1. (b)

Charge on the capacitor at any time ' t ' is

$q=CV\left(1-e^{-t/\tau}\right)$

at $t=2\tau$

$q=CV\left(1-e^{-2}\right)$

2. (c)

$f_C=\frac{1}{2\pi RC}=\frac{1}{2\times 3.14\times 100\times 10^3\times 250\times 10^{-12}}=6.37\text{kHz}$

$f_C=$ cut off frequency

As we know that f_m □ f_C

∴ (c) is correct

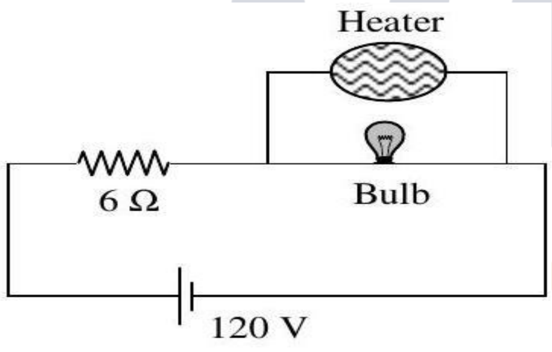
Note: The maximum frequency of modulation must be less than f_m, where

$f_m=f_C\frac{\sqrt{1-m^2}}{m}$

$m\Rightarrow$ modulation index

3. (c) Resistance of bulb $=\frac{120\times 120}{60}=240\Omega$

Resistance of Heater $=\frac{120\times 120}{240}=60\Omega$



Voltage across bulb before heater is switched on, $V_1=\frac{120}{246}\times 240$

Voltage across bulb after heater is switched on, $V_2=\frac{120}{54}\times 48$

Decrease in the voltage is $V_1-V_2=10.04$ (approximately)

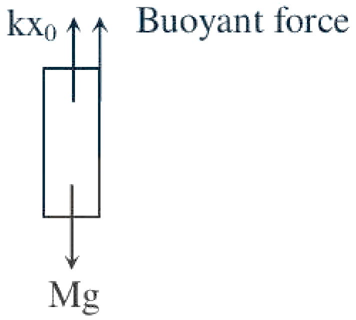
Note: Here supply voltage is taken as rated voltage.

4. (b)

At equilibrium $\Sigma F = 0$

$$kx_0 + \left(\frac{AL}{2}\sigma g\right) - Mg = 0$$

$$x_0 = Mg\left[1 - \frac{LA\sigma}{2M}\right]$$

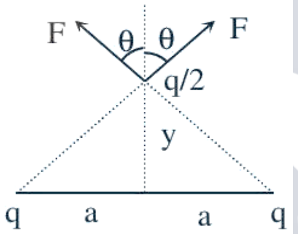


5. (d)

$$F_{\text{net}} = 2F\cos\theta$$

$$= 2\frac{k\cdot q\cdot q/2}{\left(\sqrt{a^2+y^2}\right)^2}\cdot\frac{y}{\sqrt{a^2+y^2}}$$

$$= \frac{kq^2y}{a^3}\mathbf{y} << \mathbf{a})$$



6. (b)

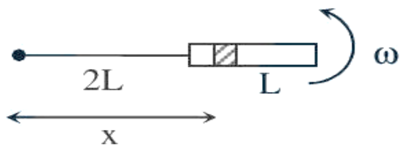
7. (b)

8. (c)

9. (c)

$$de = B(\omega x)\cdot dx$$

$$e = B\omega\int_{2L}^{3L} x\,dx$$



$$= \frac{5B\omega L^2}{2}$$

10. (c)

$$v \propto \left[\frac{1}{(n-1)^2} - \frac{1}{n^2}\right]$$

$$\propto \frac{(2n-1)}{n^2(n-1)^2}$$

$\propto \frac{1}{n^3}$ (since n □ 1)

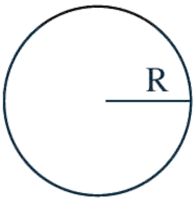
11. (c)

$\rho 4\pi R^2 \Delta RL = T4\pi[R^2 - (R - \Delta R)^2]$

$\rho R^2 \Delta RL = T[R^2 - R^2 + 2R\Delta R - \Delta R^2]$

$\rho R^2 \Delta RL = T2R\Delta R$($\Delta R$ is very small)

$R = \frac{2T}{\rho L}$.



