MOCK TEST PAPER for JEE Main

Physics, Chemistry & Mathematics

Solutions

PHYSICS

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	4	4	2	3	3	1	4	4	1	3	1	2	1	2	3
Ques.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	1	3	3	4	4	1	2	4	4	1	1	2	2	2	2

CHEMISTRY

Ques.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	3	1	3	2	2	4	1	2	4	2	3	1	3	2	1
Ques.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans	2	2	1	1	2	2	1	1	4	3	3	4	3	3	3

MATHEMATICS

Ques.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Ans.	3	3	2	3	2	3	1	3	2	2	3	4	3	1	3
Ques.	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Ans.	3	2	3	1	1	2	1	2	3	2	2	3	2	2	2

PHYSICS

1.[4] $F = \frac{\mu_0}{2\pi}\frac{i_1 i_2}{r}$

$$F' = \frac{\mu_0}{2\pi}\frac{\left(\frac{i_1}{3}\right)\left(\frac{i_2}{3}\right)}{3r} = \frac{F}{27}$$

2.[4] Along the wire $\vec{d\ell} \times \vec{r} = 0$

$\therefore$ dB = 0

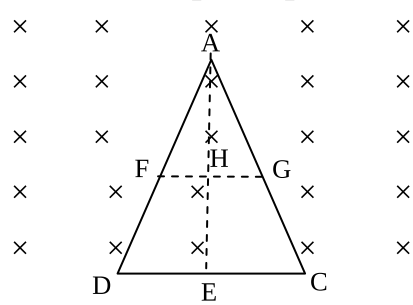
3.[2] Let 2a be the side of the triangle and b the length AE.

$$\frac{AH}{AE} = \frac{GH}{EC}$$

$$\therefore GH = \left(\frac{AH}{AE}\right)EC$$

$$= \frac{b - vt}{b}.a = a - \left(\frac{a}{b}\right)vt$$

$$\therefore FG = 2GH = 2\left[a - \frac{a}{b}vt\right]$$



Induced e.m.f., $e = Bv(FG) = 2Bv\left(a - \frac{a}{b}vt\right)$

$\therefore$ Induced current, $I = \frac{e}{R} = \frac{2Bv}{R}\left[a - \frac{a}{b}vt\right]$

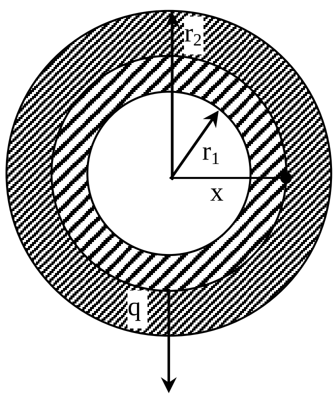
or $I = k_1 - k_2t$

Thus, I – t graph is a straight line with negative slope and positive intercept.

4. [3] $I = \frac{dq}{dt} = q_0\,(\omega \cos \omega t)$

$I = \omega q_0 \cos wt$

5. [3]



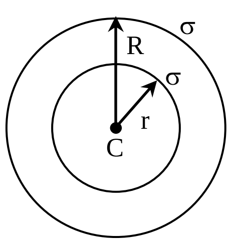
Gaussian surface

$$\oint \vec{E}\cdot\vec{dS} = \frac{q_{in}}{\epsilon_0}$$

$$E \cdot 4\pi x^2 = \frac{q \times \frac{4}{3}\pi(x^3 - r_1^3)}{\frac{4}{3}\pi(r_2^3 - r_1^3)\,\epsilon_0}$$

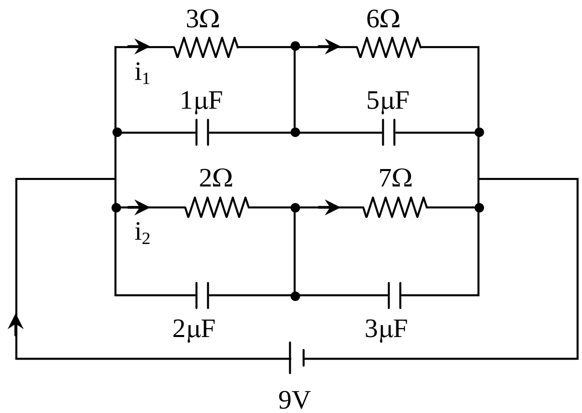
$$E = \frac{q}{4\pi\epsilon_0 x^2}\left(\frac{x^3 - r_1^3}{r_2^3 - r_1^3}\right)$$

6. [1]



$$V_C = \frac{\sigma r}{\epsilon_0} + \frac{\sigma R}{\epsilon_0}$$

7. [4]



