1. (d) By energy conservation

$U_i + K_i = U_f + K_f$

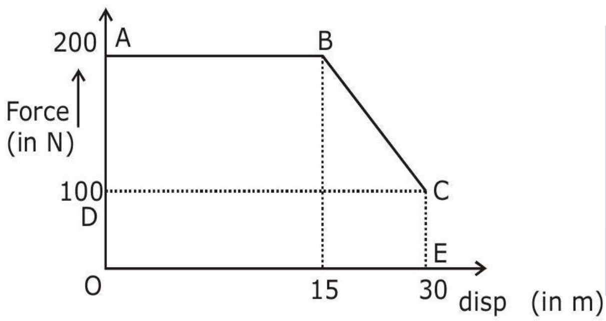
$-MB\cos 60^\circ + 0 = -MB\cos 0^\circ + \frac{1}{2}I\omega^2$

$-\frac{MB}{2} + MB = \frac{1}{2}I\omega^2$

$\frac{MB}{2} = \frac{1}{2}I\omega^2$

$\omega = \sqrt{\frac{MB}{I}} = \sqrt{\frac{20 \times 4}{0.8}} = \sqrt{100} = 10\text{rad/s}$

2. (b)



Work done = area of ABCEO

= area of trap. $ABCD$ + area of rect. ODCE

$= \frac{1}{2} \times 45 \times 30 + 100 \times 30 = 5250\text{ J}$

3. (c)

adiabatic, $\Delta Q = 0$

Isothermal, $\Delta U = 0$

Isochoric, $\int pdV = 0$

$\Delta W = 0$

Isobaric, $\Delta Q \neq 0, \Delta U \neq 0, \Delta W \neq 0$

4. (b) Freq received by wall,

$f_w = \left(\frac{330}{330 - v}\right) f_0$

freq. after reflection, $f' = \left(\frac{330+v}{330}\right) f_w$

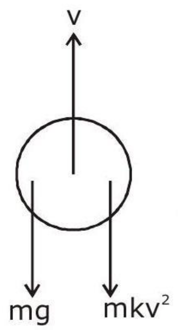
$= \left(\frac{330 + v}{330}\right) \times \left(\frac{330}{330 - v}\right) f_0$

$$490 = \left(\frac{330 + v}{330 - v}\right) 420$$

$\therefore v = 25.2\ m/s$

$= 91\ km/h$

5. (b)



at H_m, $V = 0$

$$F_{net} = ma$$

$$-mg - mKvv^2 = mv\frac{dv}{ds}$$

$$\int_{S=0}^{H} ds = (-1)\int_{v=u}^{v=0} \frac{vdv}{g + kv}$$

$$\int \frac{xdx}{a + bx^2}$$

$$H_{max} = \frac{1}{2\ K}\ln\left(\frac{g + ku^2}{g}\right)$$

$$H_m = \frac{1}{2\ K}\ln\left(1 + \frac{Ku^2}{g}\right)$$

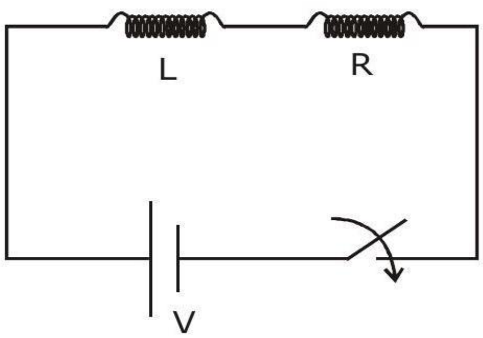
6. (b) Moment of inertia of disc, $I = \frac{MR^2}{2} = \frac{[\rho(\pi R^2)t]R^2}{2}$

$I = KR^4$

$$\frac{I_1}{I_2} = \left(\frac{R_1}{R_2}\right)^4$$

$$\frac{1}{16} = \left(\frac{R}{\alpha R}\right)^4 \Rightarrow \alpha = (16)^{\frac{1}{4}} = 2$$

7. (b)



P.E. in inductor, $U = \frac{1}{2}LI^2$

$U \propto I^2$

$$\frac{U}{U_0} = \left(\frac{I}{I_0}\right)^2$$

$$\frac{1}{n} = \left(\frac{I}{I_0}\right)^2$$

$$I = \frac{I_0}{\sqrt{n}}$$

$$I = I_0\left(1 - e^{-\frac{R}{L}}\right)$$

$$\frac{I_0}{\sqrt{n}} = I_0\left(1 - e^{-\frac{R}{L}t}\right)$$

taking ℓ n & solving we get,

$$t = \frac{L}{R}\ln\left(\frac{\sqrt{n}}{\sqrt{n} - 1}\right)$$

8. **(d)** $\vec{E} \times \vec{B}$ should be in direction of $\vec{v}$

$$\therefore \vec{B} = \frac{E_0}{C}(-\hat{x} + \hat{y})\sin(Kz - \omega t)$$

9. **(c)** $(-)\frac{\Delta P}{\Delta V/v} = B$

$$\Delta P = \left(\frac{\Delta V}{V}\right) \cdot B$$

$$= \frac{3\Delta L}{L} \times B$$

$\therefore \frac{\Delta L}{L} = \frac{\Delta P}{3\,B}$ $\therefore$ % we get, $\frac{\Delta L}{L} \times 100\%$