12. (b)

13. (a)

73. $\frac{1}{4\pi\varepsilon_0}\frac{q^2}{r^2} = F$

$$\varepsilon_0 = \frac{[A^2\ T^2]}{[MLT^{-2}\ L^2]} = [M^{-1}\ L^{-3}\ A^2\ T^4]$$

14. (b) Heat is extracted from the source in path DA and AB is

$$\Delta Q = \frac{3}{2}R\left(\frac{P_0\ V_0}{R}\right) + \frac{5}{2}R\left(\frac{2P_0\ V_0}{R}\right) = \frac{13}{2}P_0\ V_0$$

15. (a) Fundamental frequency $f = \frac{1}{2\ell}\sqrt{\frac{T}{\mu}}$

$$= \frac{1}{2\ell}\sqrt{\frac{T}{A\rho}}$$

$$= \frac{1}{2\ell}\sqrt{\frac{\text{stress}}{\rho}} = \frac{1}{2\times1.5}\sqrt{\frac{2.2\times10^{11}\times10^{-2}}{7.7\times10^3}}.$$

16. (c) For Ammeter, $S = \frac{I_g G}{I - I_g}$

So for I to increase, S should decrease, so additional S can be connected across it.

17. (d)

$T.\ E_f = -\frac{GMm}{6R}$

$T.\ E_i = -\frac{GMm}{R}$

$$\Delta W = T \cdot E_f - T \cdot E_i = \frac{5GMm}{6R}$$

18. (a) $x = t$

$y = 2t - 5t^2$

Equation of trajectory is $y = 2x - 5x^2$

19. (a) $120C_1 = 200C_2$

$6C_1 = 10C_2$

$3C_1 = 5C_2$

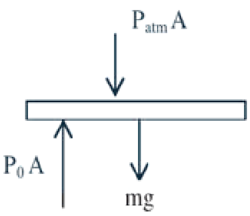
20. (b) From conservation of angular momentum about any fix point on the surface

$mr^2\omega_0 = 2mr^2\omega$

$\therefore \omega = \frac{\omega_0}{2}$

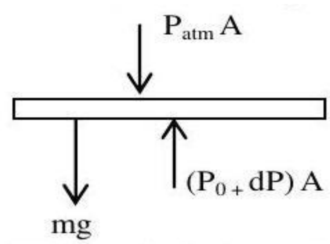
$\therefore V_{CM} = \frac{\omega_0 r}{2}$

21. (b)



FBD of piston at equilibrium

$\Rightarrow P_{atm}A + mg = P_0\ A$



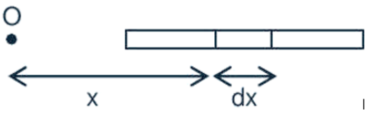
FBD of piston when piston is pushed down a distance x

$P_{atm} + mg - (P_0 + dP)A = m\frac{d^2x}{dt^2}$

Process is adiabatic $\Rightarrow PV^\gamma = C \Rightarrow -dP = \frac{\gamma P dV}{V}$

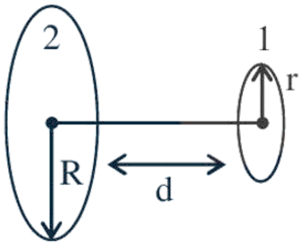
Using 1, 2, 3 me get $f = \frac{1}{2\pi}\sqrt{\frac{A^2\gamma P_0}{MV_0}}$

22.(c)



$V=\int_{x=L}^{x=2L}\frac{k}{x}\left(\frac{Q}{L}\right)dx=\frac{Q\ln 2}{4\pi\varepsilon_0 L}$

23. (d)



Let M_{12} be the coefficient of mutual induction between loops

$\phi_1=M_{12}i_2$

$\Rightarrow\frac{\mu_0 i_2 R^2}{2(d^2+R^2)^{3/2}}\pi r^2=M_{12}i_2$

$\Rightarrow M_{12}=\frac{\mu_0 R^2\pi r^2}{2(d^2+R^2)^{3/2}}$

$\phi_2=M_{12}i_1\Rightarrow\phi_2=9.1\times10^{-11}$ weber

24. (b) The temperature goes on decreasing with time (non-linearly) The rate of decrease will be more initially which is depicted in the second graph.

