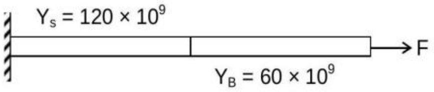
1. (c)
2. (d)
3. (a)
4. (BONUS)

$\ell = 1\text{M}$

$A = 10^{-6}\text{M}^2$

$\text{Stress} = \frac{F}{A}$

$Y_s = 120 \times 10^9$



$\text{Stress} = \frac{\text{Stress}}{Y}$

$$\Delta\ell = \frac{\ell \times \text{F}}{\text{AY}}$$
$$\Delta\ell_1 + \Delta\ell_2 = \frac{\ell_1\,\text{F}}{\text{AY}} + \frac{\ell_2\,\text{F}}{\text{AY}} = 0.2 \times 10^{-3}$$
$$\frac{\text{F}}{\text{A}} = \frac{0.2 \times 10^{-3}}{\frac{\ell}{\text{Y}_1} + \frac{\ell}{\text{Y}_2}}$$
$$= \frac{0.2 \times 10^{-3}}{1} = \frac{0.2 \times 10^{-3} \times 10^9 \times 120}{1+2}$$
$$= \frac{0.2 \times 10^6 \times 120}{3} = 8 \times 10^6$$

5. (c)

$\text{Q} = \text{C}_\text{V}\Delta\text{T}$

$\text{Q}' = \text{C}_\text{P}\Delta\text{T}$

$$\text{Q}' = \frac{\text{C}_\text{P}}{\text{C}_\text{V}}\text{Q} = \left(1 + \frac{2}{5}\right)\text{Q} = \frac{7}{5}\text{Q}$$

6. (a)

$$2.5 \times 10^{-2} \times 0.2 = \frac{1}{2} \times 20 \times 10^{-3}\{-V^2 + 1^2\}$$
$$5 \times 10^{-3} = 10 \times 10^{-3}(1 - \text{V}^2)$$
$$1 - \text{V}^2 = \frac{1}{2}; \text{V}^2 = \frac{1}{2}\,; \text{V} = \frac{1}{\sqrt{2}} = 0.7$$

7. (b)

$$\frac{400}{\frac{\pi}{4}d^2} = 379 \times 10^6$$

$$d^2 = \frac{4 \times 400 \times 10^{-6}}{\pi \times 379} = 0.336 \times 10^{-6} \times 4$$
$$d = 2\sqrt{0.336} \times 10^{-3}M \simeq 1.16\text{ mm}$$

8. (d)

$$T=\frac{2u\sin\theta}{g\cos\alpha}$$

$$R=u\cos\theta T-\frac{1}{2}g\sin\alpha T^2$$

$$=\frac{u\cos\theta 2u\sin\theta}{g\cos\alpha}-\frac{g\sin\alpha}{2}\frac{4u^2\sin^2\theta}{g^2\cos^2\alpha}$$

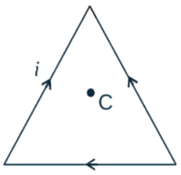
$$=\frac{u^2\sin^2\theta}{g\cos\alpha}-\frac{u^2\sin\alpha}{g\cos^2\alpha}\{1-\cos 2\theta\}$$

$$=\frac{4\times\frac{1}{2}}{10\times\frac{\sqrt{3}}{2}}-\frac{u^2\sin\alpha}{g\cos^2\alpha}\left\{1-\frac{\sqrt{3}}{2}\right\}$$

$$=\frac{4}{10\sqrt{3}}-\frac{8}{30}\left\{1-\frac{\sqrt{3}}{2}\right\}$$

$$=\frac{4}{5\sqrt{3}}-\frac{8}{30}=\frac{8\sqrt{3}-8}{30}=\frac{8(\sqrt{3}-1)}{30}=20\text{ cm}$$

9. (d)



$i = 10$ A

$\ell = 1$ m

$$\mu_0=4\pi\times10^{-7}\frac{\text{N}}{\text{A}^2}$$

$$B=\frac{\mu_0 i}{\frac{4\pi\sqrt{3}\ell}{2}}\times 3$$

$$=\frac{\mu_0 i\sqrt{3}}{2\pi\ell}=\frac{4\pi\times10^{-7}\times10\times\sqrt{3}}{2\pi\times1}=20\sqrt{3}\times10^{-7}$$

$$=3\mu\text{T}$$

10. (d) $\frac{1}{e^2}=e^{\lambda t-5\lambda t}$

$$t=\frac{1}{2\lambda}$$

11. (b) $M_A = 1$ kg, $M_B = 3$ kg

$\mu_{AB} = 0.2$

$\mu_B = 0.2$

10

$$F_{max} = (M_A+M_B)\times0.2\times10+(M_A+M_B)\times0.2\times\underset{B}{\rightarrow} F$$