Putting values we get $= 1.67$

10. **(c)** $M = \frac{CB_{ext}}{T}$

$$6 = \frac{C \times 0.4}{4}$$

$\Rightarrow C = 60$

$\therefore$ case - II :- $M = \frac{60\times0.3}{24} = \frac{60\times3}{240} = \frac{3}{4} = 0.75\ A/m$

11. (d)

$$V_0 = \sqrt{\frac{GM}{r}}, V_e = \sqrt{\frac{2GM}{r}}$$
$$\frac{v_0}{v_e} = \sqrt{\frac{GM}{r} \times \frac{r}{2GM}} = \frac{1}{\sqrt{2}}$$

12. (c)

$$W = \Delta KE$$
$$\int_0^x Fdx = 0$$
$$\int_0^x qEdx = 0$$

$$q\int_0^x E_0(1 - ax^2)dx = 0$$
$$qE_0\left[\int_0^x dx - a\int_0^x x^2dx\right] = 0$$
$$qE_0\left[x - \frac{ax^3}{3}\right] = 0$$
$$x\left(1 - \frac{ax^2}{3}\right) = 0$$
$$x = 0, 1 - \frac{ax^2}{3} = 0$$
$$\frac{ax^2}{3} = 1$$
$$x = \sqrt{\frac{3}{a}}$$

13. (d)

14. (d) B.E. $= \Delta mc^2$

$= \Delta m \times 931$

$\Delta m = (50 \times 1.00783) + (70 \times 1.00867) - \{119.902199\}$

$= \{120.9984 - 119.902199\}U$

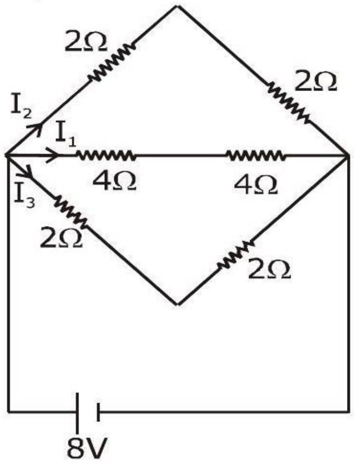
$= 1.1238U$

$BE = 1.1238 \times 931 = 1046.2578MeV$

BE per nucleon $\sim 1046/120 \approx 8.5\text{Mev}$

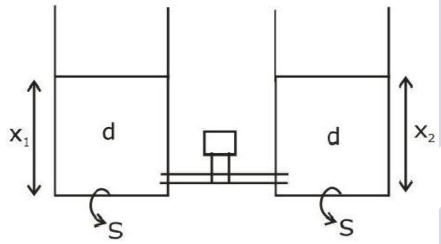
15. (d)

eq circuit $\Rightarrow$



$$I_2 = \frac{8}{4+4} = 1\text{amp}$$

16. (c)



$$u_i = \left[dsx_1 \cdot \frac{x_1}{2} + dsx_2 \cdot \frac{x_2}{2}\right] g \ \left\{dsx_1 \to m, \frac{x_1}{2} \to h(\text{ com })\right\}$$

$$u_f = \left[ds\left(\frac{x_1 + x_2}{2}\right) \times \left(\frac{x_1 + x_2}{4}\right) \times 2\right] g$$

$$u_i - u_f = dsg\left[\frac{x_1^2}{2} + \frac{x_2^2}{2} - \frac{(x_1 + x_2)^2}{4}\right]$$

$$= dsg \frac{(x_1 - x_2)^2}{4}$$

17. (b) $[x] = \frac{IFV}{WL^4} = \frac{(M^1 L^2)(MLT^{-2})(LT^{-2})^2}{(ML^2 T^{-2})L^4}$

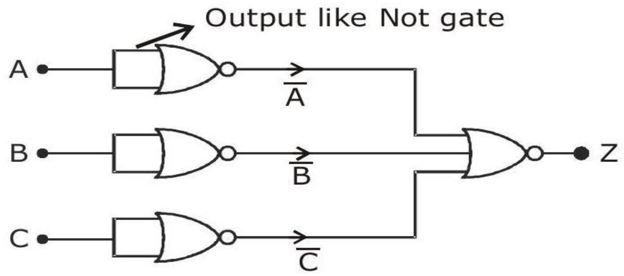
$= ML^{-1} T^{-2} = \text{Energy density}$

18. (c) $I_0 = \frac{M}{12}(a^2 + b^2)$

$$I_{0'} = \frac{M}{12}(a^2 + b^2) + M\left(\frac{a^2}{4} + \frac{b^2}{4}\right)$$

$$\frac{I_0}{I_{0'}} = \frac{\frac{M}{12}(a^2+b^2)}{\frac{M}{12}(a^2+b^2)+\frac{M}{4}(a^2+b^2)} = \frac{\frac{1}{12}}{\frac{1}{12}+\frac{1}{4}} = \frac{1}{12}\times\frac{3}{1} = \frac{1}{4}$$

19. (c)



$Z = \overline{A} + \overline{B} + \overline{C} = A.B.C$ (AND gate)

20. (d) $ev = h\nu - w(w = \text{work function})$

$$v = \frac{hu}{e} - \frac{w}{e}$$

as $\frac{h}{e}$ & $\frac{w}{e} \rightarrow$ constant

Therefore no change in graph.

