BRANCH OFFICE-1 : HO : World Trade Tower, 99- Rajpur Road. Dehradun (U.K.)
BRANCH OFFICE-2 : GMS Road, Ballupur Chowk, Dehradun (U.K.)
PH: 0135-6557701 / 02 / 03, **MOB.:** 9045062312 / 14 / 15 / 16 / 17 / 18 / 20. **web: www.aviral.co.in**

ULTIMATE TEST SERIES JEE-MAIN-2017

TEST - 01, 01-03-2017

[PHYSICS]

1. Answer (3)

$$\frac{1}{v}+\frac{1}{u}=\frac{1}{f}\Rightarrow\frac{1}{f}=-\left[\frac{1}{0.90}+\frac{1}{0.45}\right]\Rightarrow\frac{1}{f}=-\frac{10}{3}\text{ m}$$

$\Rightarrow$ $f = -0.3$ m

$$-\frac{\Delta f}{f^2}=-\frac{\Delta v}{v^2}-\frac{\Delta u}{u^2}\Rightarrow\Delta f=f^2\left[\frac{\Delta v}{v^2}+\frac{\Delta u}{u^2}\right]$$

$$\Rightarrow\Delta f=\frac{3}{10}\times\frac{3}{10}\left[\frac{0.01}{0.45\times0.45}+\frac{0.01}{0.90\times0.90}\right]$$

$$=\frac{3}{10}\times\frac{3}{10}\times\frac{1}{45}\times\frac{100}{45}\times\frac{5}{4}=0.006\text{ m}$$

$\Rightarrow f = [0.3 \pm 0.006]$ m

2. Answer (2)

$$h=\frac{1}{2}gt^2 \qquad ...(1)$$

$$\frac{h}{2}=\frac{1}{2}g(t-1)^2 \qquad ...(2)$$

Solving, t = 3.41 sec.

3. Answer (4)

$$200-120=12a_1\Rightarrow a_1=\frac{80}{12}=\frac{20}{3}\text{ms}^{-2}\uparrow$$

$$200-150=15a_2\Rightarrow a_2=\frac{50}{15}=\frac{10}{3}\text{ms}^{-2}\uparrow$$

$$a_p=\frac{\frac{20}{3}+\frac{10}{3}}{2}=5\text{ ms}^{-2}\uparrow$$

4. Answer (3)

For equilibrium,

$$F=-\frac{dU}{dx}=0=\frac{d}{dx}(x^2-6x)=2x-6\Rightarrow x=3\text{m}$$

At x = 3 m, U = 9 – 18 = – 9 joule

$E = K + U$

11 = K + (–9) $\Rightarrow K$ = 20 J

5. Answer (2)

$$V_{max}=\sqrt{gr\tan(\theta+\lambda)}=\sqrt{gr\frac{(\tan\theta+\tan\lambda)}{(1-\tan\theta.\tan\lambda)}}$$

$$=\sqrt{gr\frac{(\tan\theta+\mu)}{[1-\tan\theta\times\mu]}}=\sqrt{\frac{10\times2\left(\frac{3}{4}+\frac{1}{2}\right)}{\left(1-\frac{1}{2}\times\frac{3}{4}\right)}}$$

$$=\sqrt{200\times\frac{5\times8}{4\times5}}=\sqrt{400}=20\text{ ms}^{-1}$$

6. Answer (4)

$x=4t^2-3t\Rightarrow v=8t-3\Rightarrow a=8\text{ ms}^{-2}$

$\Rightarrow$ $\boxed{F=16\text{N}}\Rightarrow dx=(8t-3)dt$

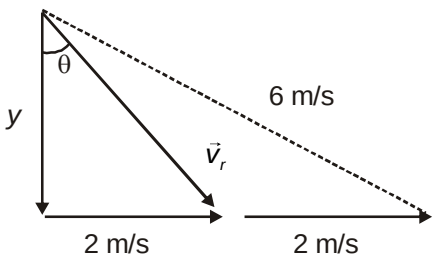
$$W=\int dW=\int F dx=\int_0^t 16(8t-3)dt=16(4t^2-3t)$$