$= 4 \times 2 + 4 \times 2 = 16$

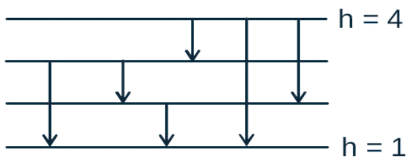
12. (b)

13. (a)

$$\frac{hc}{\lambda} = 13.6\text{eV}(g)\left\{1 - \frac{1}{16}\right\}$$

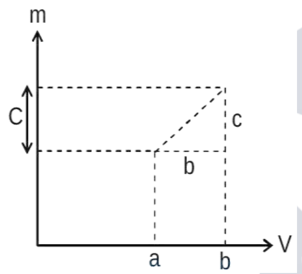
$$\frac{1240\text{eV}}{\lambda} = \frac{15}{16} \times 9 \times 13.6\text{eV}$$

$$\lambda = \frac{1240 \times 16}{15 \times 9 \times 13.6} = 10.8 \text{ nm}$$



14. (d)

$$f = \frac{b}{c}$$



15. (b) $\frac{mV^2}{r} = \frac{GMm}{r^2}$

$$V = \sqrt{\frac{GM}{r}}$$

$$n = \frac{VT}{2\pi r} = \sqrt{\frac{GM}{r}}\frac{T}{2\pi r}$$

$$= \left(\sqrt{\frac{GM}{r^3}}\right) \times \frac{T}{2\pi} = \sqrt{\frac{6.67 \times 10^{-11} \times 8 \times 10^{22}}{(202 \times 10^4)^3}} \times \frac{T}{2\pi}$$

$$= \frac{24 \times 3600}{2 \times 3.14}\sqrt{\frac{6.67 \times 8 \times 10^{11}}{(202)^3 \times 10^{12}}} = \frac{24 \times 3600}{2 \times 3.14 \times 1242.8} = \frac{24 \times 3600}{78.51} \simeq 11$$

16. (c) $I = 25\,\frac{\text{W}}{\text{cm}^2} = 25 \times 10^4 \text{ W/m}^2$

$P = 25 \times 25; W = 625 \text{ W}$

$$\frac{hc}{\lambda}\frac{dn}{dt} = P$$

$F = \frac{h}{\lambda}\frac{dn}{dt} = \frac{P}{C} = \frac{625}{3 \times 10^8}$

Momentum $= \frac{625 \times 40 \times 60}{3 \times 10^8} = 5 \times 10^{-3}$Ns

17. (a) $\vec{v} = 2\hat{i} - 6 + \hat{j}$

At $t = 2$

$\vec{v} = 2\hat{i} - 12\hat{j}$

$\vec{P} = m\vec{v} = 4i - 24\hat{j}$

At $t = 2$

$\vec{r} = 4\hat{\imath} - 12\hat{j}$

$\vec{L} = \vec{r} \times \vec{P} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 4 & -12 & 0 \\ 4 & -24 & 0 \end{vmatrix}$

$= \{4(-24) + 4 \times 12\}\hat{k}$

$= (-96 + 48)\hat{k}$

$= (-)48\hat{k}$

18. (b) $10^{-4} \times 1 = \sqrt{(1)^2 + 2 \times 10 \times 0.15} \times A$

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

19. (d)

$R = \int_a^b \frac{\rho dx}{4\pi x^2}$

$= \frac{\rho}{4\pi}\left(\frac{1}{a} - \frac{1}{b}\right)$

20. (a)

$m = 5 \times 10^{-3}$ kg, $r = 10^{-2}$ m

$\omega = 25 \times 2\pi \text{rad}/5$

$= 50\pi \text{rad/sec}$

$\omega = \frac{\tau}{l}t$

$\tau = \frac{l\omega}{t} = \frac{5mr^2}{4} \times \frac{\omega}{t}$

$= \frac{5 \times 5 \times 10^{-3} \times 10^{-4} \times 50\pi}{4 \times 5}$

$= \frac{25\pi}{4} \times 10^{-6} = 2 \times 10^{-5}$

21. (d) $V_{\text{breakdwon}} = 6$ V, $R_L = 4k\Omega$, $R_i = 1k\Omega$

$i_L = \frac{6}{4} \times 10^{-3} = 1.5 \times 10^{-3} = 1.5 \text{ mA}$

$\mathrm{i_i} = 2 \times 10^{-3}$

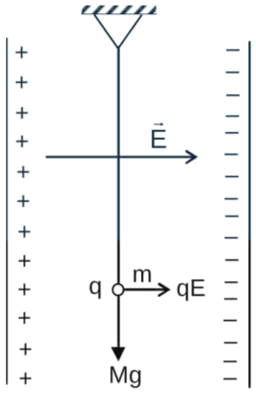
$\mathrm{i = i_1 - i_L = 0.5\ mA}$ – minimum current