25. (d) For LED, in forward bias, intensity increases with voltage.

26. (c) Loss of energy is maximum when collision is inelastic as in an inelastic collision there will be maximum deformation.

KE in COM frame is $\frac{1}{2}\left(\frac{Mm}{M+m}\right)V_{\text{rel}}^2$

$\text{KE}_\text{i}=\frac{1}{2}\left(\frac{Mm}{M+m}\right)V^2\ KE_f=0(\because V_{\text{rel}}=0)$

Hence loss in energy is $\frac{1}{2}\left(\frac{Mm}{M+m}\right)V^2$

$\Rightarrow f=\frac{M}{M+m}$

27. (b)

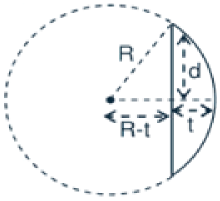
$A=A_0e^{-kt}$

$\Rightarrow 0.9A_0=A_0e^{-5k}$

and $\alpha A_0=A_0e^{-15k}$

solving $\Rightarrow\alpha=0.729$

28.(b)



$R^2 = d^2 + (R - t)^2$

$R^2 - d^2 = R^2\left\{1 - \frac{t}{R}\right\}^2$

$1 - \frac{d^2}{R^2} = 1 - \frac{2t}{R}$

$R = \frac{(3)^2}{2 \times (0 \cdot 3)} = \frac{90}{6} = 15 \text{ cm}$

$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

$\frac{1}{f} = \left(\frac{3}{2} - 1\right)\left(\frac{1}{15}\right)$

$f = 30 \text{ cm}$

29. (a)

$\mathrm{E}_0 = CB_0$

$= 3 \times 10^8 \times 20 \times 10^{-9}$

$= 6 \text{ V/m}$

30. **(a)** $B_{\text{net}} = B_{M_1} + B_{M_2} + B_H$

$= \frac{\mu_0 M_1}{4\pi x^3} + \frac{\mu_0 M_2}{4\pi x^3} + B_H$

$= \frac{\mu_0}{4\pi x^3}(M_1 + M_2) + B_H$

$= \frac{10^{-7}}{10^{-3}} \times 2.2 + 3.6 \times 10^{-5}$

$= 2.56 \times 10^{-4} \text{ Wb/m}^2$

31. (a) Reaction proceeds through carbocation formation as 3^0 carbocation is highly stable, hence reaction proceeds through S_N1 with 3^0 alcohol.

32. (a) Na $\underset{\Delta H=-5.1\text{eV}}{\overset{\Delta H=+5.1\text{eV}}{\rightleftarrows}}$ $Na^+ + e^-$, here the backward reaction releases same amount of energy and known as Electron gain enthalpy.

33. (a)

$Li_2(6) = \sigma 1\ s^2 ** 1s^2 \sigma 2\ s^2$

$B.O. = \frac{4-2}{2} = 1$

$Li_2^+(5) = \sigma 1s^2 ** 1s^2 \sigma 2s^1$

$B.\ O. = \frac{3-2}{2} = 0.5$

$Li_2^-(7) = \sigma 1s^2 \overset{*}{\sigma} 1s^2 \sigma 2s^2 ** 2s^1$

$B.O. = \frac{4-3}{2} = 0.5$

Li_2^+ is more stable than Li_2^- because Li_2^- has more numbers of antibonding electrons.

34.(d)

$M_1\ V_1 + M_2\ V_2 = MV$

$$M = \frac{M_1V_1 + M_2V_2}{V} = \frac{0.5 \times 750 + 2 \times 250}{1000}$$

$M = 0.875$

35. (All the options are correct statements)

(a) Correct, as $O \gtrless O_{\text{is bent}}$

(b) Correct, as ozone is violet-black solid.