21. (20) Distence = Area under speed - time graph

$$= \frac{1}{2}\times 8\times 5 = 20\text{ m}$$

22. (2)
23. (150)

1st case

$PV = nRT$

$PdV + VdP = 0$

$$P\Delta V + V\Delta P = 0 \Delta v = \frac{-\Delta P}{P}v$$

2nd case

$P\Delta V = -nR\Delta T$

$$\Delta V = -\frac{nR\Delta T}{P}$$

$$-\frac{\Delta P}{P}V = \frac{-nR\Delta T}{P} \Rightarrow \Delta T = \Delta P\frac{v}{nQ}$$

$$\Rightarrow \frac{\Delta T}{\Delta P} = \frac{V}{nR}$$

Now, given $|\Delta T| = C|\Delta P|$

$$C = \frac{\Delta T}{\Delta P} = \frac{V}{nR}$$

$$C = \frac{T}{P} = \frac{300}{2} = 150$$

24. (200)

For minima

$d\sin\theta = n\lambda$

or $\sin\theta = \frac{n\lambda}{d}$

$\because$ maximum value of $\sin\theta$ is 1

$$\therefore \frac{n\lambda}{d} \leq \perp$$

$$n \leq \frac{d}{\lambda}$$

$$n \leq \frac{0.6 \times 10^{-4}}{6000 \times 10^{-10}}$$

$n \leq 100$

for both sides $100 + 100 = 200$

25. (5)

$$\because f = \frac{D^2 - d^2}{4D} = \frac{100^2 - 40^2}{400}$$
$$= \frac{10000 - 1600}{400}$$
$$= \frac{100 - 16}{4} = \frac{84}{4} = 21$$
$$p = \frac{1}{f} = \frac{1}{21} = \frac{1}{21} \times \frac{100}{100} = \left(\frac{4.76}{100}\right) = \frac{N}{100}$$
$$\therefore N \approx 5$$

26. (b) 1 $H_2SO_4 + NaCl \xrightarrow{420k} NaHSO_4 + HCl$

Sp^3

2 $XeF_4 + SbF_5 \longrightarrow (XeF_3)(SbF_6)^-$

$Sp^3\ d^2\ Sp^3\ d$

3 $NH_3 \xrightarrow{H^+} NH_4^+$

$Sp^3\ Sp^3$

$4\,H_3PO_2 \xrightarrow[\text{Reaction}]{\text{Disproportionation}} PH_3 + H_3PO_4$

Sp^3 Sp^3 Sp^3

27. (a) $H_{(g)} + e^{\ominus} \longrightarrow H^{\ominus}_{(g)}$

is an exothermic Rxn.

28. (a)

$A \rightleftharpoons B + C \; K_{eq}{}^{(1)}$

$\underline{B + C \rightleftharpoons P}$

$A \rightleftharpoons P$

$K_{eq}{}^{(2)}$

$K_{eq} = K_{eq}{}^{(1)} \times K_{eq}{}^{(2)}$

Ans.(1)

29. (d) Surface theoritical egg white

30. (b)

(1) $(Ti(NH_3)_6)^{3+} \Rightarrow Ti^{3+}(3\,d^1) \Rightarrow \mu = \sqrt{3}$

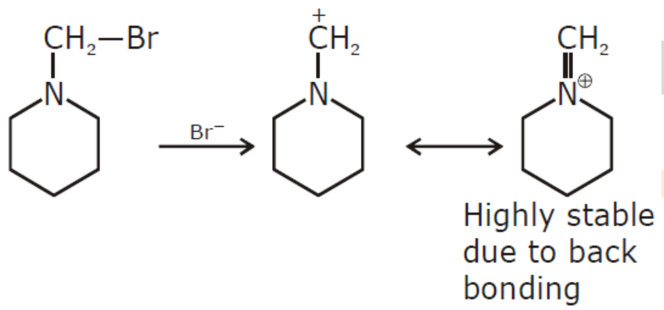
(2) $[Co(OX_2)(OH_2)^{-}(\Delta_0 > P) \Rightarrow Co^{+5}(3\,d^4) \Rightarrow t_2\,g^4eg^0\; n = 2, \mu = \sqrt{8}$

(3) $(Pd(gly)_2) \Rightarrow pd^{2+}(4\,d^8) \rightarrow$ Square planar $n = 0, \mu = 0$ diamagentic

(4) (Fe (en) (bpy) $(NH_3)_2)^{2+}$

$Fe^{2+} \Rightarrow 3\,d^6(t_2\,g^6eg^0) \Rightarrow n = 0, \mu = 0$

31. (b) rate of reaction α stability of carbocation.