$t=\frac{3}{4}$ s, $W=0$

For W to be minimum, $\frac{dW}{dt}=0\Rightarrow t=\frac{3}{8}$ s

$\frac{d^2W}{dt^2}=8,\ \frac{d^2W}{dt^2}>0$

7. Answer (4)



$$\frac{2}{y}=\tan\theta$$

$$y=2\cot\theta$$

Now, $\sqrt{y^2+16}=36\Rightarrow 4\cot^2\theta+16=36$

$\Rightarrow\ \cot^2\theta=5\Rightarrow\theta=\cot^{-1}(\sqrt{5})$

8. Answer (2)

$3kx_1 = 2kx_2 = kx_3 \Rightarrow 3x_1 = 2x_2 = x_3$ ..(1)

$x = x_1 + x_2 + x_3$

$\Rightarrow x = x_1 + \frac{3}{2}x_1 + 3x_1 \Rightarrow x = \frac{11x_1}{2}$

$\Rightarrow x_1 = \frac{2}{11}x.$

9. Answer (1)

10. Answer (3)

$2T - mg = ma_1 \uparrow$ ...(1)

$Mg - T = Ma_2 \downarrow$ ...(2)

$a_{rel} = a_1 + a_2$ ...(3)

$a_2 = 2a_1$ ...(4)

Solving, $a_1 = \frac{3g}{21}$

Then $a_{rel} = \frac{3g}{21} + \frac{6g}{21} = \frac{9}{21}g = \frac{3g}{7}$

Now, $l = \frac{1}{2}a_{rel}.t^2 \Rightarrow l = \frac{1}{2} \times \frac{3g}{7}.t^2 \Rightarrow t = \sqrt{\frac{14g}{3l}}$

11. Answer (4)

$F = -\frac{dU}{dx} \Rightarrow \frac{dU}{dx} = -F$

$\Rightarrow$ For equilibrium, $F = 0 \Rightarrow \frac{dU}{dx} = 0$

For stable equilibrium,

$\frac{d^2U}{dx^2} > 0 \Rightarrow \frac{d}{dx}\left(\frac{dU}{dx}\right) > 0 \Rightarrow \frac{d}{dx}(-F) > 0 \Rightarrow -\frac{dF}{dx} > 0$

$\Rightarrow \frac{dF}{dx} < 0$ for unstable equilibrium, $\frac{dF}{dx} > 1.$

12. Answer (3)

$\vec{v}_{rel} = (v - v\cos\theta)\hat{i} + v\sin\theta\hat{j} \Rightarrow \left|\overrightarrow{v_{rel}}\right|$

$= v\sqrt{(1-\cos\theta)^2 + \sin^2\theta} = 2v\sin\frac{\theta}{2}$

$|\bar{v}_{rel}| = \frac{\int_0^{2\pi} 2v\sin\theta/2 d\theta}{2\pi\int_0 d\theta} = \frac{2v}{2\pi} = \frac{\left(-\cos\frac{\theta}{2}\right)_0^{2\pi}}{\frac{1}{2}}$

$= \frac{2v}{\pi}\left[-\cos\frac{\theta}{2}\right]_0^{2\pi} = \frac{4v}{\pi}$

13. Answer (2)

2.221
$\times$ 1.2
2.6652 = 2.7

Now,

238.523
2.7
241.2

Number of *SF* = 4

14. Answer (2)

$t = \frac{s_{rel}}{v_{rel}} = \frac{l}{v + v\cos 60°} = \frac{2l}{3v}$

Distance = $v \times t = v \times \frac{2l}{3v} = \frac{2l}{3} = \frac{2}{3} \times 3 = 2$ m.