(c) Correct, as ozone is diamagnetic.

(d) Correct, as $ONCl = 32$ electrons and $ONO^- = 24$ electron hence are not isoelectronic.

All options are correct statements.

36.(c)

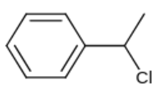
$E^0_{Mn^{+3}/Mn^{+2}} = 1.57\ V$

$E^0_{Fe^{+3}/Fe^{+2}} = 0.77\ V$

$E^0_{Co^{+3}/Co^{+2}} = 1.97\ V$

$E^0_{Cr^{+3}/Cr^{+2}} = -0.41\ V$

37. (b)



$\xrightarrow{SbCl_5} [Ph-CH-CH_3]^+ [SbCl_6]^-$

Planer structure

38. (a) $As_2\ S_3$ is an anionic sol (negative sol) hence coagulation will depend upon coagulating power of cation, which is directly proportional to the valency of cation (Hardy-Schulze rule).

39. (c)

Initial pH = 1, i.e. $[H^+] = 0.1$ mole/ litre

New pH = 2, i.e. $[H^+] = 0.01$ mole/litre

In case of dilution: $M_1 V_1 = M_2 V_2$

$0.1 \times 1 = 0.01 \times V_2$

$V_2 = 10$ litre.

Volume of water added = 9 litre.

40. (a) & (d) both are correct answers.

$N_2 \rightarrow$ Diamagnetic

$O_2 \rightarrow$ Paramagnetic

$S_2 \rightarrow$ Paramagnetic
$C_2 \rightarrow$ Diamagnetic

41. (b) & (d) both are correct answers)

The exothermic hydration enthalpies of the given trivalent cations are:

$Sc^{+3} = 3960$ kJ/mole

$Fe^{+3} = 4429$ kJ/mole

$Co^{+3} = 4653$ kJ/mole

$Cr^{+3} = 4563$ kJ/mole

Hence Sc^{+3} is least hydrated; so least stable (not most stable)

Fe^{+2} contains 4 unpaired electrons where as Mn^{+2} contains 5 unpaired electrons hence (d) is incorrect.

42. (a)

Metal oxide = $M_{0.98}O$

If ' x ' ions of M are in +3 state, then

$3x + (0.98 - x) \times 2 = 2$

$x = 0.04$

So the percentage of metal in +3 state would be $\frac{0.04}{0.98} \times 100 = 4.08\%$

43. (a)

$$R-NH_2 + CH_3-\overset{\overset{O}{\|}}{C}-Cl \longrightarrow R-NH-\overset{\overset{O}{\|}}{C}-CH_3 + HCl$$

Each $CH_3 - C$ addition increases the molecular wt. by 42 .

Total increase in m.wt. $= 390 - 180 = 210$

Then number of NH_2 groups $= \frac{210}{42} = 5$

44. (c) As per data mentioned

MnO_4^- is strongest oxidizing agent as it has maximum SRP value.

45. (b) Correct order of acidic strength is III > I > II > IV

46. (d) As per Arrhenius equation:

$$\ln\frac{k_2}{k_1} = -\frac{E_a}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

$$2.303\log 2 = -\frac{E_a}{8.314}\left(\frac{1}{310} - \frac{1}{300}\right)$$

$\Rightarrow E_a = 53.6\ \mathrm{kJ/mole}$

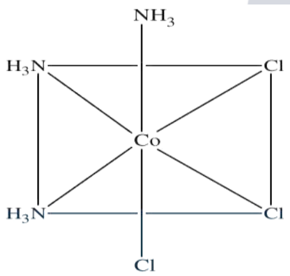
47. (d)

$$12H_2O + 12NADP + 18ADP \xrightarrow{\text{Light reaction}} 6O_2 + 18ATP + 12NADPH$$

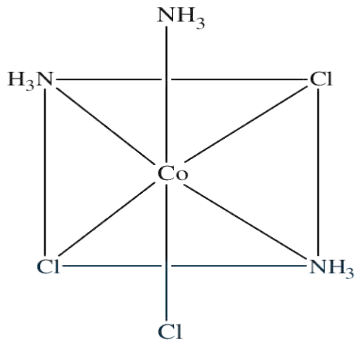
$$6CO_2 + 12NADPH + 18ATP \xrightarrow{\text{Dark reaction}} C_6H_{12}O_6 + 12NADP + 18ADP + 6H_2O$$

Net reaction: $6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$

48. (b) $[Co(NH_3)_3Cl_3]$ exists in two forms (facial and meridonial)



facial



meridonial

Both of these forms are achiral. Hence, $[Co(NH_3)_3Cl_3]$ does not show optical isomerism.