$i_1 = \frac{9}{3+6} = 1A$, $i_2 = \frac{9}{2+7} = 1A$

Pd at 1μF = P.d of 3Ω

$= i_1 \times 3 = 1 \times 3 = 3V$

$\therefore$ Charge at 1μF = CV = 1μF × 3 = 3μC

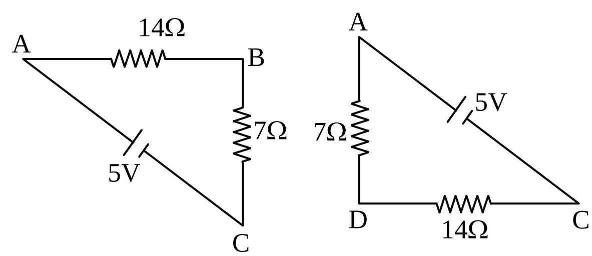
P.d. at 3μF = p.d at 7 Ω = $i_2 \times 7 = 1 \times 7 = 7V$

Charge at 3μF = CV = 3μF × 7 V = 21μC

8. [4] Resistance of an ideal ammeter = 0

$\therefore$ V = i × 0 = 0

9. [1]



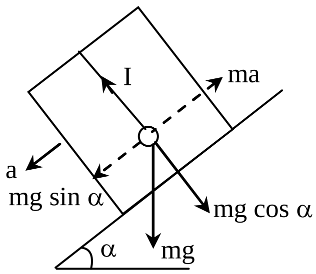
$$V_B - V_C = \frac{7}{14+7} \times 5 = \frac{5}{3}\ V$$

$$V_D - V_C = \frac{14}{7+14} \times 5 = \frac{10}{3}\ V$$

$$\therefore\ V_D - V_B = \frac{10}{3} - \frac{5}{3} = \frac{5}{3}\ V$$

10. [3] When an object is released from moving frame it will have same velocity as that of frame so packet will have same orbital velocity as that of satellite so it will never reach the earth.

11. [1]



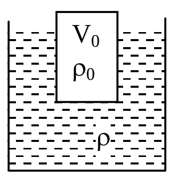
$g_{eff} = \frac{T}{m}$

$g_{eff} = \frac{mg\cos\alpha}{m}$

$T = 2\pi\sqrt{\frac{L}{g_{eff}}}$

$T = 2\pi\sqrt{\frac{L}{g\cos\alpha}}$

12. [2]



$V_{in}\,\rho g = V_0\rho_0 g$

$\frac{V_{in}}{V_0} = \frac{\rho_0}{\rho}$

$\frac{V_{out}}{V_0} = 1 - \frac{V_{in}}{V_0} = 1 - \frac{\rho_0}{\rho}$

13. [1] By conservation of momentum

$\vec{P_i} = \vec{P_f}$

$m_1\sqrt{(2gd)} = (m_1 + m_2)v$ ...(1)

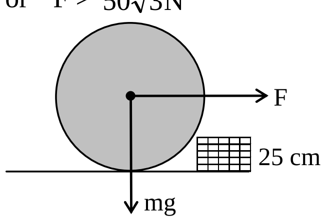
$\frac{1}{2}(m_1 + m_2)u^2 = (m_1 + m_2)gh$

$h = d\left\{\frac{m_1}{m_1 + m_2}\right\}^2$

14.[2] $\tau_F > \tau_{Mg}$

$F \times 25 > (5g) \times \sqrt{50^2 - 25^2}$

or $F > 50\sqrt{3}N$



15.[3] Line = n – 1 = 3

16.[1] $\xrightarrow[\text{constant rate}]{X} \underset{N}{(A)} \xrightarrow{\lambda}$

No. of nuclei of A will be maximum when the radio active equilibrium is established.

Rate of formation of A = Rate of decay of A

$X = \lambda N\left(\lambda = \frac{\ell n2}{T_H} = \frac{\ell n2}{Y}\right)$

$X = \frac{\ell n2}{Y}N$

$N = \frac{XY}{\ell n2}$

17.[3] $E = \frac{hc}{\lambda} - \phi_0$ .....(1)

$2E = \frac{hc}{\lambda'} - \phi_0$ .....(2)]

on solving $\lambda' = \frac{hc\lambda}{E\lambda + hc}$

18. [3] Transverse elastic waves can propagates in solid and on the water surface.