15. Answer (4)

For no motion between blocks,

$F_{max} = \mu_2(m_1 + m_2)q = 0.4 \times 10 \times 10 = 40$ N

Thus, $F_{max} = 40$ N

As, $F_{max} > F$ applied.

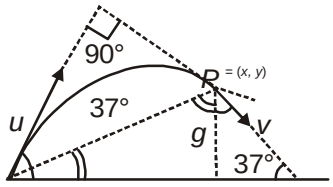
Hence between blocks $a_{rel} = 0$

$\Rightarrow a_{common} = \frac{30}{10} = 3\ ms^{-2}$

Now, for 4 kg

$f = ma = 4 \times 3 = 12$ N.

16. Answer (3)



$\theta = 53$

When $\vec{v} \perp \vec{u}$

$t = \frac{u}{g\sin\theta}$ ...(1)

$v = u\cot\theta$ ...(2)

$\Rightarrow v = u \times \frac{3}{4} = 10 \times \frac{3}{4} = \frac{15}{2}\ ms^{-1}$

At *P*, $\frac{v^2}{R} = g\cos 37° \Rightarrow R = \frac{v^2}{g\cos 37°}$

$\Rightarrow R = \frac{15}{2} \times \frac{15}{2} \times \frac{5}{10 \times 4}$

$R = \frac{225}{32}$m

17. Answer (4)

F_{upon} due to $B = (m_A + m_B)(g + a)$

$= (2 + 3)(10 + 2) = 60\text{N}\downarrow$

Displacement $s = ut + \frac{1}{2}at^2 = -5 \times t = \frac{1}{2} \times 2 \times t^2$

$= -5 \times 2 + \frac{1}{2} \times 2 \times 4 = -10 + 4 = 6 \text{ m} \downarrow$

$W = \vec{F}.\vec{S} = 60 \times 6 = 360 \text{ J}$

18. Answer (4)

$\mu_s mg = m\sqrt{a_T^2 + \frac{v_m^4}{r^2}}$

$\Rightarrow \mu^2 g^2 = a_T^2 + \frac{v_m^4}{r^2}$

$\Rightarrow \frac{1}{4} \times 100 = 9 + \frac{v_m^4}{16}$

$\Rightarrow v_m^4 = 16 \times 16$

$\Rightarrow v_m = 4 \text{ms}^{-1}$

Now, $a = \frac{vdv}{ds} \Rightarrow vdv = ads$

$\int_u^v vdv = \int_o^s ads$

$v^2 = u^2 + 2as$

$(4)^2 = (2)^2 + 2 \times 3 \times s$

$2 \times 6 = 6 \times s \Rightarrow \boxed{s = 2\text{m}}$

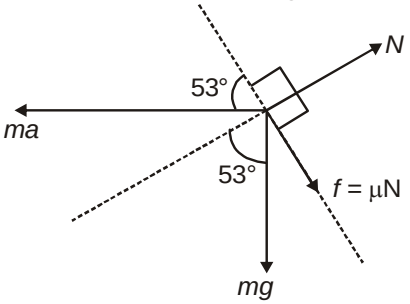
19. Answer (3)

$N = mg\cos 53° + ma.\sin 53°$

$N = mg \times \frac{3}{5} + ma \times \frac{4}{5}$ ...(1)

$\mu N + mg \sin 53° = ma\cos 53°$ ...(2)

FBD of block w.r.t. wedge



$0.1\left[\frac{3}{5}mg + \frac{4}{5}ma\right] + \frac{4}{5}mg = \frac{3}{5}ma$

$\frac{1}{10}[3mg + 4ma] + 4mg = 3ma$

$3mg + 4ma + 40mg = 30\, ma$

$\Rightarrow 43\, mg = 26\, ma$

$\Rightarrow \boxed{a = \frac{43}{26}g}$ ...(3)

Now, $F = (M + m)a = 6 \times \frac{43}{26}g = \frac{129}{13}$ g N

20. Answer (1)

$T - mg = ma$ ...(1)

