = v - \frac{h}{M\lambda} = v - \frac{hf}{Mc}$$

By energy cons.

$$En + \frac{1}{2}mv^2 = E_m + \frac{1}{2}mv'^2 + hf$$

$$hf = +\frac{1}{2}mv^2 + (E_n - E_m) - \frac{1}{2}Mv'^2$$

$$= \frac{1}{2}mv^2 - \frac{1}{2}m\left(v - \frac{h+}{mc}\right)^2 + hf_0$$

$$f_0 = f\left(1 - \frac{v}{c}\right)$$

15. Ans. (A)

Sol. $\phi = Li$

$$EMF = -\frac{d\phi}{dt} = -\frac{Ldi}{dt}$$

If $i = i_0 \sin(2\pi f_1 t)$

$$\frac{e_1}{e_2} = \frac{-L\left(\frac{di}{dt}\right)_{f=f_1}}{-L\left(\frac{di}{dt}\right)_{f=f_2}}$$

$$\frac{e_1}{e_2} = \frac{f_1}{f_2}$$

16. Ans. (B)

Sol. $t = \frac{\pi R}{v} = \frac{\pi(20)}{10(\pi)} = 2s$

So time of flight $\frac{2V\sin\theta}{g} = 2$

$Vy = 10$

Now $VxT = R$

$Vx\ (2) = 20\sqrt{3}$

$$\tan\theta = \frac{Vy}{V_x} = \frac{10}{10\sqrt{3}} = \frac{1}{\sqrt{3}}$$

$\theta = 30°$

17. Ans. (B)

18. Ans. (A)

Sol. AV = constant

$$P+\frac{1}{2}\rho v^2 = \text{constant}$$

If velocity increases then pressure decreases.

19. Ans. (B)

Sol. L = 60 dB = 10 log I/I_0

$I = 10^{-6}$ w/m^2

Power = (I) Area = (10^{-6}) (4p × 500^2)

= 3.14 watt

$$t=\frac{w}{p}=\frac{(10^3)(0.30)}{3.14}=95.5\text{s}$$

20. Ans. (A)

Sol. $$W=\int PdV=\int\frac{nRT}{(V-b)}dV$$

$$=nRT\ln(V-b)\Big|_v^{2v}$$

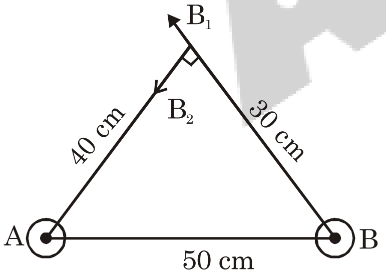
$$W=nRT\ln\left(\frac{2V-b}{V-b}\right)$$

SECTION-II

1. Ans. 5.00

2. Ans. 14.14

Sol.



$$B_1=\frac{\mu_0 i}{2\pi r_1}$$

$$=\frac{(2\times10^{-7})(20)}{(0.4)}=10^{-5}T$$

$$B_2=\frac{\mu_0 i}{2\pi r_2}=\frac{(2\times10^{-7})(15)}{0.30}=10^{-5}T$$

$$B_{net}=\sqrt{B_1^2+B_2^2}=\sqrt{2}\times10^{-5}=14.14$$

3. Ans. 16.19

Sol. $$\Delta s=\int\frac{dQ}{T}$$

$$\int_{136.5}^{273}\frac{M_{ice}\ s_{ice}\ dT}{T}+\left(\frac{\int dQ}{T}\right)\text{phase change}$$