19. [4] $y = 4\sin 2\pi\left(\frac{t}{0.02} - \frac{x}{100}\right)$

compare it with the standard eq^n

$y = A\sin 2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right)$

So T = 0.02 sec

$n = \frac{1}{T} = \frac{1}{0.02} = 50$ Hz .....(i)

λ = 100 cm = 1 m

Wave velocity v = nλ = 50 m/sec

Maximum particle velocity $V_{max} = A\omega$

= 4 (2π × 50) = 400 π cm/sec

= 4π m/sec

21. [1] $d = \sqrt{2Rh}$

$N = \pi d^2\sigma = 2\pi Rh\,\sigma$

= 2 × 3.14 × 6400 × 0.1 × 1000

$= 2 \times 3.14 \times 6.4 \times 10^5$

$= 39.5 \times 10^5$

22. [2] $\frac{\Delta X}{X} \times 100 = \left[3\frac{\Delta a}{a} + 2\frac{\Delta b}{b} + \frac{\Delta d}{d} + \frac{1}{2}\frac{\Delta c}{c}\right] \times 100$

$= 3 \times 1 + 2 \times 3 + 4 + \frac{1}{2} \times 2$

$= 3 + 6 + 4 + 1 = 14\ \%$

23. [4] If t is the time of flight, then

$$0 = vt - \frac{1}{2} g \cos\theta\, t^2$$

$$t = \frac{2v}{g\cos\theta}$$

$$\Rightarrow \quad R = 0 + \frac{1}{2} g \sin\theta t^2$$

$$R = \frac{1}{2} g \sin\theta \times \left(\frac{2v}{g\cos\theta}\right)^2$$

$$R = \frac{2v^2}{g} \tan\theta \sec\theta$$

24. [4] Angular magnification $= -\frac{f_0}{f_e} = \frac{16m}{2cm} = -800$

Length of tube $L = f_0 + f_e = 16.02$ m

–ve sign represents inverted image.

25. [1] Angular separation of two adjacent maxima is

$$\Delta\theta = \frac{\lambda}{d}$$

Let angular separation be 10 % greater for wavelength λ'

their $\frac{1.1\lambda}{d} = \frac{\lambda'}{d}$

$\lambda' = 1.10\ \lambda = 648$ mm

26. [1] Least count of V.C. $= \frac{1}{10} = 0.1$ mm

Side of cube = 10mm + 1 × 0.1mm = 1.01 cm

density $= \frac{\text{mass}}{\text{volume}} = \frac{2.736g}{(1.01)^3 cm^3} = 2.66\ g/cm^3$

27. [2] $P = P_0 - aV^2$

From ideal gas equation

PV = nRT

$(P_0 - aV^2)\, V = nRT$

$$T = \frac{P_0 V}{nR} - \frac{aV^3}{nR}$$

$$\frac{dT}{dV} = \frac{P_0}{nR} - \frac{-3aV^2}{nR} = 0$$

$$P_0 = 3aV^2 \Rightarrow \quad V = \sqrt{\frac{P_0}{3a}}$$

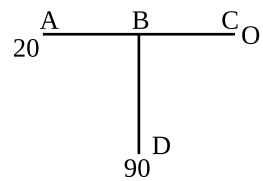
$$P = P_0 - a\left(\frac{P_0}{3a}\right)$$

$$P = \frac{2P_0}{3}$$

$$\left(\frac{2P_0}{3}\right)\sqrt{\frac{P_0}{3a}} = nRT_{max}$$

$$T_{max} = \left(\frac{2P_0}{3nR}\right)\left(\frac{P_0}{3a}\right)^{1/2}$$

28. [2]



$H_{AB} = 0$

$H_{DB} = H_{BC}$

[means $T_A = T_B = 20$]

$$\frac{KA(90-20)}{\ell_{BD}} = \frac{KA(20-0)}{\ell_{BC}}$$

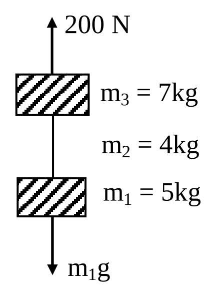
$$= \frac{\ell_{BD}}{\ell_{BC}} = \frac{7}{2}$$

29. [2] Reading = 2T

$$= \frac{4m_1 m_2 (g+a)}{m_1 + m_2}$$

= 8 g

30. [2]



200 – 160 = 16a

40 = 16a

$a = \frac{10}{4} = \frac{5}{2}$

$a = 2.5\ m/s^2$

200 – 70 – T = 7 × a

130 – T = 7 × 2.5

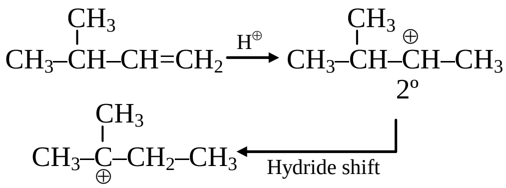
130 – T = 17.5

T = 130 – 17.5

T = 112.5 N

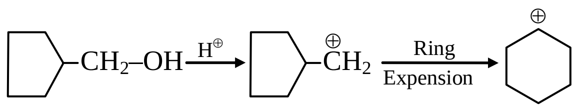
CHEMISTRY

31.[3]