49. (d) Process is isothermal reversible expansion, hence $\Delta U = 0$.

$\therefore q = -W$

As $q = +208$ J

Hence $W = -208$ J

50. (c)

51. (c) Order of stability is III > I > II.

(Stability ∝ extent of delocalization)

52. (b) Increasing order of first ionization enthalpy is

$Ba < Ca < Se < S < Ar$

53. (b)

$$C^* = \sqrt{\frac{2RT}{M}}, \bar{C} = \sqrt{\frac{8RT}{\pi M}}, C = \sqrt{\frac{3RT}{M}}$$

54. (d) It was methyl isocyanate (CH_3NCO)

55. (b) $2MnO_4^- + 5C_2O_4^{-2} + 16H^+ \longrightarrow 2Mn^{+2} + 10CO_2 + 8H_2O$

$x = 2, y = 5, z = 16$

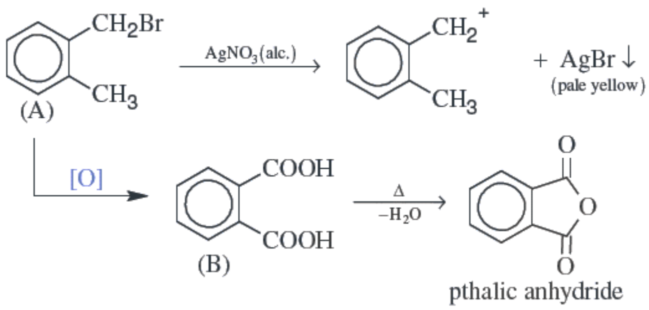
56. (a) Silicon (Si) - covalent solid

Sulphur (S_8) - molecular solid

Phosphorous (P_4) - Molecular solid

Iodine (I_2) - Molecular solid

57.



58. (d) $E = \frac{hc}{\lambda} = 2.178 \times 10^{-18} \times Z^2 \left[\frac{1}{1^2} - \frac{1}{2^2}\right]$

$\Rightarrow \lambda = 1.214 \times 10^{-7}$ m

59. (c)

60. (b) Bond order of H_2^{2+} and He_2 is zero, thus their existence is not possible.

61. (b) $(x-3)^2 + y^2 + \lambda y = 0$

The circle passes through $(1,-2)$

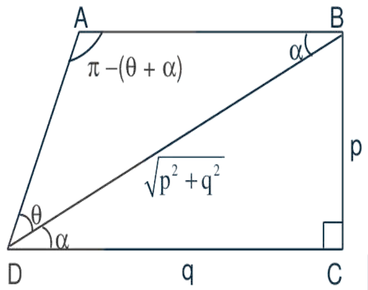
$\Rightarrow 4+4-2\lambda=0 \Rightarrow \lambda=4$

$(x-3)^2+y^2+4y=0 \Rightarrow$ Clearly $(5,-2)$ satisfies.

62. (d) Using sine rule in triangle ABD

$$\frac{\mathrm{AB}}{\sin\theta}=\frac{\mathrm{BD}}{\sin(\theta+\alpha)}$$

$$\Rightarrow \mathrm{AB}=\frac{\sqrt{\mathrm{p}^2+\mathrm{q}^2}\sin\theta}{\sin\theta\cos\alpha+\cos\theta\sin\alpha}=\frac{\sqrt{\mathrm{p}^2+\mathrm{q}^2}\sin\theta}{\frac{\sin\theta\cdot\mathrm{q}}{\sqrt{\mathrm{p}^2+\mathrm{q}^2}}+\frac{\cos\theta\cdot\mathrm{p}}{\sqrt{\mathrm{p}^2+\mathrm{q}^2}}}$$



$\Rightarrow \mathrm{AB}=\frac{(\mathrm{p}^2+\mathrm{q}^2)\sin\theta}{(\mathrm{p}\cos\theta+\mathrm{q}\sin\theta)}$.