$$=M_{ice}S_{ice}\int\frac{dT}{T}+\frac{mL}{T}$$

$$=(27.3)\ (0.5)\ \ln\left(\frac{273}{136.5}\right)+\frac{(27.3)(80)}{(273)}$$

ΔS = 16.19 cal/gm

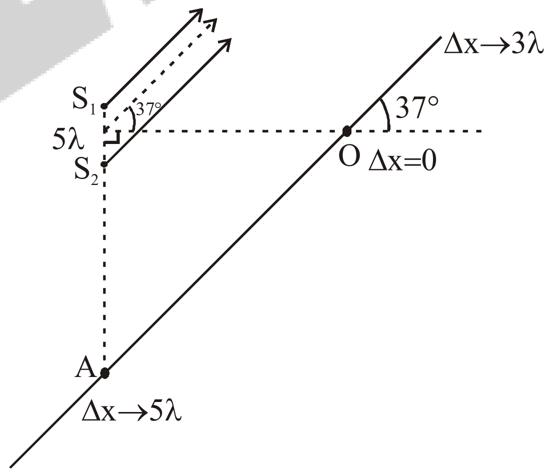
4. Ans. 6.00

Sol. Mg = mg + B

$$Mg = mg + p_2\times\frac{M}{p_1}g$$

$$M\left(1-\frac{p_2}{p_1}\right)=m=6\text{ kg}$$

5. Ans. 8.00



At A, $\Delta x = 5\lambda$

At O, $\Delta x = O$

At ∞ distance

$\Delta x = 5\lambda\sin 37°$

= 3λ

$\therefore$ No. of minima between A and O = 5

No. of minima beyond point O = 3

$\therefore$ Total no. of minima = 8

PART–2 : CHEMISTRY SOLUTION

SECTION - I

1. Ans.(C)

Initial pressure of water vapour P_1 = 0.2 x.75 = 0.15 atm

$P_1V_1 = P_2V_2$

0.15 x 30 = 0.2xV

V = 22.5 litre

2. Ans.(A)

CH_3CHCl – (–I), $CH_3 - CH_2$ – (+I),

Acidic strength $\propto (-I)$ and $\frac{1}{+I}$

(i) $CH_3CHClCOOH$>(iv) HCOOH>(iii) CH_3CH_2COOH>(ii) CH_3CH_2OH

3. Ans.(D) Factual

Sc < Y < La Atomic radii

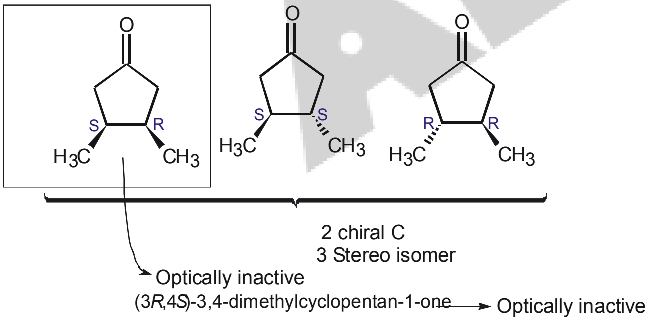
4. Ans.(A)

$$4\pi r^2\psi^2$$

$$4\pi r^2 \frac{Z^3}{\pi a_0^3} . e^{(-2zr/a_0)}$$

above function has a maxima at (a_0/z) and zero at infinite,so it follows 1st graph.

5. Ans.(D)



6. Ans.(D)

A $\rightarrow (NH_4)_2CO_3$

B $\rightarrow NH_4HCO_3$

C $\rightarrow NH_4Cl$

D $\rightarrow NaHCO_3$

7. Ans.(A)

$$CaF_2(s) \rightleftharpoons Ca^{+2}(aq) + 2F^-(aq)$$

$$K_{sp} = 6.0 \times 10^{-9}$$

$$K_{sp} = [Ca^{+2}]\,[F^-]^2$$

Given

$$[Ca^{+2}] = \frac{120}{10^3 L} x \frac{1}{40} = 3x10^{-3} mol/L$$

$$[F^-]^2 = \frac{6.0 \times 10^{-9}}{3x10^{-3}}$$

$$[F^-] = 1.414 \times 10^{-3} \text{ mol/L}$$

$$[F^-] = 1.414 \times 10^{-3} \times 19 \times 10^3$$

$$[F^-] = 26.84 \text{ ppm}$$

8. Ans.(C)

E_2 reaction

9. Ans.(C)

(ii) $Cu^+_{(aq)} \longrightarrow Cu^{+2}_{(aq)} + Cu_{(s)}$

(iii) $2Cr^{+2}_{(aq)} + 2H^+ \longrightarrow 2Cr^{+3}_{(aq)} + H_{2(g)} \uparrow$

(v) Zn, Cd, Hg are not consider as transition elements.