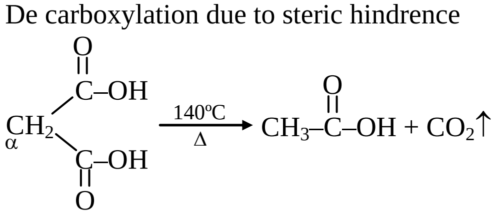
3º (more stable)

32.[1]



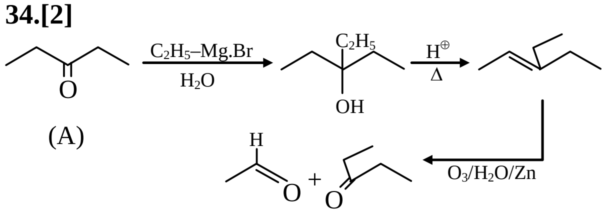
[More stable]

33.[3] De carboxylation due to steric hindrence



[Melonic Acid]

34.[2]



35.[2] $Zn \rightarrow ZnS$
$Cu \rightarrow CuFeS_2$
$Pb \rightarrow PbS$

36.[4]

Compound	No. of unpaired e^-
$[MnCl_4]^{-2}$	5
$[CoCl_4]^{-2}$	3
$[Fe(CN)_6]^{-4}$	0

37.[1]

Compound	No. of ions per molecule
$[Pt(NH_3)_5Cl]Cl_3$	4
$[Pt(NH_3)_6]Cl_4$	5
$[Pt(NH_3)_2Cl_4]$	0
$[Pt(NH_3)_4Cl_2]Cl_2$	3

38.[2] $(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} N_2 + Cr_2O_3 + H_2O$

39.[4] 'I' can not form 4 bonds

40.[2] $Zn(NO_3)_2 \xrightarrow{\Delta} ZnO + NO_2 + O_2$

41.[3] Ionic compounds are solid due to presence of strong electrostatics force of attraction.

42.[1] Down the group solubility of alkali metal hydroxide is increases.
So correct order
$LiOH < NaOH < KOH < RbOH < CsOH$

43.[3] $\Delta G = \Delta H - T\Delta S$

$\Delta H - T\Delta S < 0$

$-38.3 \times 10^3 - T(-113) < 0$

$T < 338.93$ K (i.e. 66°C)

44.[2] According to third law of thermodynamics.

45.[1] $NH_4COONH_2(s) \rightleftharpoons 2NH_3(g) + CO_2(g)$

2P   P

= 2   = 1

3P = 3

P = 1

$K_P = P^2_{NH_3} \cdot P_{CO_2}$

$= 2^2 \times 1 = 4.$

46.[2] For –ve deviation $\Delta H_{mixixng} = -ve$
and $\Delta V_{mixng} = -ve$

47.[2] $a = 2(r^+ + r^-)$

$400 = 2(80 + r_a)$

$\therefore r_a = 120$

48.[1] $E^o = \frac{0.0591}{2} \log K_{eq.}$

$\log K_{eq.} = \frac{2 \times 0.22}{0.0591} = 7.44$

$K_{eq} = 2.8 \times 10^7$

49.[1] According to arrhenius equation,
$K = A.e^{-Ea/RT}$

50.[2] $K = \frac{2.303}{t} \log \left[\frac{C_{A_0}}{C_A}\right]$

$$2.303 \times 1 = 2.303 \log \left[\frac{C_{A_0}}{C_A}\right]$$

$$\frac{C_{A_0}}{C_A} = 10$$

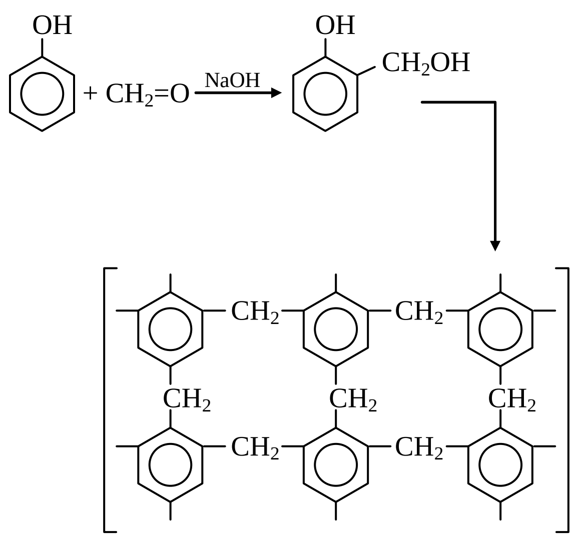
$$\therefore C_A = \frac{1}{10} = 0.1$$

$\therefore$ rate after 1 min, $r_1 = KC_A$
$= 2.303 \times 0.1 = 0.2303\ M.min^{-1}$

51.[2] Phenelzine is use as a antidepressant.