$\mathrm{i_i} = 10 \times 10^{-3} = 10 \text{ mA}$

$\mathrm{i_{max}} = 8.5 \text{ mA}$

22. (d)

$$T = 2\pi \sqrt{\frac{L}{\sqrt{g^2+\frac{q^2E^2}{M^2}}}}$$



23. (BONUS)

24. (d)

$$2 \times 10^{-3} = \frac{hc}{\lambda}\frac{dn}{dt}$$

$$\frac{dn}{dt} = \frac{2 \times 10^{-3}\lambda}{hc}$$
$$= \frac{2 \times 10^{-3} \times 500 \times 10^{-9}}{6.6 \times 10^{-34} \times 3 \times 10^{8}}$$
$$= \frac{1000}{6.6 \times 3} \times 10^{14} = 5 \times 10^{15}$$

25. (a)

$L = 10 \times 10^{-3}\mathrm{H}, r_1 = 0.1\Omega$

$\mathrm{i} = \varepsilon\{1 - \mathrm{e}^{-t/2}\}$

$\mathrm{i_{saturation}} = \varepsilon$

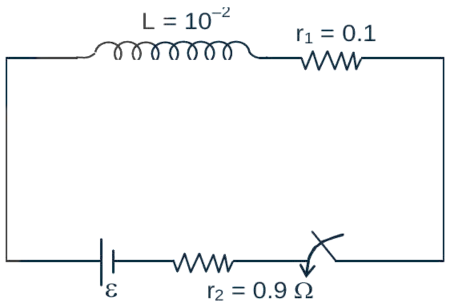
$80\%\mathrm{i_{saturation}} = 0.8\varepsilon$

$0.8\varepsilon = \varepsilon\{1 - \mathrm{e}^{-t/2}\}$

$0.8 = 1 - \mathrm{e}^{-t/2};\ \mathrm{e}^{-t/2} = 0.2$

$\mathrm{e}^{t/L} = 5$

$t = L\ln 5 = 10 \times 10^{-3} \times 1.6 = 16 \times 10^{-3}$



26. (d)

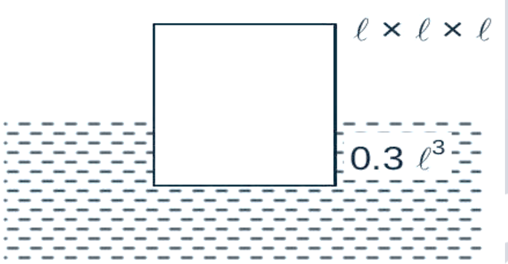
27. (d)

$0.3\ell^3\rho_\omega = \ell^3\rho$

$\rho = 300\dfrac{\mathrm{kg}}{\mathrm{m}^3}$

$\mathrm{m} + \ell^3\rho = \ell^3\rho_\omega$

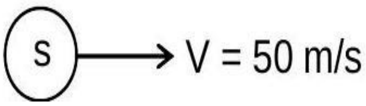
$M = \ell^3(\rho_w - \rho) = (5)^3\{1000 - 300\} = 700 \times (5)^3$
$= 87.5\ \mathrm{kg}$



28. (c) $\frac{I_{\mathrm{Max}}}{I_{\mathrm{Min}}} = \frac{9}{1}$

29. (c)

$f_a = \dfrac{V}{V - V_s} f_o = 1000Hz$



$f_a' = \dfrac{V}{V + V_s} f_o$

$\dfrac{f_a'}{f_a} = \dfrac{V - V_s}{V + V_s} = \dfrac{350 - 50}{350 + 50} = \dfrac{300}{400} = \dfrac{3}{4}$

$\mathrm{f}_\mathrm{a}' = \dfrac{3}{4} \times 1000 = 750\ \mathrm{Hz}$

30. (c)

$\mathrm{m} = \mathrm{I}^2$

$2\pi r = 4\ell$

$\mathrm{m}' = \dfrac{14\ell^2}{\pi}$

$r = \frac{2\ell}{\pi}$

$\frac{m'}{m} = \frac{4}{\pi}$

$\pi r^2 = \frac{\pi 4\ell^2}{\pi^2} = \frac{4\ell^2}{\pi}$

$m' = \frac{4}{\pi} m$

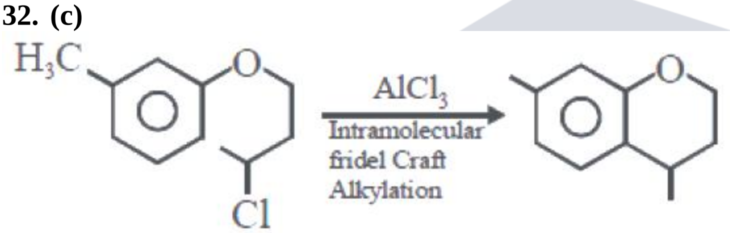
31. (a) $C_7H_{16}(\ell) + 11O_2(g) \longrightarrow 7CO_2(g) + 8H_2O(\ell)$