10. Ans.(C)

Based on law of thermodynamics

$$W = -nRT\ln\frac{V_2}{V_1} \quad -\left(\frac{W}{nR}\right) = T\ln\left(\frac{V_2}{V_1}\right)$$

11. Ans.(D)

It is aldol reaction and form product from alpha hydrogen and produce

$C_6H_5CH = C(CH_3)CHO$.

12. Ans.(B)

due to removal of e^- from A.B.M.O (anti bonding molecular orbital)

13. Ans.(C)

For octahedral structure = $\frac{R^+}{R^-} = 0.414$

$R^+ = 0.414 \times R^-$

$= 0.414 \times 500$

$R^+ = 207$ pm

14. Ans.(D) Factual

15. Ans.(C)

At 1200K C will reduce MO into $M_{(l)}$

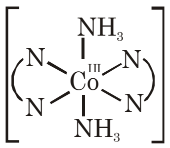
16. Ans.(D)

$(\Delta G)_{T,P} < 0$ for a spontaneous process

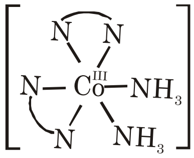
17. Ans.(A)

Ranitidine is only antacid drug while NaOH is not drug.

18. Ans.(C)



trans optically inactive



Cis (Optically active)

$Co^{+3} \rightarrow [Ar],\ 3d^6$

Hybridisation d^2sp^3 in presence of strong field ligand.

Total 15 N–Co–N bond angles

19. Ans.(A)

For 1st order Rxn.

$$k = \frac{\ln 2}{t_{1/2}} = \frac{0.7}{28 \times 60} = \frac{1}{40 \times 60} = \frac{1}{2400}$$

$$\log\left(\frac{1}{2400}\right) = 15 - \frac{9.19 \times 10^3}{T}$$

$$-2 - 1.38 = 15 - \frac{9.19 \times 10^3}{T}$$

$$\frac{9.19 \times 10^3}{T} = 18.38$$

$$T = \frac{10^3}{2} = 500K$$

20. Ans.(B)

a,c are aromatic

SECTION-II

1. Ans.(1.66 or 1.67)

$Ma_2b_2c_2$: 5 GI

$M(AA)b_2c_2$: 3 GI

2. Ans.(0.21)

$$AgCl(s) \rightleftharpoons Ag^+(aq) + Cl^-(aq).$$

$$ksp = [Ag^+]\ [Cl^-]$$

$$[Ag^+] = \frac{ksp}{[Cl^-]} = \frac{10^{-10}}{1} = 10^{-10}$$

$$Ag^+ + e^- \longrightarrow Ag(s)$$

$$E = E^\circ_{Cell} - \frac{0.059}{1}\log\frac{1}{10^{-10}}$$

$$E = 0.80 - 0.59$$

$$E = 0.21\ V$$

3. Ans.(1.00)

$$CH_3CH_2COONa \xrightarrow[\Delta]{NaOH\ \&\ CaO} CH_3CH_3 + Na_2CO_3$$

4. Ans.(3.00)

Atomic number: 58, 64, 71

5. Ans.(350.00)

Sol. $\left(200 = \frac{P_i}{4} + \frac{P_P \times 3}{4}\right)$ ....(1)

$\left(300 = \frac{3P_i}{4} + \frac{P_P}{4}\right) \times 3$ ....(2)

$$700 = \frac{9}{4}P_i - \frac{P_i}{4} = 2P_i$$

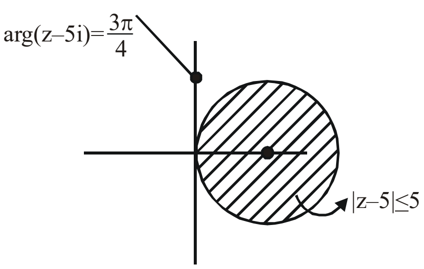
$$P_i = \frac{700}{2} = 350 \text{ mm of Hg.}$$

PART-3 : MATHEMATICS SOLUTION

SECTION-I

1. Ans. (A)

Sol.