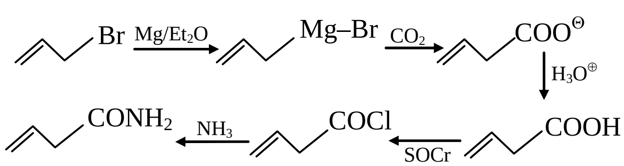
52.[1] Both the structure of starch (Amylose and amylopectine) are formed by α-D glucose.

53.[1]

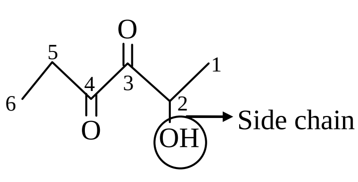


(Bakelite)

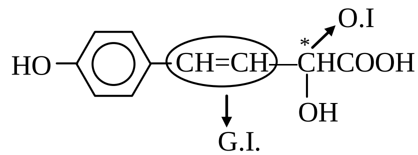
54.[4]



55.[3]

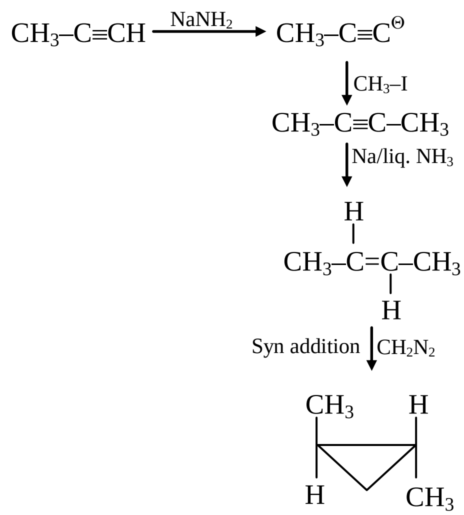


56.[3]



Both O.I. & G.I. possible.

57.[4]



(±) Trans-1,2-dimethylcyclopropane.

58.[3] $\lambda = \frac{h}{mv}$ and $v \propto \sqrt{T}$

$$\frac{\lambda_1}{\lambda_2} = \sqrt{\frac{T_2}{T_1}}$$

$$= \frac{\lambda_1}{\lambda_2} = \sqrt{\frac{1200}{300}}$$

$$\lambda_2 = \frac{\lambda}{2}$$

60.[3] Let the mass of mixture = 100 gm
Mass of CO_2 = 66 gm
Mass of H_2= 34 gm

no. of moles of $CO_2 = \frac{66}{44} = 1.5$

no. of moles of $H_2 = \frac{34}{2} = 17$

total no. of moles = $\frac{\text{mass of mixture}}{\text{Mav}}$

$$\text{Mav} = \frac{100}{18.5} = 5.4$$

$$\text{V.D.} = \frac{M}{2} = \frac{5.4}{2}$$
$= 2.7$

MATHEMATICS

61.[3] The tangent of slope m must be of the form $y = m(x+2) + \frac{a}{m}$

So, $2m + \frac{2}{m} = c \Rightarrow c = 2\left(m + \frac{1}{m}\right) \geq 2 \times 2$. So

$c_{min} = 4$

62.[3] $\vec{a} + \vec{b} = \vec{p}$

$\Rightarrow |\vec{a} + \vec{b}|^2 = |\vec{p}|^2$

$\Rightarrow (\vec{a} + \vec{b}).(\vec{a} + \vec{b}) = |\vec{p}|^2$

$= |\vec{a}|^2 + |\vec{b}|^2 + 2\vec{a}.\vec{b} = |\vec{p}|^2$

Also, $\vec{a} - \vec{b} = \vec{q}$

$\Rightarrow |\vec{a} - \vec{b}|^2 = |\vec{q}|^2$

$\Rightarrow (\vec{a} - \vec{b}).(\vec{a} - \vec{b}) = |\vec{q}|^2$

$= |\vec{a}|^2 + |\vec{b}|^2 - 2\vec{a}.\vec{b} = |\vec{q}|^2$

Thus $2(|\vec{a}|^2 + |\vec{b}|^2) = |\vec{p}|^2 + |\vec{q}|^2$

63.[2] Equation of the required plane is

$(x + y + z - 6) + \lambda(2x + 3y + z + 5) = 0$

i.e. $(1+2\lambda)x + (1+3\lambda)y + (1+\lambda)z + (-6+5\lambda) = 0$

This plane is perpendicular to xy plane whose equation is $z = 0$

i.e. $0 \,.\, x + 0 \,.\, y + z = 0$

$\therefore$ By condition of perpendicularity

$0\,.(1 + 2\lambda) + 0.\,(1 + 3\lambda) + (1 + \lambda)\,.1 = 0$

i.e. $\lambda = -1$

$\therefore$ Equation of required plane is

$(1 - 2)x + (1 - 3)y + (1 - 1)z + (-6 - 5) = 0$ or $x + 2y + 11 = 0$.