63. (a) Let the tangent to the parabola be $y=mx+\frac{\sqrt{5}}{m}(m\neq 0)$.

Now, its distance from the center of the circle must be equal to the radius of the circle.

So, $\left|\frac{\sqrt{5}}{\mathrm{m}}\right|=\frac{\sqrt{5}}{\sqrt{2}}\sqrt{1+\mathrm{m}^2} \Rightarrow (1+\mathrm{m}^2)\mathrm{m}^2=2 \Rightarrow \mathrm{m}^4+\mathrm{m}^2-2=0$.

$\Rightarrow (\mathrm{m}^2-1)(\mathrm{m}^2+2)=0 \Rightarrow \mathrm{m}=\pm 1$

So, the common tangents are $\mathrm{y}=\mathrm{x}+\sqrt{5}$ and $\mathrm{y}=-\mathrm{x}-\sqrt{5}$.

64. (a) Slope of the incident ray is $-\frac{1}{\sqrt{3}}$.

So, the slope of the reflected ray must be $\frac{1}{\sqrt{3}}$.

The point of incidence is $(\sqrt{3},0)$. So, the equation of reflected ray is $y=\frac{1}{\sqrt{3}}(x-\sqrt{3})$.

65. (c) Variance is not changed by the change of origin.

Alternate Solution:

$$\sigma=\sqrt{\frac{\sum|\mathrm{x}-\bar{\mathrm{x}}|^2}{\mathrm{n}}} \text{ for } \mathrm{y}=\mathrm{x}+10 \Rightarrow \bar{\mathrm{y}}=\bar{\mathrm{x}}+10$$

$$\sigma_1=\sqrt{\frac{\sum|\mathrm{y}+10-\bar{\mathrm{y}}-10|^2}{\mathrm{n}}}=\sqrt{\frac{\sum|\mathrm{y}-\bar{\mathrm{y}}|^2}{\mathrm{n}}}=\sigma.$$

66. (d) If x, y, z are in A.P.

$2y = x + z$

and $\tan^{-1} x, \tan^{-1} y, \tan^{-1} z$ are in A.P.

$2\tan^{-1} y = \tan^{-1} x + \tan^{-1} z \Rightarrow x = y = z.$

Note: If $y = 0$, then none of the options is appropriate.

67. (b) $\int f(x)dx = \psi(x)$

Let $x^3 = t$

$3x^2 dx = dt$

then $\int x^5 f(x^3)dx = \frac{1}{3}\int tf(t)dt$

$= \frac{1}{3}\left[t\int f(t)dt - \int \{1 \cdot \int f(t)dt\}dt\right] = \frac{1}{3}x^3\psi(x^3) - \int x^2\psi(x^3)dx + C.$

68. (d) foci $\equiv (\pm\, ae, 0)$

We have $a^2e^2 = a^2 - b^2 = 7$

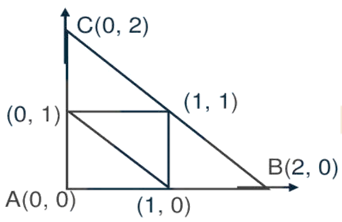
Equation of circle $(x-0)^2 + (y-3)^2 = (\sqrt{7}-0)^2 + (0-3)^2$

$\Rightarrow x^2 + y^2 - 6y - 7 = 0.$

69. (a) x-coordinate $= \frac{ax_1+bx_2+cx_3}{a+b+c}$

$$= \frac{2 \times 2 + 2\sqrt{2} \times 0 + 2 \times 0}{2 + 2 + 2\sqrt{2}}$$

$= \frac{4}{4+2\sqrt{2}} = \frac{2}{2+\sqrt{2}} = 2 - \sqrt{2}.$



Alternate Solution:

x-coordinate $= r = (s-a)\tan A/2$

$= \left(\frac{4+2\sqrt{2}}{2} - 2\sqrt{2}\right)\tan\frac{\pi}{4} = 2 - \sqrt{2}.$