32. (a) As it is free expansion against zero ext. pressure

$\therefore$ Work Done = zero

33. (a) Amount of charge transfered $= \frac{1\times15\times60}{96500} = \frac{9}{965} \simeq 10 \times 10^{-3}$

moles of gold deposited $= \frac{0.1\times250}{1000} = 25 \times 10^{-3}$

Both wil be deposited

34. (d) The mechanism of action of "Terfenadine" (Seldane) is to inhibit the action of histamine receptor.

35. (a)

$$\frac{1}{\lambda_1} = R_4 \times (1)^2 \times \left\{1 \times \frac{1}{x^2}\right\} = R_H$$

$$\frac{1}{\lambda_2} = R_4 \times (2)^2 \times \left\{\frac{1}{4} - \frac{1}{a}\right\} = R_H \left\{\frac{5}{9}\right\}$$

$$\frac{\lambda_2}{\lambda_1} = \frac{9}{5}$$

$$\lambda_2 = \frac{9}{5}\lambda_1$$

36. (b)

37. (a)

38. (d)

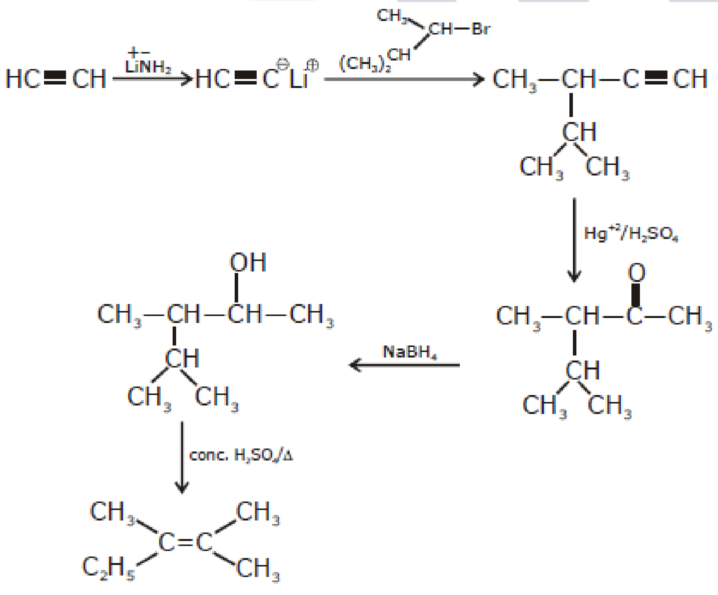
$[CoF_3(H_2O)_3](\Delta_0 < P)$

$CO^3 + (3\ d^3) = t_2\ g^4 eg^2$

$$\begin{aligned} \text{CFSE } &= \left(-\frac{2}{5} \times 4 + \frac{3}{5} \times 2\right)\Delta_0 \\ &= -0.4\Delta_0 \end{aligned}$$

39. (d)

40. (b)



(R)

41. (d)

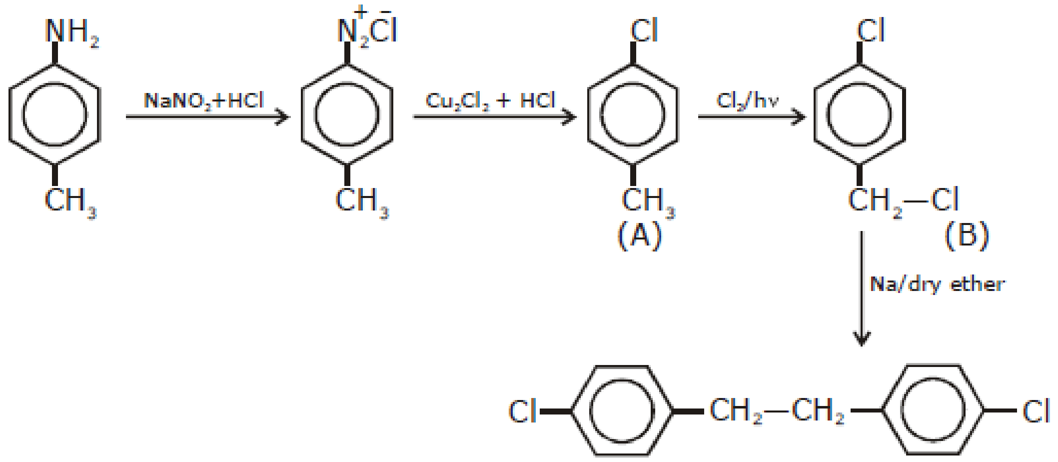
(a) $(CrF_6)^{3-} - d^2Sp^3$

(b) $XeF_4 - Sp^3\ d^2$

(c) $BrF_5 - Sp^3\ d^2$

(d) $[Ni(CN)_4]^{2-} \rightarrow dsp^2$

42. (d)