$\Delta n_g = n_p - n_r = 7 - 11 = -4$

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

$\therefore \Delta H - \Delta U = -4RT$

32. (c)

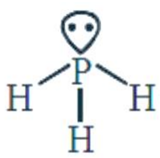


33. (a)
34. (d)
35. (c)

(a) $\underset{\text{Ionic hydride}}{\overset{\oplus}{H}} + \overset{\ominus}{H}OH \longrightarrow MOH + H_2$

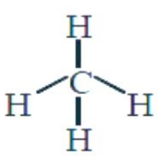
(b) $4BF_3 + 3LiAlH_4 \longrightarrow 2\,B_2H_6 + 3LiF + 3AlF_3$

(c)



→ phosphorous is electron rich

hydride due to presence of lone pair



→ It is electron precise hydride.

(d) $HF \& CH_4$ are molecular hydride due to they are covalent molecules.

36. (a)
37. (b)

$H_2(g) + I_2(g) \rightarrow 2HI(g)$ Apply Arrhenius equation

$$\log\frac{K_2}{K_1}=\frac{E_a}{2.303R}\left(\frac{1}{600}-\frac{1}{800}\right)$$

$$\log\frac{1}{2.5\times10^{-4}}=\frac{E_a}{2.303\times8.31}\left(\frac{200}{600\times800}\right)$$

$\therefore E_a\approx166\ \mathrm{kJ/mol}$

38. (c) R_f value can't measure the extent of adsorption.

39. (a)

$$\underset{\substack{\text{washing soda}\\(X)}}{Na_2CO_3.10H_2O(s)}\xrightarrow{\Delta}\underset{(Y)}{Na_2CO_3.H_2O}\xrightarrow[T>373k]{\Delta}\underset{\substack{\text{(soda ash)}\\(Z)}}{Na_2CO_3}$$

40. (c)

41. (b) Angle strain govern stability in cyclic compound.

42. (c)

43. (a) In option (B)- Δn_g is -ve therefore increase in pressure will bring reaction in forward direction.

In option (C)- as the reaction is exothermic therefore increase in temperature will decrease the equilibrium constant.

In option (D)- Equilibrium constant changes only with temperature. Hence, option (B), (C) and (D) are correct therefore option (1) is incorrect choice.

44. (a)

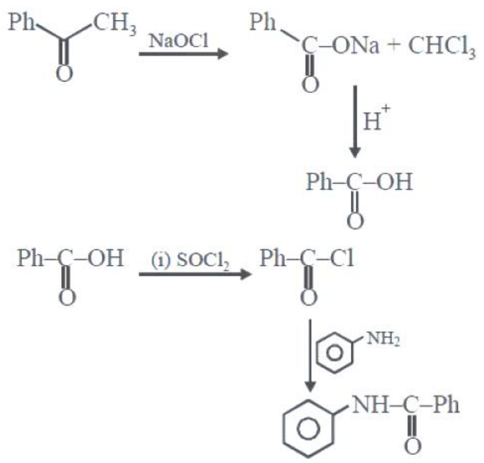
$$\underbrace{\bar{O}H > CH_3-\overset{\underset{\|}{}}{\underset{\underset{O}{\|}}{C}}-O^- > CH_3-\overset{\overset{O}{\|}}{\underset{\underset{O}{\|}}{S}}-O^-}_{\text{Charged ion}} > \underbrace{H_2O}_{\substack{\text{neutral}\\\text{system}}}$$

ione pair donating tendency on oxygen is reduced, nucleophilicity reduced $b<c<a<d$

45. (d)

(a) High density	(III) Ziegler-Natta Catalyst
(b) Polyacrylonitrile	(I) Peroxide catalyst
(c) Novolac	(IV) Acid or base catalyst
(d) Nylon 6	(II) Condensation at high temperature & pressure

46. (a)