$Mg - 31T = M \times \frac{a}{31}$ ...(2)

Solving, $a = \frac{31g(M - 31m)}{M + 961m}$

21. Answer (4)

From work-energy theorem,

$W_F + W_{by}mg + W_{by}tr = \Delta K = 0$

$W_F - mgR\sin 60° - \mu mg(R - R\cos 60°) = 0$

$W_F = mgR\frac{\sqrt{3}}{2} + \frac{\mu mgR}{2} = \frac{mgR}{2}\left(\mu + \sqrt{3}\right)$

22. Answer (3)

$F = -\frac{dU}{dx} = -\left[\frac{d}{dx}\left(-\frac{2}{3}x^3 + \frac{3}{2}x^2 + 2x\right)\right]$

$= -\left[-\frac{2}{3} \times 3x^2 + \frac{3}{2} \times 2x + 2\right] = -\left[-2x^2 + 3x + 2\right]$

$F = 2x^2 - 3x - 2$ ..(1)

$F = 0 \Rightarrow 2x^2 - 3x - 2 = 0$

$\Rightarrow 2x^2 - 4x + x - 2 = 0$

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

$x = 2,\ x = -\frac{1}{2}$

Now, $\frac{dF}{dx} = 4x - 3$ at $x = 2$,

$\frac{dF}{dx} = 4 \times 2 - 3 = 8 - 3 = 5$

$\frac{dF}{dx} > 0 \Rightarrow \frac{d^2y}{dx^2} < 0$

Thus at $x = 2$, unstable equilibrium.

At $x = -\frac{1}{2}, \frac{dF}{dx} = 4x\left(-\frac{1}{2}\right) - 3x = -5, \frac{dF}{dx} < 0$

$\Rightarrow \frac{d^2y}{dx^2} > 0$

Thus $x = -\frac{1}{2}$, stable equilibrium.

23. Answer (4)

Limiting friction between B and C = 0.5 × 4 × 10 = 20 N

Maximum common acceleration $= \frac{20}{4} = 5\ ms^{-2}$

Now, $a_{max} = \frac{m_{Amax}.g}{m_A + 3 + 4} \Rightarrow 5 = \frac{m \times 10}{m + 7}$

$10m_A = 5m_A + 35 \Rightarrow m_A = 7$ kg

When $m_A = 5$ kg, $a = \frac{5 \times 10}{5 + 3 + 4} = \frac{50}{12} ms^{-2}$

$\Rightarrow f = 4 \times \frac{50}{12} = \frac{50}{3}$ N

24. Answer (4)

At A, $T_A - mg = \frac{mv_A^2}{l} \Rightarrow T_A = mg + 6mg = 7\ mg$

At B, $T_B = \frac{mv_B^2}{l} = 4mg, T$ and C,

$T_C + mg - \frac{mv_C^2}{l} \Rightarrow T_C = m \times \frac{V_C^2}{l} - mg - 2mg - mg$

$\boxed{T_B = 4mg}$ $\boxed{T_A = 7mg}$ $\boxed{T_C = mg}$

25. Answer (4)

For $UCM, \vec{v} \perp \frac{d}{dt}\vec{v}$

For accelerated CM, $\vec{v}.\frac{d}{dt}\vec{v} > 0$

For decelerated $CM, \vec{v}.\frac{d}{dt}\vec{v} < 0$.

26. Answer (4)

27. Answer (2)

28. Answer (3)

29. Answer (2)

30. Answer (1)

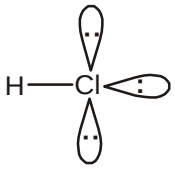
[CHEMISTRY]

31. Answer (1)

Uue (119) $\rightarrow [Rn]_{86}5f^{14}6d^{10}7s^27p^7$

Hence it belongs to 17th group.

32. Answer (3)



1 bond pair, 3 lone pair.