43. (d) Environmental

Calcination Releases $\rightarrow CO_2 \rightarrow$ Global warming

Roasting Releases $\rightarrow SO_2 \rightarrow$ Acid Rain

44. (d)
45. (b)
46. (167)

$$\frac{0.1 \times 1 + 0.2 \times 2}{3}$$

$$= \frac{0.5}{3} = \frac{500}{3} \times 10^{-3} = 167$$

47. $\frac{1}{5} = \frac{e^{-Ea/300R}}{e^{-Ea/315R}}$

$$5 = e^{\frac{Ea}{R}\left(\frac{1}{300} - \frac{1}{315}\right)}$$

$$\frac{Ea}{R}\left(\frac{15}{300 \times 315}\right) = \ln(5)$$

$$E_a = 1.6094 \times 315 \times 20 \times 8.314$$

$$E_a^a = 84297.47 \text{ J/mol}$$

48. (10) $\frac{0.1}{2} \times \frac{100}{1000} = \frac{1.43}{1.6+18x}$

$$106 + 18x = 286$$

$18x = 180 \Rightarrow x = 10$

49. (19)

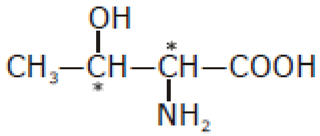
$2Fe^{2+} + H_2O_2 \longrightarrow xA + yB \longrightarrow 2Fe^{3+} + 2OH^-$

$2MnO_4^- + 6H^{\oplus} + 5H_2O_2 \longrightarrow x^{'}C + y^{'}D + Z^{'}E \longrightarrow 2Mn^{+2} + 5O_2 + 8H_2O$

$x = 2; y = 2; x' = 2, y' = 5, z' = 8$

$2 + 2 + 2 + 5 + 8 = 19$

50. (b)



51. (a)

$$A = \begin{bmatrix} a_1 & a_2 & a_3 \\ a_4 & a_5 & a_6 \\ a_7 & a_8 & a_9 \end{bmatrix}_{3\times 3}$$

$a_1 + a_2 + a_3 = 1\ 2a_2 + a_3 = 0$

$a_4 + a_5 + a_6 = 0\ 2a_5 + a_6 = 2$

$a_7 + a_8 + a_9 = 0\ 2a_8 + a_9 = 0$

$a_3 = 0, a_6 = 0, a_9 = 2$

$\therefore a_8 = -1, a_5 = 1,\ a_2 = 0 \Rightarrow a_1 = \phi, a_4 = -1,\ a_7 = -1$

$$A = \begin{bmatrix} 1 & 0 & 0 \\ -1 & 1 & 0 \\ -1 & -1 & 2 \end{bmatrix}$$

$|A| = 2(a) = 2$

52. (c)

$(2 + \alpha)^4 = a + b\alpha$

$$\left(2 + \frac{\sqrt{3}i - 1}{2}\right)^4 = a + b\alpha$$

$$\left(\frac{3 + \sqrt{3}i}{2}\right)^4 = 9\left(\frac{\sqrt{3}}{2} + \frac{i}{2}\right)^4$$

$9\{e^{i\pi/6}\}^4=9e^{i2\pi/3}=9\left(\frac{-1}{2}+\frac{\sqrt{3}i}{2}\right)=\frac{-9}{2}+\frac{9\sqrt{3}}{2}\mathrm{i}$

$-\frac{9}{2}+\frac{9\sqrt{3}}{2}i=a+b\left(\frac{-1}{2}+\frac{i\sqrt{3}}{2}\right)$

$=a-\frac{b}{2}+\frac{bi\sqrt{3}}{2}$

$\therefore\frac{b\sqrt{3}}{2}=\frac{9\sqrt{3}}{2}\Rightarrow b=9$

$\mathrm{a}=0\therefore\mathrm{a}+\mathrm{b}=9$

53. (d) Equation of line through $(1,-2,3)$ whose dr's are $(2,3,-6)$

$\frac{x-1}{2}=\frac{y+2}{3}=\frac{z-3}{-6}=\lambda$

any point on line $(2\lambda+1,3\lambda-2,-6\lambda+3)$

put in $(x-y+z=5)$

$2\lambda+1-3\lambda+2-6\lambda+3=5$

$-7\lambda=-1$

$\lambda=\frac{1}{7}$

distance $=\sqrt{(2\lambda)^2+(3\lambda)^2+(6\lambda)^2}$

$\sqrt{4\lambda^2+9\lambda^2+36\lambda^2}=7\lambda=1$

54. (c)