So number of common solution of both the equations is 0.

2. Ans. (A)

Sol. Angle bisectors are

$$\frac{3x - 4y + 1}{5} = \pm\frac{(3x + 4y - 7)}{5}$$

$\Rightarrow$ y = 1 or x = 1

3. Ans. (B)

Sol. $S = {}^{25}C_{13} + {}^{25}C_{14} + ... + {}^{25}C_{25}$

$\Rightarrow S = {}^{25}C_{12} + {}^{25}C_{11} + ... + {}^{25}C_0\ (\because {}^nC_r = {}^nC_{n-r})$

$\Rightarrow 2S = {}^{25}C_0 + {}^{25}C_1 + ... + {}^{25}C_{25} = 2^{25}$

$\Rightarrow S = 2^{24}$

4. Ans. (D)

Sol. $f(x)=\begin{cases}(x+1)2^{-\frac{2}{x}} & , \quad x>0\\ 0 & , \quad x=0\\ x+1 & , \quad x<0\end{cases}$

RHL $=\lim\limits_{x\to 0^+}(x+1)2^{\frac{-2}{x}}=0$

LHL $=\lim\limits_{x\to 0^-}(x+1)=1$

$\Rightarrow \lim\limits_{x\to 0^+}f(x)\neq \lim\limits_{x\to 0^-}f(x)$

5. Ans. (C)

Sol. A : Sum on the dice equal to 10

B : One die shows '6'

Sum of 10 is possible

When 6, 1, 3

6, 2, 2

5, 1, 4

5, 2, 3

4, 2, 4

4, 3, 3

so n(A) = 6

Also, $n(A \cap B) = 2$

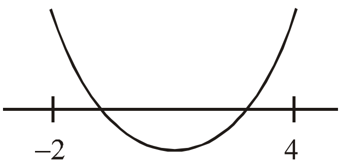
Hence, $P\left(\frac{B}{A}\right)=\frac{n(A\cap B)}{n(A)}=\frac{2}{6}=\frac{1}{3}$

6. Ans. (A)

Sol. $f'(x)=3x^2-3\alpha(2x)+3(\alpha^2-1)=3x^2-6\alpha x+3(\alpha^2-1)$

since, extrema lie in (–2, 4)

so roots of $f'(x)$ lie in (–2, 4)



$f'(x) = 3(x-(\alpha-1))(x-(\alpha+1))$

$\Rightarrow -2 < \alpha - 1$ and $\alpha + 1 < 4$

$\Rightarrow -1 < \alpha < 3$

Second method

$f'(-2)>0$

$\Rightarrow 12 + 12\alpha + 3\alpha^2 - 3 > 0$

$\Rightarrow 3\alpha^2 + 12\alpha + 9 > 0$

$\Rightarrow \alpha^2 + 4\alpha + 3 > 0,$

$\Rightarrow (\alpha + 1)(\alpha + 3) > 0$

$\Rightarrow \alpha \in (-\infty, -3) \cup (-1, \infty)$ ..... (1)

Also, $f'(4) > 0$

$\Rightarrow 48 - 24\alpha + 3\alpha^2 - 3 > 0$

$\Rightarrow 3\alpha^2 - 24\alpha + 45 > 0$

$\Rightarrow \alpha^2 - 8\alpha + 15 > 0$

$\Rightarrow (\alpha - 5)(\alpha - 3) > 0 \Rightarrow \alpha \in (-\infty,3)\cup(5,\infty)$ ...... (2)