33. Answer (1)

NO (15) Bond order = 2.5

NO^+ (14) Bond order = 3

NO^- (16) Bond order = 2

Hence, order of bond energy $NO^+ > NO > NO^-$

34. Answer (2)

Let the uncertainty in momentum = x

Uncertainty in position = 4x

$\therefore \quad 4x^2 = \frac{h}{4\pi} \Rightarrow x = \frac{1}{4}\sqrt{\frac{h}{\pi}}$

Hence uncertainty in position $= \sqrt{\frac{h}{\pi}}$.

35. Answer (3)

$C_nH_{2n}O_n + nO_2(g) \longrightarrow nCO_2(g) + nH_2O(l)$

1 mL n mL n mL

$\therefore$ Contraction in volume = 1 + n – n = 1 mL.

36. Answer (4)

Fact.

37. Answer (2)

Electronic configuration (56) – $[Xe]_{54}6s^2$

38. Answer (4)

Radius of n^{th} shell = r_0n^2

$\Rightarrow r_0(n + 1)^2 - r_0(n - 1)^2 = 2r_0n^2$

$\Rightarrow (n + 1 + n - 1)(n + 1 - n + 1) = 2n^2$

$\Rightarrow 2n \times 2 = 2n^2$

$\Rightarrow \boxed{n = 2}$

39. Answer (1)

$I_2 + AsO_2^- + 2H_2O \rightarrow AsO_4^{3-} + 2I^- + 3H^+$

m.eq. of $HAsO_2$ (in 50 mL) = m.eq. of I_2 = 35 × 0.05 × 2 = 3.5

$\therefore$ meq of $HAsO_2$ in 250 mL = 17.5

weight of $HAsO_2 = \frac{17.5}{2} \times 108 \times 10^{-3} = 0.945$ g

% of $HAsO_2$ in the sample $= \frac{0.945}{3.78} \times 100 = 25\%$.

40. Answer (3)

Isodiaphers have same (n - p)

41. Answer (4)

$XeOF_4$ is square pyramidal.

42. Answer (2)

C : H : N = 9 : 1 : 3.5

Ratio by moles

$$C:H:N=\frac{9}{12}:\frac{1}{1}:\frac{3.5}{14}=\frac{3}{4}:1:1:\frac{1}{4}=3:4:1$$

C_3H_4N is empirical formula.

$$n=\frac{108}{54}=2$$

Hence molecular formula $C_6H_8N_2$

43. Answer (1)

Separation energy

$$=+R_H\frac{n^2}{Z^2}=13.6\times\frac{(2)^2}{(3)^2}=+6.04\text{ eV}$$

($\because$ for first excited state n = 2)

44. Answer (3)

45. Answer (2)

$$2\pi r_n=n\lambda\Rightarrow 2\pi\times 0.53\frac{n^2}{Z}=n\lambda$$

$$\Rightarrow\lambda=2\pi\times 0.53\times\frac{n}{Z}$$

$$E_{sep}=3.4=13.6\frac{Z^2}{n^2}\Rightarrow\frac{n}{Z}=2$$

46. Answer (2)

$$Fe_2(C_2O_4)_3+MnO_4^-+H^+\rightarrow 2Fe^{3+}+6CO_2+H_2O$$

$$FeC_2O_4+MnO_4^-+H^+\rightarrow Fe^{3+}+2CO_2+H_2O$$

Total equivalents of $Fe_2(C_2O_4)_3$ and FeC_2O_4 = equivalents of $KMnO_4$

On solving, x = 0.9 mole.

47. Answer (3)

Limiting agent is Na_2CO_3.

Now 106 g of Na_2CO_3 gives 22.4 L of CO_2

$\therefore$ 5.3 g of Na_2CO_3 gives $\frac{22.4}{106}\times 5.3=1.12L$

48. Answer (4)

Fact.