47. (d)

$$V_{mp} = \sqrt{\frac{2RT}{M}} \Rightarrow V_{mp} \propto \sqrt{\frac{T}{M}}$$

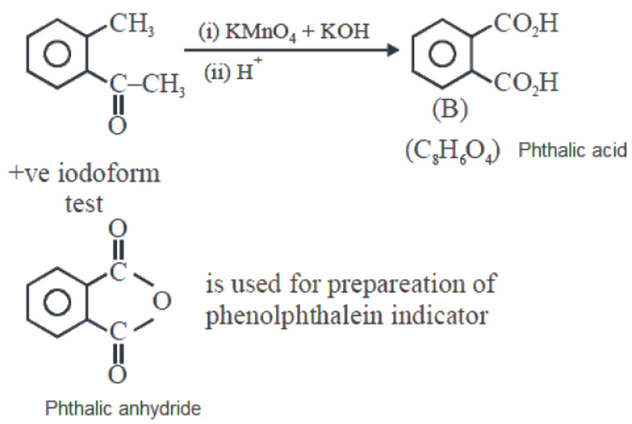
For N_2, O_2, H_2

$$\sqrt{\frac{300}{28}} < \sqrt{\frac{400}{32}} < \sqrt{\frac{300}{2}}$$

V_{mp} of $N_2(300\text{ K}) < V_{mp}$ of $O_2(400\text{ K}) < V_{mp}$ of $H_2(300\text{ K})$

48. (d) The highest oxidation state of U and Pu is $6+$ and $7+$ respectively.

49. (a)



50. (b)

51. (b)

For the salt of strong acid and weak base

$$H^+ = \sqrt{\frac{K_w \times C}{K_b}}$$

$$[H^+] = \sqrt{\frac{10^{-14} \times 2 \times 10^{-2}}{10^{-5}}}$$

$$-\log[H^+] = 6 - \frac{1}{2}\log 20$$

$$\therefore \text{pH} = 5.35$$

52. (a)

53. (a) In electrophoresis precipitation occurs at the electrode which is oppositely charged therefore (A) is correct.

54. (b) Both $NaCl$ and KCl are strong electrolytes and as Na^+(aq.) has less conductance than K^+(aq.) due to more hydration therefore the graph of option (b) is correct.

55. (c) $\Delta T_b = K_b \times m$

$$\therefore \frac{\Delta T_{b(A)}}{\Delta T_{b(B)}} = \frac{K_{b(A)}}{K_{b(B)}} \text{ as } m_A = m_B$$

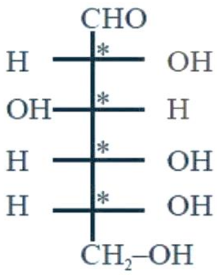
$$\therefore \frac{\Delta T_{b(A)}}{\Delta T_{b(B)}} = \frac{1}{5}$$

56. (a) Benzylamine will not give cyanobenzene with HCl/H_2O & $NaBH_4$.

57. (c)

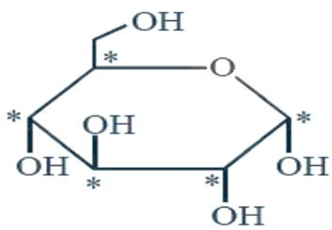
58. (c)

59. (a)



D-Glucose

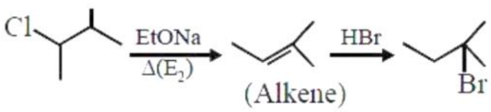
(Linear structure)



α-D-Glucose

(cyclic structure)

60. (c)



(Saytzeff prod.)

61. (d) $\lim_{x\to 1}\frac{x^2-ax+b}{x-1}=5$

$1-a+b=0$

$2-a=5$

$\Rightarrow \mathrm{a}+\mathrm{b}=-7$

62. (b) By expansion, we get

$-5x^3+30x-30+5x=0$

$\Rightarrow -5x^3+35x-30=0$

$\Rightarrow x^3-7x+6=0$, All roots area real

So, sum of roots $=0$

63. (a)

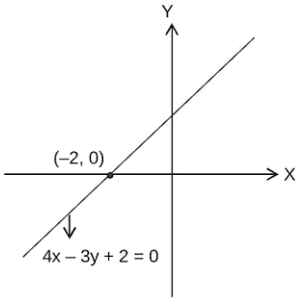
Required line is $4x-3y+\lambda=0$

$\left|\frac{\lambda}{5}\right|=\frac{3}{5}$

$\Rightarrow \lambda=\pm 3$

So, required equation of line is $4x-3y+3=0$ and $4x-3y-3=0$

(1) $4\left(-\frac{1}{4}\right)-3\left(\frac{2}{3}\right)+3=0$



64. (a) $\left.\frac{dy}{dx}\right|_{(\alpha,\beta)}=\frac{-\alpha^2-3}{(\alpha^2-3)^2}$

Given that :