And, $D \geq 0$

$\Rightarrow 36\alpha^2 - 4\cdot 3\cdot 3(\alpha^2 - 1) \geq 0$

$\Rightarrow \alpha^2 - \alpha^2 + 1 \geq 0$ (this is always true)

Also $-2<\frac{6\alpha}{2\cdot 3}<4 \Rightarrow \alpha\in(-2,4)$ ....(3)

Taking intersetion of (1), (2), (3) $\alpha \in (-1, 3)$

7. Ans. (B)

Sol.

P	Q	$P\to Q$	R	$(P\to Q)\Leftrightarrow R$
T	F	F	F	T
T	F	F	T	F
F	F	T	T	T
F	T	T	T	T

8. Ans. (D)

Sol. $3A + 2B = A^T$ .... (1)

$2A + 2B = A^T - A$

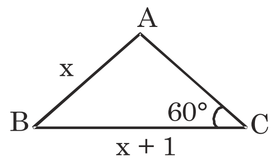
$\because A^T - A$ is skew symmetric matrix

$\therefore |2A + 2B| = 0$

$\Rightarrow |A + B| = 0$

9. Ans. (B)

Sol.



Let AC = y

$\cos 60^\circ=\frac{(x+1)^2-x^2+y^2}{2(x+1)y}$

$\Rightarrow (x + 1)y = 2x + 1 + y^2$

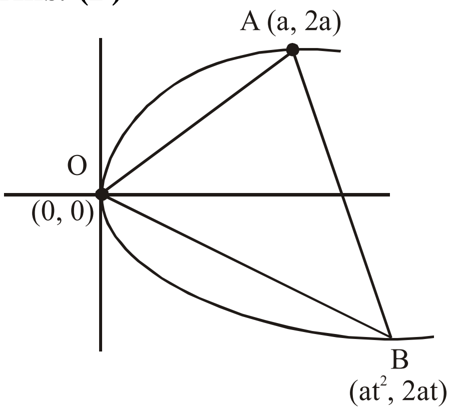
$\Rightarrow y^2 - (x + 1)y + (2x + 1) = 0$

Now, $D \geq 0$

$\Rightarrow (x + 1)^2 - 4(2x + 1) \geq 0 \Rightarrow x \geq 3+\sqrt{12}$

10. Ans. (B)

Sol.



For isosceles triangle

$OB^2 = AB^2$

$\Rightarrow (at^2)^2 + (2at)^2 = (at^2 - a)^2 + (2at - 2a)^2$

$\Rightarrow t^4 + 4t^2 = t^4 + 1 - 2t^2 + 4t^2 + 4 - 8t$

$\Rightarrow 2t^2 + 8t - 5 = 0$

11. Ans. (C)

Sol. $\sigma^2 = \dfrac{\sum_{i=1}^{n} x_i^2}{n} - \left(\dfrac{\sum_{i=1}^{n} x_i}{n}\right)^2$

$\Rightarrow 25 = \dfrac{260}{n} - \dfrac{100}{n^2}$

$\Rightarrow 25n^2 - 260n + 100 = 0 \Rightarrow n = \dfrac{2}{5}, 10$

12. Ans. (C)

Sol. put tan x = t

$$I = \int \frac{(1+t^2)(1+t^2)^2}{t^4}\frac{dt}{1+t^2}$$

$$I = \int \frac{(1+t^2)^2}{t^4}dt = \int \frac{1+t^4+2t^2}{t^4}dt = \int\left(\frac{1}{t^4}+1+\frac{2}{t^2}\right)dt$$

$$= \frac{1}{-3t^3} + t + \frac{2}{-t} + c$$

$$I = \frac{1}{-3\tan^3 x} + \tan x - \frac{2}{\tan x} + c$$

So $f(x) = \dfrac{1}{-3\tan^3 x} + \tan x - \dfrac{2}{\tan x}$

$$\Rightarrow f\left(\frac{\pi}{4}\right) = -\frac{1}{3} + 1 - 2 = -\frac{4}{3}$$