49. Answer (3)

50. Answer (4)

51. Answer (3)

No. of molecules in 1 gm NH_3 is $\frac{1}{17}\times N_A$

No. of molecules in 1 gm N_2 is $\frac{1}{28}\times N_A$

52. Answer (2)

$$\frac{1}{\lambda}=109700\left(\frac{1}{2^2}-\frac{1}{4^2}\right)\text{ cm}^{-1}$$

λ = 486 nm

53. Answer (1)

$2Al + 3H_2SO_4 \longrightarrow Al_2(SO_4)_3 + 3H_2$

$2Al + 2NaOH + 2H_2O \longrightarrow 2NaAlO_2 + 3H_2$

54. Answer (3)

$MnO_2 + 4HCl \longrightarrow MnCl_2 + 2H_2O + Cl_2$

$Cl_2 + 2KI \longrightarrow 2KCl + I_2$

The number of moles of MnO_2 equals that of I_2.

Thus 25.4 of I_2 is liberated.

55. Answer (1)

$Cr(24) \longrightarrow [Ar]_{18}3d^5 4s^1$

19th electron is in 4*s* orbital hence 4, 0, 0, $+\frac{1}{2}$

56. Answer (4)

57. Answer (1)

58. Answer (3)

59. Answer (1)

60. Answer (2)

[MATHEMATICS]

61. Answer (2)

sec*A* + sec*B* is minimum when

$$A=B=\frac{\pi}{6}$$

Hence minimum value = $\frac{4}{\sqrt{3}}$

62. Answer (2)

ΔABC is isosceles.

Let *A* and *C* are equal.

$$\Rightarrow\ 2\tan A+\tan B=100$$

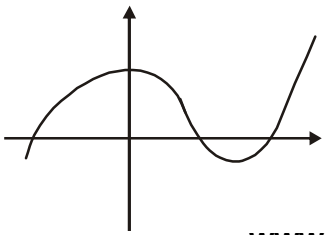
$$\Rightarrow\ 2x+\left(-\frac{2x}{1-x^2}\right)=100$$

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

$$\Rightarrow\ 2x^3-100x^2+100=0$$

$$\Rightarrow\ x^3-50x^2+50=0$$

Hence there are 2 possible positive roots.



63. Answer (3)

$$S_n = \cos^n\theta + \sin^n\theta$$

$$S_4 = \cos^4\theta + \sin^4\theta$$

$$= (\sin^2\theta + \cos^2\theta)^2 - 2\sin^2\theta\cos^2\theta$$

$$= 1 - 2\sin^2\theta\cos^2\theta$$

$$S_6 = \cos^6\theta + \sin^6\theta$$

$$= (\cos^2\theta)^3 + (\sin^2\theta)^3$$

$$= (\cos^2\theta + \sin^2\theta)(\cos^4\theta + \sin^4\theta - \cos^2\theta\sin^2\theta)$$

$$S_6 = S_4 - \left(\frac{1 - S_4}{2}\right)$$

$$\Rightarrow S_6 = \frac{3S_4 - 1}{2}$$

$$\Rightarrow 3S_4 - 2S_6 = 1$$

64. Answer (1)

$\sec\theta = m$ and $\tan\theta = n$, then $\frac{1}{m}\left[(m+n) + \frac{1}{(m+n)}\right]$

$$\frac{1}{\sec\theta}\left[(\sec\theta + \tan\theta) + \frac{1}{((\sec\theta) + \tan\theta)}\right]$$

$$\cos\theta\left[\frac{1}{(\sec\theta - \tan\theta)} + \frac{1}{\sec\theta + \tan\theta}\right]$$

$$\cos\theta\left[\frac{\sec\theta + \tan\theta + \sec\theta - \tan\theta}{\sec^2\theta - \tan^2\theta}\right] = 2$$

65. Answer (4)

$a^2 - 4a + 6$

Its minimum value is 2.