$\frac{-\alpha^2-3}{(\alpha^2-3)^2}=-\frac{1}{3}$

$\Rightarrow \alpha=0,\pm 3\ (\alpha\neq 0)$

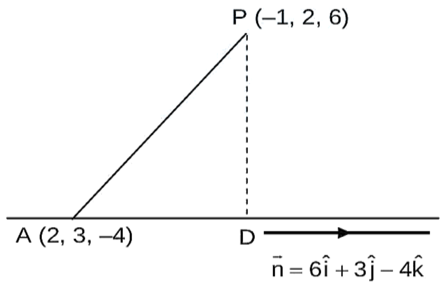
$\Rightarrow \beta=\pm\frac{1}{2}.\ (\beta\neq 0)$

$|6\alpha+2\beta|=19$

65. (a)

$AD = \left|\frac{\overrightarrow{AP}\cdot\vec{n}}{|\vec{n}|}\right| = \sqrt{61}$

$\Rightarrow PD = \sqrt{AP^2 - AD^2} = \sqrt{110-61} = 7$



66. (b) Tangent to $y^2 = 4\sqrt{2}x$ is $y = mx + \frac{\sqrt{2}}{m}$ it is also tangent to $x^2 + y^2 = 1$

$\Rightarrow \left|\frac{\sqrt{2}/m}{\sqrt{1+m^2}}\right| = 1 \Rightarrow m = \pm 1$

$\Rightarrow$ Tangent will be $y = x + \sqrt{2}$ or $y = -x - \sqrt{2}$ compare with $y = -ax + C$

$\Rightarrow a = \pm 1$ and $C = \pm\sqrt{2}$

67. (c) $fog(x) = (-x) \Rightarrow (fg(\alpha)) = -\alpha = b$

$(fg(x))' = -1 \Rightarrow (fg(\alpha))' = -1 = a$

68. (c) $\frac{x^2}{9} - \frac{y^2}{16} = 1$

$a = 3, b = 4$ and $e = \sqrt{1 + \frac{16}{9}} = \frac{5}{3}$

corresponding focus will be $(-ae, 0)$ i.e. $(-5,0)$.

69. (d) $\cos^{-1} x - \cos^{-1}\frac{y}{2} = \alpha$

$\cos\left(\cos^{-1} x - \cos^{-1}\frac{y}{2}\right) = \cos\,\alpha$

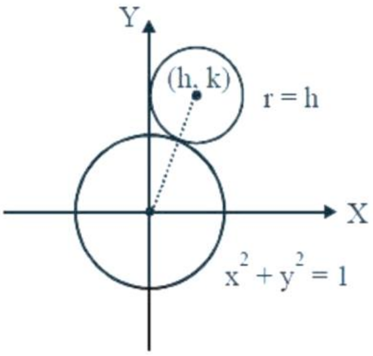
$\Rightarrow x \times \frac{y}{2} + \sqrt{1-x^2}\sqrt{1-\frac{y^2}{4}} = \cos\,\alpha$

$\Rightarrow \left(\cos\,\alpha - \frac{xy}{2}\right)^2 = (1-x^2)\left(1-\frac{y^2}{4}\right)$

$x^2 + \frac{y^2}{4} - xy\cos\,\alpha = 1 - \cos^2\,\alpha = \sin^2\,\alpha$

70. (d) $\sqrt{h^2+k^2} = |h| + 1$

$\Rightarrow x^2 + y^2 = x^2 + 1 + 2x$
$\Rightarrow y^2 = 1 + 2x$
$\Rightarrow y = \sqrt{1+2x}; x \geq 0$



71. (b) Let a is first term and d is common difference then, a + 5 d = 2 (given) $f(d) = (2-5d)(2-2d)(2-d)$

$f'(x) = 0 \Rightarrow d = \frac{2}{3}, \frac{8}{5}$

$f''(d) < 0$ at $d = \frac{8}{5}$

$\Rightarrow d = \frac{8}{5}$

72. (a) $T_{r+1} = \sum_{r=0}^{n} {}^{n}C_r x^{2n-2r} \cdot x^{-3r}$

$2n - 5r = 1 \Rightarrow 2n = 5r + 1$ for $r = 15, n = 38$ smallest value of n is 38

73. (c) Total cases = number of diagonals in 20-sided polygon.