13. Ans. (B)

Sol. Since, $T_r = \tan^{-1}\left(\dfrac{(r+1)^2 - r^2}{1 + ((r+1)r)^2}\right)$

Hence, $S_n = \tan^{-1}(n^2) - \tan^{-1}(0) \Rightarrow S_\infty = \dfrac{\pi}{2}$

14. Ans. (C)

Sol. $|\bar{a}+\bar{b}|^2 = |a|^2 + |b|^2 + 2\bar{a}\,\bar{b} = 1 + 1 + 2\cos\theta$

$\Rightarrow |\bar{a}+\bar{b}|^2 = 2 \cdot 2\cos^2\dfrac{\theta}{2}$

$\Rightarrow |\bar{a}+\bar{b}| = 2\cos\dfrac{\theta}{2}$

Also, $|\bar{a}-\bar{b}| = 2\sin\dfrac{\theta}{2}$

So, $S = \dfrac{3}{2}\left(2\cos\dfrac{\theta}{2}\right) + 2\left(2\sin\dfrac{\theta}{2}\right)$

$= 3\cos\dfrac{\theta}{2} + 4\sin\dfrac{\theta}{2} \in [3,5]$ as $\dfrac{\theta}{2} \in \left[0, \dfrac{\pi}{2}\right]$

15. Ans. (D)

Sol. Number of onto function from A to B

$= 3^6 - {}^3C_1 2^6 + {}^3C_2 1 = 729 - 192 + 3$

16. Ans. (C)

Sol. $\sec x + \tan x = \dfrac{1}{3}$ .... (1)

$\sec x - \tan x = 3$ .... (2)

(1) – (2) :-

$2\tan x = -\dfrac{8}{3} \Rightarrow \tan x = -\dfrac{4}{3}$

$\Rightarrow$ x lies in IVth quadrant

(in IInd quadrant secx, tanx < 0)

17. Ans. (D)

Sol. $e^x(y + y') = 1$

Integrating :-

$ye^x = x + c \Rightarrow y = (x + c)e^{-x}$

18. Ans. (C)

Length of tangent $= \sqrt{s_1} = \sqrt{100 - r^2}$

Area $= \dfrac{1}{2}s_1 \sin 2\theta$

Now $\tan\theta = \dfrac{r}{\sqrt{s_1}}$

$$\sin 2\theta = \frac{2\dfrac{r}{\sqrt{s_1}}}{1 + \dfrac{r^2}{s_1}} = \frac{2r\sqrt{s_1}}{s_1 + r^2}$$

$$A = \frac{1}{2}(100 - r^2)\cdot\frac{2r\sqrt{100-r^2}}{100 - r^2 + r^2} = \frac{1}{100}\left[r\left(100-r^2\right)^{\frac{3}{2}}\right]$$

$$\frac{dA}{dr} = \frac{1}{100}\left[r\cdot\frac{3}{2}(100-r^2)^{\frac{1}{2}}(-2r) + (100-r^2)^{\frac{3}{2}}\cdot 1\right]$$

For critical point

$$\frac{dA}{dr} = 0 \Rightarrow 3r^2\sqrt{100-r^2} = (100-r^2)^{\frac{3}{2}}$$

$\Rightarrow 3r^2 = 100 - r^2$

$\Rightarrow 4r^2 = 100$

$\Rightarrow r^2 = 25$

$\Rightarrow r = 5$

at this 'r' the area is maximum

19. Ans. (C)

Sol. Let $f(x) = \pi(x-2)(x-3) + e(x-3)(x-4) - 1$

Now $f(2) = 2e - 1 > 0$

$f(3) = -1 < 0$

$f(4) = 2\pi - 1 > 0$

So, f(x) has two distinct real roots one in (2, 3) and other in (3,4).