70. (d)

$\frac{dy}{dx} = |x| = 2 \Rightarrow x = \pm 2 \Rightarrow y = \int_0^2 |t|dt = 2$ for $x = 2$

and $y = \int_0^{-2} |t| dt = -2$ for $x = -2$

$\therefore$ tangents are $y - 2 = 2(x - 2) \Rightarrow y = 2x - 2$

and $y + 2 = 2(x + 2) \Rightarrow y = 2x + 2$

Putting $y = 0$, we get $x = 1$ and -1 .

71. (b) $t_r = 0.777 \ldots . r$ times

$$= 7(10^{-1} + 10^{-2} + 10^{-3} + \cdots . +10^{-r})$$
$$= \frac{7}{9}(1 - 10^{-r})$$
$$S_{20} = \sum_{r=1}^{20} t_r = \frac{7}{9}\left(20 - \sum_{r=1}^{20} 10^{-r}\right) = \frac{7}{9}\left(20 - \frac{1}{9}(1 - 10^{-20})\right) = \frac{7}{81}(179 + 10^{-20})$$

72. (a)

S1:

p	q	~p	~q	p^~q	~p^q	(p^~q)^(~p^q)
T	T	F	F	F	F	F
T	F	F	T	T	F	F
F	T	T	F	F	T	F
F	F	T	T	F	F	F

Fallacy

S2:

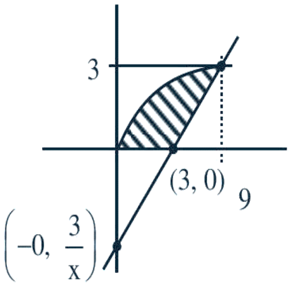
p	q	~ p	~ q	$p \Rightarrow q$	$\sim q \Rightarrow \sim p$	$(p \Rightarrow q) \Leftrightarrow (\sim q \Rightarrow \sim p)$
T	T	F	F	T	T	T
T	F	F	T	F	F	T
F	T	T	F	T	T	T
F	F	T	T	T	T	T

Tautology

S2 is not an explanation of S1

73. (d)

$$2\sqrt{x} = x - 3$$
$$4x = x^2 - 6x + 9$$
$$x^2 - 10x + 9$$
$$x = 9, x = 1$$
$$\int_0^3 (2y + 3) - y^2 \Big] dy$$
$$\left[y^2 + 3y - \frac{y^3}{3}\right]_0^3 = 9 + 9 - 9 = 9$$



74. (a) $\frac{1}{\cot A(1-\cot A)}-\frac{\cot^2 A}{(1-\cot A)}=\frac{1-\cot^3 A}{\cot A(1-\cot A)}=\frac{\operatorname{cosec}^2 A+\cot A}{\cot A}=1+\sec A \operatorname{cosec} A$

75. (c) If $2x^3+3x+k=0$ has 2 distinct real roots in $[0,1]$, then $f'(x)$ will change sign but $f'(x)=6x^2+3>0$

So, no value of K exists.

76. (c) $\lim_{x\to 0}\frac{(1-\cos 2x)}{x(\tan 4x)}(3+\cos x)$

$\lim_{x\to 0} 2\left(\frac{\sin x}{x}\right)^2\cdot\frac{1}{4}\left(\frac{4x}{\tan 4x}\right)(3+\cos x)=2\times 1\times\frac{1}{4}\times 1\times(3+1)=2.$