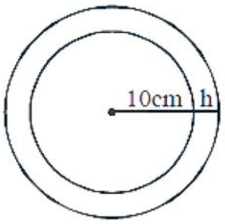
$= {}^{20}C_2 - 20 = 170$

74. (d) $V = \frac{4}{3}\pi((10+h)^3 - 10^3)$

$\frac{dV}{dt} = 4\pi(10+h)^2 \frac{dh}{dt}$

$-50 = 4\pi(10+5)^2 \frac{dh}{dt}$

$\Rightarrow \frac{dh}{dt} = -\frac{1}{18\pi} \frac{cm}{min}$



e

75. (a) Mean $(\mu) = \frac{\sum x_i}{50} = 16$

Standard deviation $(\sigma) = \sqrt{-- (\mu)^2} = 16$

$\Rightarrow (256) \times 2 = \frac{\sum x_i^2}{50}$

$\Rightarrow$ New mean

$= \dfrac{\sum(x_i-4)^2}{50} = \dfrac{\sum x_i^2 + 16\times 50 - 8\sum x_i}{50}$

$= (256)\times 2 + 16 - 8\times 16 = 400$

76. (d)

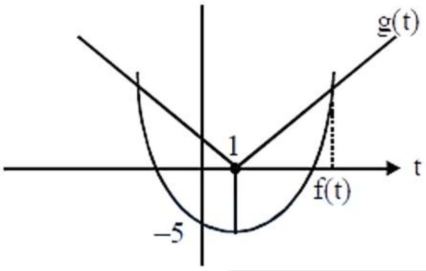
Let $2^x = t$

$5 + |t-1| = t^2 - 2t$

$\Rightarrow \underset{g(t)}{|t-1|} = \underset{f(t)}{(t^2-2t-5)}$

From the graph

So, number of real root is 1 .



77. (b) $3x^2 + 5y^2 = 32$

$\left.\dfrac{dy}{dx}\right|_{(2,2)} = -\dfrac{3}{5}$

Tangent : $y-2 = -\frac{3}{5}(x-2) \Rightarrow Q\left(\frac{16}{3},0\right)$

Normal : $y-2 = \frac{5}{3}(x-2) \Rightarrow R\left(\frac{4}{5},0\right)$

Area is $= \frac{1}{2}(\mathrm{QR})\times 2 = \mathrm{QR} = \frac{68}{15}$

78. (a) Let point P on the line is $(2\lambda+1,-\lambda-1,\lambda)$ foot of perpendicular Q is given by

$\dfrac{x-2\lambda-1}{1} = \dfrac{y+\lambda+1}{1} = \dfrac{z-\lambda}{1} = \dfrac{-(2\lambda-3)}{3}$

$\because$ Q lies on $x+y+z=3$ and $x-y+z=3$

$\Rightarrow x+z=3$ and $y=0$

$y=0 \Rightarrow \lambda+1 = \dfrac{-2\lambda+3}{3} \Rightarrow \lambda = 0$

$\Rightarrow$ Q is $(2,0,1)$

79. (c) $I = \int \frac{1}{\cos^{2/3}x\sin^{1/3}x\cdot\sin x}dx$

$= \int \dfrac{\tan^{2/3}x}{\tan^2 x}\cdot\sec^2 x\cdot dx$

$= \int \dfrac{\sec^2 x}{\tan^{4/3}x}\cdot dx\ \{\tan x = t, \sec^2 x dx = dt\}$

$= \int \frac{dt}{\tan^{4/3}} = \frac{t^{-1/3}}{-1/3} = -3\left(t^{-1/3}\right)$

$\Rightarrow 1 = -3\tan(x)^{-1/3}$

$\Rightarrow I = \left.\frac{3}{(\tan x)^{1/3}}\right|_{\pi/6}^{\pi/3} = -3\left(\frac{1}{(\sqrt{3})^{1/3}} - (\sqrt{3})^{1/3}\right)$

$= 3^{7/6} - 3^{5/6}$

80. (a) $\angle B = \frac{\pi}{3}$, by sine Rule

$\sin A = \frac{1}{2}$

$\Rightarrow A = 30°, a = 2, b = 2\sqrt{3}, c = 4$

$\Delta = \frac{1}{2} \times 2\sqrt{3} \times 2 = 2\sqrt{3}$sq. cm

81. (a) $b = ar$

$c = ar^2$

3a, 7 b and 15c are in A.P.

$\Rightarrow 14\ b = 3a + 15c$

$\Rightarrow 14(ar) = 3a + 15ar^2$

$\Rightarrow 14r = 3 + 15r^2$

$\Rightarrow 15r^2 - 14r + 3 = 0 \ \Rightarrow (3r-1)(5r-3) = 0$

$r = \frac{1}{3}, \frac{3}{5}$

Only acceptable value is $r = \frac{1}{3}$, because $r \in \left(0, \frac{1}{2}\right]$

$\therefore c.d = 7b - 3a = 7ar - 3a = \frac{7}{3}a - 3a = -\frac{2}{3}a$

$\therefore 4^{\text{th}}$ term $= 15c - \frac{2}{3}a = \frac{15}{9}a - \frac{2}{3}a = a$