64.[3] We have

$f(x) = \sin(\log(-x + \sqrt{1+x^2}\,))$

$f(-x) = \sin\log(x + \sqrt{1+x^2}\,)$

$=\sin\log\left(\left(x + \sqrt{1+x^2}\right)\left(\frac{-x + \sqrt{1+x^2}}{-x + \sqrt{1+x^2}}\right)\right)$

$= \sin\log\left(\frac{1}{-x + \sqrt{1+x^2}}\right)$

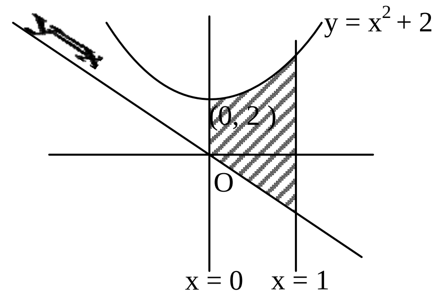
$= -\sin\log\left(-x + \sqrt{1+x^2}\right)$

$= -f(x)$ odd function, hence zero (S-I) is true.

$\int_{-a}^{a} f(x) = 0$ only when, f(x) is odd function

Hence S-II is wrong.

65.[2]



Required shaded area

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

$= \int_0^1 (x^2 + x + 2)dx = \left(\frac{x^3}{3} + \frac{x^2}{2} + 2x\right)_0^1$

$= \frac{1}{3} + \frac{1}{2} + 2 = \frac{17}{6}$

66.[3] We have

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

$(x + 1)\,\frac{dy}{dx} = y - y^2$

$\frac{dy}{y(1-y)} = \frac{dx}{x+1}$

$\left(\frac{1}{y} + \frac{1}{1-y}\right)dy = \frac{dx}{x+1}$

On integrating both side, we get

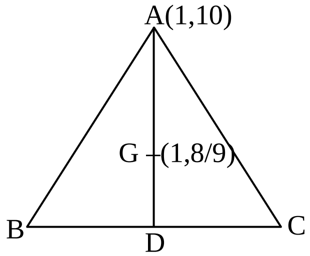
$\log y - \log(1 - y) = \log(x + 1) + \log c$

$\log\left(\frac{y}{y-1}\right) = \log\,(x+1)c$

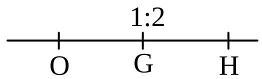
$\frac{y}{y-1} = (x+1)c$

$c'y = (x + 1)(y - 1)$

67.[1]



Circumcentre O ≡ (–1/3, 2/3) and orthocenter H ≡ (11/3, 4/3).

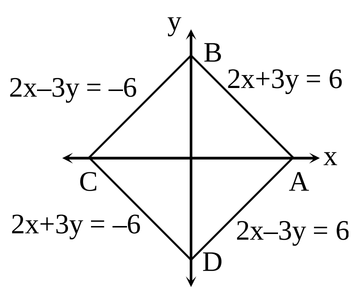


Therefore, the coordinates of G are (1, 8/9). Now, the point A is (1, 10) as G is (1, 8/9). Hence, AD : DG = 3 : 1

$\therefore\ D_x = \frac{3-1}{2} = 1, D_y = \frac{\frac{8}{3}-10}{2} = -\frac{11}{3}$

Hence, the coordinates of the mid-point of BC are (1, –11/3).

68.[3]



The given inequality represents a rhombus with sides 2x ± 3y = 6 and 2x ± 3y = –6

$\text{Area} = \frac{2c^2}{db} = \frac{2(6)^2}{(2)(3)} = 12$

69.[2] $c_1 = (1, 2),\ r_1 = \sqrt{1+4+95} = 10$

$c_2 = (3, 4);\ r_2 = \sqrt{9+16-16} = 3$

$c_1c_2 = \sqrt{(3-1)^2+(4-2)^2} = \sqrt{8} = 2\sqrt{2}$

$\therefore\ c_1c_2 < |r_1 - r_2|$ (one circle lies in side the other)

$\therefore$ The statement-I is true and statement-II is also true and correct explanation of statement-I.