20. Ans. (B)

$$I = \int_0^{2\pi}[\sin x]dx$$

$$\Rightarrow I = \int_0^{2\pi}[-\sin x]dx$$

$$\Rightarrow 2I = \int_0^{2\pi}(-1)dx \Rightarrow I = -\pi$$

SECTION-II

1. Ans. 4.00

The value of n is the least degree of numerator

$$Nr. = (\cos x - 1)(\cos x - e^x) - \frac{x^3}{2}$$

(expanding this)

$$= \left(1 - \frac{x^2}{2} + \frac{x^4}{24}\ldots - 1\right)\left(\left(1 - \frac{x^2}{2} + \frac{x^4}{24}\ldots\right) - \left(1 + x + \frac{x^2}{2} + \frac{x^3}{6}\ldots\right)\right) - \frac{x^3}{2}$$

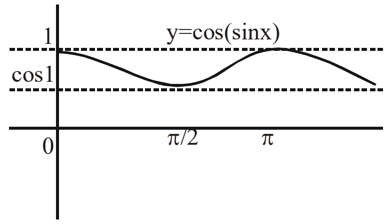
$$= \left(-\frac{x^2}{2} + \frac{x^4}{24}\ldots\right)\left(-x - x^2 - \frac{x^3}{6} - \frac{x^5}{120}\ldots\right) - \frac{x^3}{2}$$

$$= \frac{x^3}{2} - \frac{x^5}{24}\ldots + \frac{x^4}{2} - \frac{x^6}{24}\ldots - \frac{x^3}{2}$$

So, minimum degree of numerator is 4

So, the value of n is 4.

2. Ans. 2.00



3. Ans. –16.25

Normal at $\left(ct, \frac{c}{t}\right)$ intersect the curve again $\left(ct', \frac{c}{t'}\right)$ then $t't^3 = -1$.

$$\Rightarrow (x', y') = \left(-\frac{1}{4}, -16\right)$$

4. Ans. 3.00

$$\theta + (60 - \theta) = \sqrt{3}$$

$$\Rightarrow \frac{\tan\theta + \tan(60-\theta)}{1 - \tan\theta\tan(60-\theta)} = \sqrt{3}$$

$$\Rightarrow \tan\theta + \tan 60 - \theta = \sqrt{3} - \sqrt{3}\tan\theta\tan(60-\theta)$$

$$\Rightarrow \tan\theta + \tan(60-\theta) + \sqrt{3}\tan\theta\tan(60-\theta) = \sqrt{3}$$

$$\Rightarrow \tan\theta + \sqrt{3}\tan^2\theta + \tan(60-\theta)(1+\sqrt{3}\tan\theta) = \sqrt{3}\sec^2\theta$$

$$\Rightarrow (1+\sqrt{3}\tan\theta)(\tan\theta + \tan(60-\theta)) = \sqrt{3}\sec^2\theta$$

$$\Rightarrow \frac{(1+\sqrt{3}\tan\theta)(\tan\theta + \tan(60-\theta))}{(1+\tan^2\theta)} = \sqrt{3}$$

Now, put θ = 1° and θ = 2°

$$\frac{(1+\sqrt{3}\tan 1°)(1+\sqrt{3}\tan 2°)(\tan 10° + \tan 59°)(\tan 2° + \tan 54°)}{(1+\tan^2 1°)(1+\tan^2 2°)} = \sqrt{3}\cdot\sqrt{3}$$

$= 3$

5. Ans. 999.87 or 999.88

$$\sum_{r=1}^{19}\frac{3(r+1)r+1}{(r+1)(r^5+2r^4+r^3)} = \sum_{r=1}^{19}\frac{1}{r^3} - \frac{1}{(r+1)^3}$$

$$T_r = \frac{1}{r^3} - \frac{1}{(r+1)^3}$$

$$S = 1 - \frac{1}{20^3} = \frac{8000-1}{8000} = \frac{7999}{8000}$$

$$1000K = \frac{7999}{8} = 999.875$$