$f(\mathrm{a})=e$

$\lim_{t\to x}\frac{t^2f^2(x)-x^2f^2(t)}{t-x}$

L' Hospital

$\lim_{t\to x}(2tf^2(x)-2x^2f(t)\cdot f'(t))$

$\Rightarrow 2xf^2(x)-2x^2f(x)\cdot f'(x)=0$

$2xf(x)\{f(x)-xf'(x)\}=0$

$=)\frac{f'(x)}{f(x)}=\frac{1}{x}$

$\ln f(x)=\ln x+\ln c$

$f(x)=cx$

$\text{if } \mathrm{x}=1,\mathrm{e}=\mathrm{c}$

$y=ex$

$\therefore$ if $f(x) = 1 \Rightarrow x = \frac{1}{e}$

55. (a) Contrapositive of $P \to q = \sim q \to \sim p$

56. (b) $y = 2^{\sin x} + 2^{\cos x}$

by Am $\geq$ GM

$$\frac{2^{\sin x} + 2^{\cos x}}{2} \geq \sqrt{2^{\sin x + \cos x}}$$

$$2^{\sin x} + 2^{\cos x} \geq 2^1 \cdot 2^{\frac{\sin x + \cos x}{2}}$$

$$2^{\sin x} + 2^{\cos x} \geq 2^{\frac{2+\sin x + \cos x}{2}} \therefore \left(2^{\sin x} + 2^{\cos x}\right)_{\min} = 2^{\frac{2-\sqrt{2}}{2}} = 2^{\frac{-1}{\sqrt{2}}+1}$$

57. (d) $m_{PQ} = \frac{4-3}{1-k} \Rightarrow m_{\perp} = k - 1$

mid -point of $PQ = \left(\frac{k+1}{2}, \frac{7}{2}\right)$

equation of perpendicular bisector

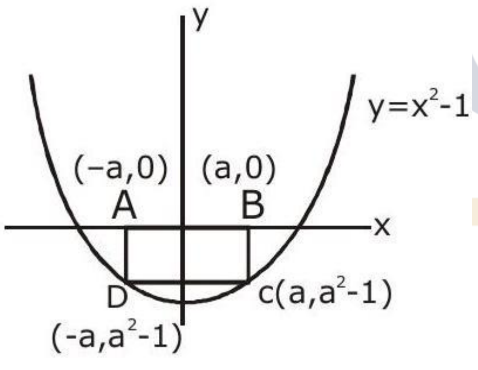
$$y - \frac{7}{2} = (k-1)\left(x - \frac{k+1}{2}\right)$$

for y intercept put $x = 0$

$$y = \frac{7}{2} - \left(\frac{k^2-1}{2}\right) = -4$$

$$\frac{k^2-1}{2} = \frac{15}{2} \Rightarrow k = \pm 4$$

58. (d)



Area $= 2a(a^2 - 1)$

$A = 2a^3 - 2a$

$$\frac{dA}{da} = 6a^2 - 2 = 0$$

$a = \pm 1\sqrt{3}$

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

59. (b)

$$\begin{aligned}I&=\int_{\pi/6}^{\pi/3} 2\cdot\tan^3 x\sec^2 x\sin^4 3x+3\tan^4 x\sin^2 3x.2\sin 3x\cos 3x dx\\&=\frac{1}{2}\int_{\pi/6}^{\pi/3} 4\tan^3 x\sec^2 x\sin^4 3x+3\cdot 4\tan^4 x\sin^3 3x\cos 3x dx\\&=\frac{1}{2}\int_{\pi/6}^{\pi/3}\frac{d}{dx}(\tan^4 x\sin^4 3x)dx\\&=\frac{1}{2}[\tan^4 x\sin^4 3x]_{\pi/6}^{\pi/3}\\&=\frac{1}{2}\left[9\cdot(0)-\frac{1}{3}\cdot\frac{1}{3}(\mathrm{a})\right]=-\frac{1}{18}\end{aligned}$$

60. (b) $D=0\begin{vmatrix}1&1&1\\2&4&-1\\3&2&\lambda\end{vmatrix}=0$

$(4\lambda+2)-1(2\lambda+3)+1(4-12)=0$

$4\lambda+2-2\lambda-3-8=0$

$2\lambda=9\Rightarrow\lambda=\frac{9}{2}$

$D_x=\begin{vmatrix}2&1&1\\6&4&-1\\\mu&2&-9/2\end{vmatrix}=0$

$\Rightarrow\mu=5$

Now check option

$2\lambda+\mu=14$

61. (c) sum total $7=(1,6)(2,5)(3,4)(4,3)(5,2)(6,1)$

$\mathrm{P}(\text{ sum })=\frac{6}{36}$

sum total $6\Rightarrow(1,5)(2,4)(3,3)(4,2)(5,1)$

$\mathrm{P}(\text{ sum } 6)=\frac{5}{36}$

$\mathrm{P}(\mathrm{A}_{\text{win}})=\mathrm{P}(6)+P(\bar{6})\cdot P(\bar{7})\cdot P(6)+\cdots.$

$=\frac{5}{36}+\frac{31}{36}\times\frac{30}{36}\times\frac{5}{36}+\cdots..$

$$=\frac{\frac{5}{36}}{1-\frac{31\times 30}{36\times 36}}\Rightarrow\frac{5\times 36}{36\times 36-31\times 30}\Rightarrow\frac{5\times 36}{1296-930}=\frac{5\times 36}{366}\Rightarrow\frac{30}{61}$$