70.[2] $\int \frac{dx}{x^2.x^{n-1}[1+x^{-n}]^{\frac{n-1}{n}}}$

$\int \frac{dx}{x^{n+1}(1+x^{-n})^{\frac{n-1}{n}}}$

Put $1 + x^{-n} = t^n$

$\frac{dx}{x^{n+1}} = t^{n-1}dt$

71.[3] for point of intersection at exactly one point

$\lambda x + 3 = (\lambda + 1)x^2 + 2$

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

$\Delta = 0$

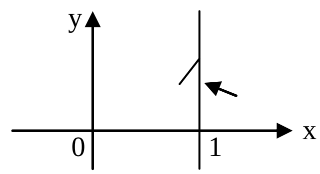
$\lambda^2 + 4(\lambda + 1) = 0$

$\lambda^2 + 4\lambda + 4 = 0$

$(\lambda + 2)^2 = 0$

$\lambda = -2$

72.[4]

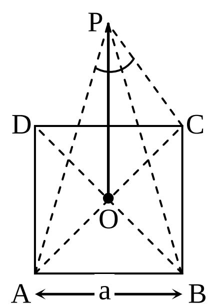


V ≥ R

$5 \geq -2(1 + h) + \log_2(b^2 - 2)$

solve for b then $b^2 - 2 > 0$

73.[3]



Let side of square = a

then $OA = a/\sqrt{2}$

As ∠OPA = 45º

$OA = OP = a/\sqrt{2}$

Clearly, AP = a = BP

As AB = a

So, ΔABP be equilateral Δ

Hence ∠APB = 60º

74.[1] Put $\frac{1}{2}\cos^{-1}\frac{\sqrt{5}}{3} = \theta$

$\Rightarrow \cos 2\theta = \frac{\sqrt{5}}{3}$ and $0 \leq 2\theta \leq \pi$

$\Rightarrow \frac{1-\tan^2\theta}{1+\tan^2\theta} = \frac{\sqrt{5}}{3}$

$\Rightarrow \frac{1+\tan^2\theta}{1-\tan^2\theta} = \frac{3}{\sqrt{5}}$

$\Rightarrow \tan^2\theta = \frac{3-\sqrt{5}}{3+\sqrt{5}} = \frac{(3-\sqrt{5})^2}{4}$

$\Rightarrow \tan\theta = \pm\dfrac{3-\sqrt{5}}{2}$

$\Rightarrow \tan\theta = \dfrac{3-\sqrt{5}}{2}$ As $0 \le \theta \le \pi/2$

75.[3] Since $A \subseteq B$, $\therefore$ $A \cup B = B$
So, $n(A \cup B) = n(B) = 6$

76.[3] $(\log_3 512 \log_4 9 - \log_3 8 \log_4 3) \times (\log_2 3 \log_3 4 - \log_3 4 \log_8 3)$

$= \left(\dfrac{\log 512}{\log 3}\dfrac{\log 9}{\log 4} - \dfrac{\log 8}{\log 3}\dfrac{\log 3}{\log 4}\right) \times \left(\dfrac{\log 3}{\log 2}\dfrac{\log 4}{\log 3} - \dfrac{\log 4}{\log 3}\dfrac{\log 3}{\log 8}\right)$

$= \left(\dfrac{9\log 2}{\log 3}\dfrac{2\log 3}{2\log 2} - \dfrac{3\log 2}{\log 3}\dfrac{\log 3}{2\log 2}\right) \times \left(\dfrac{\log 3}{\log 2}\dfrac{2\log 2}{\log 3} - \dfrac{2\log 2}{\log 3}\dfrac{\log 3}{3\log 2}\right)$

$= \left(9 - \dfrac{3}{2}\right)\left(2 - \dfrac{2}{3}\right) = 10$

77.[2] $\dfrac{\alpha}{10} = (A^{-1})_{23} = \dfrac{C_{32}}{|A|} = \dfrac{-\begin{vmatrix} 1 & 1 \\ 2 & -3 \end{vmatrix}}{10} = \dfrac{5}{10} \Rightarrow \alpha = 5$

78.[3] mean $(\mu) = \dfrac{\sum f_i y_i}{\sum f_i}$

$\sum f_i\ (y_i - \mu) = \sum f_i y_i - \mu \sum f_i = 0$

Statement-I is true.

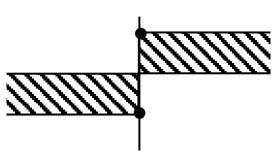
Again the mean of the square of the first n natural numbers $= \dfrac{\sum n^2}{n}$

$= \dfrac{n(n+1)(2n+1)}{6n} = \dfrac{(n+1)(2n+1)}{6}$

Statement-II is false .