82. (c) $\frac{dy}{dx} + y(\tan x) = 2x + x^2\tan x$

I.F. $= e^{\pm\int \tan x dx} = e^{\ln \cdot \sec x} = \sec x$

$\therefore y \cdot \sec x = \int (2x + x^2\tan x)\sec x \cdot dx$

$= \int 2x\sec x dx + \int x^2(\sec x \cdot \tan x)dx$

$y\sec x = x^2\sec x + \lambda$

$\Rightarrow y = x^2 + \lambda\cos x$

$y(0) = 0 + \lambda = 1 \Rightarrow \lambda = 1$

$y = x^2 + \cos x$

$y\left(\frac{\pi}{4}\right) = \frac{\pi^2}{16} + \frac{1}{\sqrt{2}}$

$y\left(-\frac{\pi}{4}\right) = \frac{\pi^2}{16} + \frac{1}{\sqrt{2}}$

$y'(x) = 2x - \sin x$

$y'\left(\frac{\pi}{4}\right) = \frac{\pi}{2} - \frac{1}{\sqrt{2}}$

$y'\left(\frac{-\pi}{4}\right) = \frac{-\pi}{2} + \frac{1}{\sqrt{2}}$

$y'\left(\frac{\pi}{4}\right) - y'\left(\frac{-\pi}{4}\right) = \pi - \sqrt{2}$

83. (b) $4x - 2y + 4z + 6 = 0$

$\frac{|\lambda - 6|}{\sqrt{16+4+16}} = \left|\frac{\lambda - 6}{6}\right| = \frac{1}{3}$

$|\lambda - 6| = 2$

$\lambda = 8,4$

$\frac{|\mu - 3|}{\sqrt{4+4+1}} = \frac{2}{3}$

$|\mu - 3| = 2$

$\mu = 5,1$

$\therefore$ Maximum value of $(\mu + \lambda) = 13$.

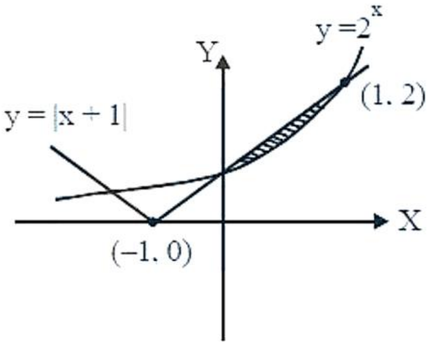
84. (c) Required Area

$\int_0^1 ((x+1) - 2^x)dx$

$= \left(\frac{x^2}{2} + x - \frac{2^x}{\ln 2}\right)_0^1$

$= \left(\frac{1}{2} + 1 - \frac{2}{\ln 2}\right) - \left(0 + 0 - \frac{1}{\ln 2}\right)$

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



85. (a) $D = 0$

$$\begin{vmatrix} 1 & 1 & 1 \\ 4 & \lambda & \lambda \\ 3 & 2 & -4 \end{vmatrix} = 0 \Rightarrow \lambda = 3$$

86. (a)

87. (c) $1 - \left(\frac{1}{2}\right)^n > \frac{99}{100}$

$\Rightarrow \left(\frac{1}{2}\right)^n < \frac{1}{100}$

$\Rightarrow n = 7$

88. (d) $\sim (\sim s \vee (\sim \wedge s))$

$s \wedge (r \vee \sim s)$

$(s \wedge r) \vee (s \wedge \sim s)$

$(s \wedge r) \vee (\phi)$

$(s \wedge r)$

89. (c) Let $x^2 = t\ 2xdx = dt$

$\Rightarrow \frac{1}{2}\int t^2 \cdot e^{-t}dt = \frac{1}{2}\left[-t^2 \cdot e^{-t} + \int 2t \cdot e^{-t}, dt\right]$

$= \frac{1}{2}(-t^2 \cdot e^{-t}) + \left(-t \cdot e^{-t} + \int 1 \cdot e^{-t} \cdot dt\right)$

$= -\frac{t^2 e^{-t}}{2} - te^{-t} - e^{-t} = \left(-\frac{t^2}{2} - t - 1\right)e^{-t}$

$= \left(-\frac{x^4}{2} - x^2 - 1\right)e^{-x^2} + C$

for $k = 0$

$g(-1) = -1 - 1 - \frac{1}{2} = -\frac{5}{2}$

90. (d) $|z| \cdot |w| = 1\ z = re^{i\left(\theta + \frac{\pi}{2}\right)}$ and $w = \frac{1}{r}e^{i\theta}$

$\bar{z} \cdot w = e^{-i\left(\theta + \frac{\pi}{2}\right)} \cdot e^{i\theta} = e^{-i\left(\frac{\pi}{2}\right)} = -i$

$z \cdot \bar{W} = e^{i\left(\theta+\frac{\pi}{2}\right)} \cdot e^{-i\theta} = e^{i\left(\frac{\pi}{2}\right)} = i$