62. (c)

$T_r : T_{r+1} : T_{r+2}$
${}^{n+5}C_{r-1}\,{}^{n+5}C_r \cdot {}^{n+5}C_{r+1} = 5:10:14$
$\frac{(n+5)!}{(r-1)!-(n+6-r)!} : \frac{(n+5)!}{r!\,(n+5-r)!} = \frac{5}{10}$
$\frac{r}{n+6-r} = \frac{1}{2}\ \frac{(r+1)!\,(n+4-r)!}{r!\,(n+5-r)!} = \frac{5}{7}$
$2r = n + 6 - r$
$3r = n + 6$
$\frac{r+1}{n+5-r} = \frac{5}{7}$
$7r + 7 = 5n + 25 - 5r$
$12r = 5n + 18$
$\therefore 4(n+6) = 5n + 18$
$n = 6$
$\therefore (1+x)$ largest coeff $= {}^{11}C_5 = 462$

63. (c)

$$f(x) = \begin{cases} \frac{\pi}{4} + \tan^{-1} x & x \in [-1,1] \\ \frac{1}{2}(x-1) & x > 1 \\ \frac{1}{2}(-x-1) & x < -1 \end{cases}$$

at $x = 1$

$f(a) = \frac{\pi}{2}\ f(1^+) = 0$

$\therefore$ discontinuous $\Rightarrow$ non diff.

at $x = -1$

$f(-1) = 0\ f(-1^-) = \frac{1}{2}\{+1-1\} = 0$

cont. at $x = -1$

$$f'(x) = \begin{cases} \frac{1}{1+x^2} & x \in [-1,1] \\ \frac{1}{2} & x > 1 \\ -\frac{1}{2} & x < -1 \end{cases}$$

64. (b) $\frac{dy}{dx} - \frac{y+3x}{\ln(y+3x)} + 3 = 0$

Let $\ln(y+3x) = t$

$\frac{1}{y+3x} \cdot \left(\frac{dy}{dx} + 3\right) = \frac{dt}{dx}$
$\Rightarrow \left(\frac{dy}{dx} + 3\right) = \frac{y+3x}{\ln(y+3x)}$

$\therefore (y+3x)\dfrac{dt}{dx} = \dfrac{y+3x}{t}$

$\Rightarrow$ tdt = dx

$\dfrac{t^2}{2} = x + c$

$\dfrac{1}{2}(\ln(y+3x))^2 = \mathrm{x} + \mathrm{c}$

65. (c) $x^2 - x + 2\lambda = 0(\alpha, \beta)$

$3x^2 - 10x + 27\lambda = 0(\alpha, \gamma)$

$3x^2 - 3x + 6\lambda = 0$

$\underline{\quad - \quad + \quad}$

$-7x + 21\lambda = 0$

$\therefore \alpha = 3\lambda$
$9\lambda^2 - 3\lambda + 2\lambda = 0$

Put in equation

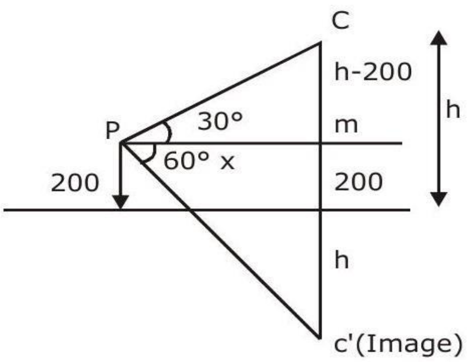
$9\lambda^2 - \lambda = 0 \Rightarrow \lambda = \dfrac{1}{9} \Rightarrow \alpha = \dfrac{1}{3}$

$\alpha.\beta = \dfrac{2}{9} \Rightarrow \beta = \dfrac{2}{3}$

$\alpha \cdot \gamma = 1 \Rightarrow \gamma = 3$

$\therefore \dfrac{\beta \cdot r}{\lambda} \Rightarrow \dfrac{\frac{2}{3} \cdot 3}{\frac{1}{9}} = 18$

66. (c)



$\dfrac{h-200}{x} = \tan 30^\circ \quad \dfrac{h+200}{x} = \tan 60^\circ$

$\dfrac{h+200}{h-200} = 3$

$h + 200 = 3h - 600$

$2h = 800$

$h = 400$

$\therefore \dfrac{h-200}{PC} = \sin 30°$

$PC = 400$ m

67. (b)