77. (a) ${}^{n+1}C_3-{}^{n}C_3=10\Rightarrow {}^{n}C_2=10\Rightarrow n=5$

78. (b) $\int_{2000}^{P} dP=\int_0^{25}(100-12\sqrt{x})dx$

$$(P-2000)=25\times 100-\frac{12\times 2}{3}(25)^{3/2}$$

$P=3500.$

79. (c) $I=\int_{\pi/6}^{\pi/3}\frac{dx}{1+\sqrt{\tan x}}$

$$I=\int_{\pi/6}^{\pi/3}\frac{\sqrt{\tan x}}{1+\sqrt{\tan x}}dx$$

$$2I=\frac{\pi}{6}$$

$I=\frac{\pi}{12}.$

80. (a) $P=\begin{bmatrix}1 & \alpha & 3\\ 1 & 3 & 3\\ 2 & 4 & 4\end{bmatrix}$

$|\text{Adj } A|=|A|^2$

$|\text{ Adj } A\ |=16$

$1(12-12)-\alpha(4-6)+3(4-6)=16.$

$2\alpha-6=16.$

$2\alpha=22.$

$\alpha=11.$

81. (a) For no solution

$\frac{k+1}{k}=\frac{8}{k+3}\neq\frac{4k}{3k-1}$

$\Rightarrow (k+1)(k+3)-8k=0$

or $k^2-4k+3=0 \Rightarrow k=1,3$

But for $k=1$, equation (1) is not satisfied

Hence $k=3$.

82. (d)

$$y=\sec(\tan^{-1}x)$$
$$\frac{dy}{dx}=\sec(\tan^{-1}x)\tan(\tan^{-1}x)\cdot\frac{1}{1+x^2}$$
$$\left.\frac{dy}{dx}\right|_{x=1}=\sqrt{2}\times 1\times\frac{1}{2}=\frac{1}{\sqrt{2}}.$$

83. (b) $\begin{vmatrix}1 & -1 & -1\\ 1 & 1 & -k\\ k & 2 & 1\end{vmatrix}=0$

$1(1+2k)+1(1+k^2)-1(2-k)=0$

$k^2+1+2k+1-2+k=0$

$k^2+3k=0$

$(k)\ (k+3)=0$

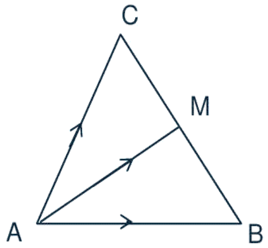
2 values of k.

84. (b) $A\times B$ will have 8 elements.

$2^8-{}^8C_0-{}^8C_1-{}^8C_2=256-1-8-28=219.$

85. (b)

$$\overrightarrow{AM}=\frac{\overrightarrow{AB}+\overrightarrow{AC}}{2}$$
$$\overrightarrow{AM}=4\hat{i}-\hat{j}+4\hat{k}$$
$$|\overrightarrow{AM}|=\sqrt{16+16+1}=\sqrt{33}$$



86. (b) P(correct answer) $=1/3$

$${}^5C_4\left(\frac{1}{3}\right)^4\left(\frac{2}{3}\right)^1+{}^5C_5\left(\frac{1}{3}\right)^5$$

$\frac{5\times2}{(3)^5}+\frac{1}{(3)^5}=\frac{11}{3^5}$.

87. (b)

$$|z|=1\Rightarrow z\bar{z}=1$$
$$\frac{1+z}{1+\bar{z}}=\frac{1+z}{1+\frac{1}{z}}=z$$

88. (d) For equation $x^2+2x+3=0$

both roots are imaginary.

Since $a,b,c\in R$.

If one root is common then both roots are common

Hence, $\frac{a}{1}=\frac{b}{2}=\frac{c}{3}$

$a:b:c=1:2:3$.

89. (b)
$$4x+2y+4z=16$$
$$4x+2y+4z=-5$$
$$d_{\min}=\frac{21}{\sqrt{36}}=\frac{21}{6}=\frac{7}{2}.$$

90. (b) $\left(\frac{(x^{1/3}+1)(x^{2/3}-x^{1/3}+1)}{x^{2/3}-x^{1/3}+1}-\frac{1}{\sqrt{x}}\cdot\frac{(\sqrt{x}+1)(\sqrt{x}-1)}{(\sqrt{x}-1)}\right)^{10}=\left(x^{1/3}-x^{-1/2}\right)^{10}$

$T_{r+1}=(-1)^r\,{}^{10}C_r x^{\frac{20-5r}{6}}\Rightarrow r=4$

${}^{10}C_4=210$.