Hence, $\sin x + \cos x = 1$

General solution $\rightarrow n\pi + (-1)^n\frac{\pi}{4} - \frac{\pi}{4}$

66. Answer (4)

$2a^2 + 4b^2 + c^2 = 4ab + 2ac$

$(a - 2b)^2 + (a - c)^2 = 0$

$a = 2b$, $a = c$

$$\cos B = \frac{a^2 + c^2 - b^2}{2ac} = \frac{4b^2 + 4b^2 - b^2}{2(4b^2)}$$

$$= \frac{7b^2}{8b^2} = \frac{7}{8}$$

67. Answer (3)

$$\tan A = \frac{4}{3}$$

$$\cos A = \frac{3}{5}$$

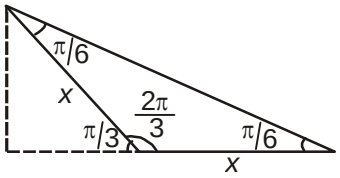
$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$= \frac{(b+c)^2 - 2bc - a^2}{2bc}$$

$$= \frac{(61)^2 - 2(820) - a^2}{1640} \Rightarrow \frac{3}{5} = \frac{3721 - 1640 - a^2}{1640}$$

$2081 - a^2 = 984 \quad \Rightarrow a^2 = 2081 - 984 = 1097$

68. Answer (3)



$$\frac{\sin\frac{\pi}{6}}{x} = \frac{\sin\frac{2\pi}{3}}{y} = \frac{1}{2x} = \frac{\sqrt{3}}{2y}$$

$$r = \frac{\Delta}{s} \qquad y = \sqrt{3}x$$

$$\Rightarrow (2 - \sqrt{3}) = \frac{\frac{1}{2} \times x \times x\sin\frac{\pi}{3}}{\frac{2x + \sqrt{3}x}{2}}$$

$$\Rightarrow (2 - \sqrt{3})(2 + \sqrt{3})x = \frac{1}{2} \times x^2 \times \frac{\sqrt{3}}{2}$$

$$\Rightarrow x = \frac{2}{\sqrt{3}}$$

Area = $\frac{1}{2} \times \frac{4}{3} \times \frac{\sqrt{3}}{2}$

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

69. Answer (4)

No. of one to one functions

$= 6 \times 5 \times 4 \times 3$

$= 360$

70. Answer (4)

$$f\left(\frac{3x+x^3}{1+3x^2}\right)=\log\left(\frac{1+x}{1-x}\right)^3=3\log\left(\frac{1+x}{1-x}\right)=3f(x)$$

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

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

71. Answer (2)

$$f(f(x))=g(f(x))$$

$$\Rightarrow a(ax+b)+b=c(ax+b)+d$$

$$\Rightarrow a^2x+ab+b=cax+bc+d$$

$a^2 = ac,\ ab + b = bc + d$

$a=0$	$a=c$
$b=bc+d$	$b=d$
$\Rightarrow f(b)=g(b)$	Not possible ·

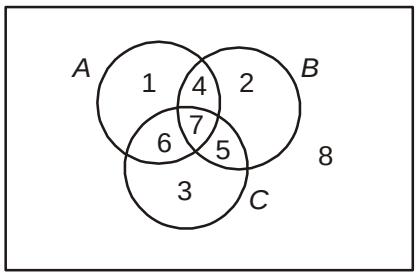
72. Answer (3)

$$f(x)=\{x\}-\frac{1}{2}$$

$f(x)=\frac{1}{2}$, when $\{x\} = 1$

Not possible

73. Answer (4)



$A - B = 1 + 6$

$B - C = 2 + 4$

$C - A = 3 + 5$

$$(A-B)\cup(B-C)\cup(C-A)=1+2+3+4+5+6$$

$$=(A\cup B\cup C)-(A\cap B\cap C)$$

74. Answer (1)

$y = 41 - 2x \qquad x, y \in N$

Domain $\Rightarrow \{1, 2, 3, - - - - 20\}$

Hence correct answer is (1)