$\dfrac{50 \times 10}{20} = \dfrac{n \times 5}{6}$

$\dfrac{50}{2} \times \dfrac{6}{5} = n \Rightarrow n = 30$

68. (b) $e = \frac{1}{2}$

$x = \dfrac{a}{e} = 4$

$\Rightarrow a = 2$

$e^2 = 1 - \dfrac{b^2}{a^2} \Rightarrow \dfrac{1}{4} = 1 - \dfrac{b^2}{4}$

$\dfrac{b^2}{4} = \dfrac{3}{4} \Rightarrow b^2 = 3$

$\therefore$ Ellipse $\frac{x^2}{4} + \frac{y^2}{3} = 1$

$P(1, \beta)$

$x = 1; \dfrac{1}{4} + \dfrac{\beta^2}{3} = 1$

$\dfrac{\beta^2}{3} = \dfrac{3}{4} \Rightarrow \beta = \dfrac{3}{2}$

$\Rightarrow P\left(1, \dfrac{3}{2}\right)$

Equation of normal $\frac{a^2x}{x_1} - \frac{b^2y}{y_1} = a^2 - b^2$

$\dfrac{4x}{1} - \dfrac{3y}{\frac{3}{2}} = 4 - 3$

$4x - 2y = 1$

69. (d) $a_1 = 1, a_n = 300, 15 \leq n \leq 50$

$300 = 1 + (n-1)d$

$(n-1) = \frac{299}{d}$

d can 23 or 13

if $n-1 = 13$

$n = 14$

reject

or $d = 13$

$n-1 = 23$

$n = 24$

$S_{20} = \frac{20}{2}\{2 + 19.13\}$

$a_{20} = 1 + 19.13$

$= 10\{249\} = 2490$

$a_{20} = 248$

$(S_{20}, a_{20}) = (2490, 248)$

70. (c) $S_1 + \lambda(S_1 - S_2) = 0$

$x^2 + y^2 - 6x + \lambda(4y - 6x) = 0$

$x^2 + y^2 - 6x(1+\lambda) + 4\lambda y = 0$

Centre $(3(1+\lambda), -2\lambda)$ put in $2x - 3y + 12 = 0$

$6 + 6\lambda + 6\lambda + 12 = 0$

$12\lambda = -18$

$\lambda = -3/2$

∴ Circle is $x^2 + y^2 + 3x - 6y = 0$

71. (21)

$\int_0^n \{x\}dx = n\int_0^1 x dx = n\left(\frac{x^2}{2}\right) = \frac{n}{2}$

$\int_0^n [x]dx = \int_0^1 0 + \int_1^2 1dx + \int_2^3 2dx \ldots + \int_{n-1}^n (n-1)dx$

$= 1 + 2 + \cdots \ldots \ldots + n - 1 \Rightarrow \frac{n(n-1)}{2}$

$= \frac{n}{2}, \frac{n(n-1)}{2}, 10(n^2 - n) \rightarrow G \cdot P$

$$= \frac{n^2(n-1)^2}{4} = \frac{n}{2} \cdot 10 \cdot n(n-1)$$

$n - 1 = 20; n = 21$

72. (135)

$^{6}C_4 \times 1 \times 3^2 = 15 \times 9 = 135$

73. (18)

$|\hat{\imath} \times (\vec{a} \times \hat{\imath})|^2 = |\vec{a} - (a.\hat{\imath})\hat{\imath}|^2$

$= |\hat{\jmath} + 2\hat{k}|^2 = 1 + 4 = 5$

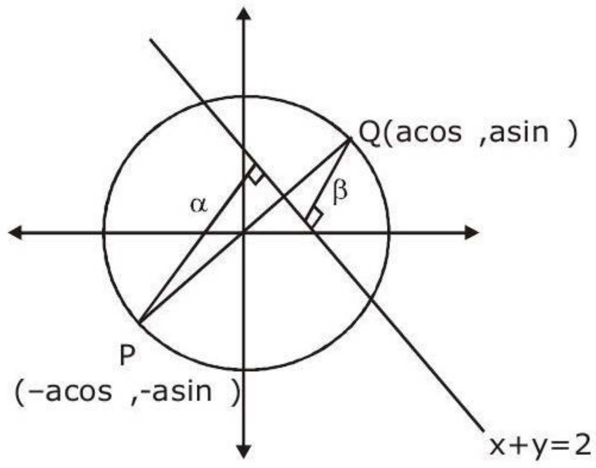
Similarly

$|\hat{\jmath} \times (\vec{a} \times \hat{\jmath})|^2 = |2\hat{\imath} + 2\hat{k}|^2 = 4 + 4 = 8$

$|\hat{k} \times (\vec{a} \times \hat{k})|^2 = |2\hat{\imath} + \hat{\jmath}|^2 = 4 + 1 = 5$

$\Rightarrow 5 + 8 + 5 = 18$

74. (7)



$$\alpha = \left|\frac{3\cos\theta + 3\sin\theta - 2}{\sqrt{2}}\right|$$

$$\beta = \left|\frac{+3\cos\theta + 3\sin\theta + 2}{\sqrt{2}}\right|$$

$$\alpha\beta = \left|\frac{(3\cos\theta + 3\sin\theta)^2 - 4}{2}\right| \Rightarrow \alpha\beta = \left|\frac{9 + 9\sin 2\theta - 4}{2}\right| \Rightarrow \alpha\beta = \left|\frac{5 + 9\sin 2\theta}{2}\right|$$

$$\alpha\beta_{\max} = \frac{9+5}{2} = 7$$

75. (4)