79.[1] Clearly (a) is wrong as it is '$\vee$' operator

80.[1]



odd function

$\left(\text{sgn}(x)^{\text{sgn}\,x}\right)^n = \begin{cases} ((1)^1)^n & ; x > 0 \\ ((-1)^{-1})^n ; & x < 0 \end{cases}$

$= \begin{cases} 1; & x > 0 \\ -1; & x < 0 \end{cases}$

81.[2] Do your self

82.[1] Given fog = I

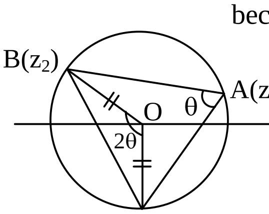
$\Rightarrow$ fog(x) = x for all x

$\Rightarrow f'(g(x))\, g'(x) = 1$ for all x

$\Rightarrow f'(g(a)) = \dfrac{1}{g'(a)} = \dfrac{1}{2}$

$\Rightarrow f'(b) = \dfrac{1}{2}$

83.[2] After solving the determinant
$a^3 + b^3 + c^3 - 3abc = 0$
$(a + b + c)\cdot(a^2 + b^2 + c^2 - ab - bc - ca) = 0$
$\dfrac{1}{2}(a + b + c)\,[(a-b)^2 + (b-c)^2 + (c-a)^2] = 0$
$\because (a-b)^2 + (b-c)^2 + (c-a)^2 = 0$
$\because a = b = c$ [$\because a + b + c \ne 0 \because z_1 \ne 0$ because $|z_1| = a \ne 0$ etc]



Hence OA = OB = OC
where O is the origin and A, B, C are the points representing z_1, z_2, z_3 respectively.
Therefore, O is circumcentre of ΔABC.

$\arg\left(\dfrac{z_3}{z_2}\right) = \angle BOC = 2\angle BAC$

$= 2\arg\left(\dfrac{z_3 - z_1}{z_2 - z_1}\right) = \arg\left(\dfrac{z_3 - z_1}{z_2 - z_1}\right)^2$

84.[3] let $a_1 = 1$
$a_2 = 2$
$a_3 = 4$
$a_4 = 8$
So, $b_1 = 1$
$b_2 = 1 + 2 = 3$
$b_3 = 3 + 4 = 7$
$b_4 = 7 + 8 = 15$

The numbers b_1, b_2, b_3 , b_4 are not in G.P. and A.P.
Statement-I is correct but Statement-II wrong.

85.[2] If $(x + 2)^2 = (\omega - \omega^2)^2$

$x^2 + 4 + 4x = \omega^2 + \omega^4 - 2\omega^3$

$x^2 + 4 + 4x = \omega^2 + \omega - 2$

$(x^2 + 4x + 7) = 0$ ...(i)

$x^4 + 3x^3 + 2x^2 - 11x - 6$

$= x^2(x^2 + 4x + 7) - x(x^2 + 4x + 7) - (x^2 + 4x + 7) + 1$

$= x^2(0) - x(0) - 0 + 1$ By (i)

$= 1$

86.[2] $T_{r+1} = {}^{1024}C_r(5^{1/2})^{1024-r}(7^{1/8})^r$

Now this term is an integer if 1024 – r is an even integer, for which

r = 0, 2, 4, 6, …, 1022, 1024 of which r = 0,8,16. 2424,...., 1024 are divisible by 8 which makes r/8 an integer.

For A.P., r = 0, 8, 16, 24, ..., 1024

$1024 = 0 + (n - 1)8 \Rightarrow n = 129$

87.[3] Sum of coefficients in $(1 - x\sin\theta + x^2)^n$ is $(1 - \sin\theta + 1)^n$ (putting x = 1)

This sum is greatest when $\sin\theta = -1$, then maximum sum is 3^n.

88.[2] Suppose there 'n' players in the beginning. The total number of games to be played was equal to ${}^nC_2$ and each player would have played n – 1 games.

Let us assume that A and B fell ill. Now the total number of games of A and B is (n – 1) + (n – 1) – 1 = 2n – 3. But they have played 3 games each. Then their remaining number of games is 2n – 3 – 6 = 2n – 9. Given,

${}^nC_2 - (2n - 9) = 84$

$\Rightarrow n^2 - 5n - 150 = 0$

$\Rightarrow n = 15$

Alternative solutions :

The number of games excluding A and B is ${}^{n-2}C_2$. But before leaving A and B played 3 games each. Then, ${}^{n-2}C_2 + 6 = 84$

Solving this equation, we get n = 15.

89.[2] $P = \frac{\lfloor n-2 \times \lfloor 2}{\lfloor n-1} = \frac{2}{n-1} = \frac{2}{2+n-3}$

odds against = n – 3 : 2

90.[2] $P(A) = \frac{1}{1+2} = \frac{1}{3}$

$P(A \cup B) = \frac{3}{3+1} = \frac{3}{4}$

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$\Rightarrow P(B) = \frac{3}{4} - \frac{1}{3} + P(A \cap B)$

$P(B) = \frac{5}{12} + P(A \cap B) \quad \Rightarrow \frac{5}{12} \le P(B) \le 3/4$