75. Answer (4)

76. Answer (4)

$$[x]^2-5[x]+6=0$$

$$([x]-2)([x]-3)=0$$

$[x] = 2, 3$

$x \in [2, 4)$

77. Answer (2)

Case I

$$x\geq 1$$

$$x>2\{x\}$$

$$\Rightarrow x\geq 1$$

Case II

$$x<1$$

$$x<2\{x\}$$

$$\Rightarrow x\in(-\infty,\ 0)\cup(0,\ 1)$$

Taking union $\Rightarrow (-\infty,\ 0)\cup(0,\ \infty)$

78. Answer (3)

$$\sin^3 x\sin 3x=C_1\cos x+C_2\cos 2x+....+C_n\cos nx$$

$$=\frac{(3\sin x-\sin 3x)\sin 3x}{4}$$

$$=\frac{(3\times 2)}{8}\sin x\sin 3x-\frac{1}{4}\sin^2 3x$$

$$=\frac{3}{8}(2\sin x\sin 3x)-\frac{1}{4}\sin^2 3x$$

$$=\frac{3}{8}[\cos 2x-\cos 4x]-\frac{1}{4}\frac{(1-\cos 6)}{2}$$

$$=\frac{3}{8}[\cos 2x]-\frac{3}{8}\cos 4x-\frac{1}{8}+\frac{1}{8}\cos 6x$$

Hence $n = 6$

79. Answer (1)

p : Both are decreasing functions

Hence larger of the two is $\cos(\ln\theta)$

as $\cos\left(\ln e^{-\pi/2^+}\right)>\ln\left(\cos\left(e^{-\pi/2^+}\right)\right)$

and $\cos\left(\pi/2^+\right)>\ln\left(\cos\frac{\pi}{2}^+\right)$

q : $\cos x+\cos\left(\frac{2\pi}{3}-x\right)=\frac{3}{2}$

Hence $\cos x+\left(\left(-\frac{1}{2}\cos x\right)+\frac{\sqrt{3}}{2}\sin x\right)=\frac{3}{2}$

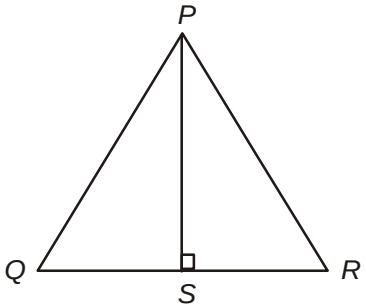
$$\Rightarrow \frac{1}{2}\cos x+\frac{\sqrt{3}}{2}\sin x=\frac{3}{2}$$

Never possible.

Hence p and q, both are correct.

80. Answer (1)

81. Answer (2)



sin$P$, sin$Q$, sin$R$ are in A.P.

$2\sin Q = \sin P + \sin R$

$2q = p + r$

$2 \times \frac{2\Delta}{A_q} = \frac{2\Delta}{A_p} + \frac{2\Delta}{A_r}$

$\frac{2}{A_q} = \frac{1}{A_p} + \frac{1}{A_r}$

Altitudes are in H.P.

82. Answer (1)

$f(x) = ax^7 + bx^3 + cx - 5$

$f(-7) = a(-7)^7 + b(-7)^3 + c(-7) - 5$

$\Rightarrow 7 = -a.7^7 - b.7^3 - c.7 - 5$

$\Rightarrow 7 = -\left(a.(7)^7 + b.(7)^3 + c(7)\right) - 5$

$\Rightarrow 7 = -\left(f(7) + 5\right) - 5$

$\Rightarrow 7 = -f(7) - 10$

$\Rightarrow f(7) = -17$

Range of $f(7) + 17\cos x$ is [–34, 0]

83. Answer (3)

$f(x) = \frac{e^x - e^{|x|}}{e^x + e^{|x|}}$

$x > 0$

$\frac{e^x - e^x}{e^x + e^x} = 0$

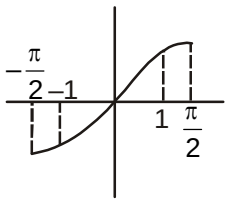
x < 0

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

$\Rightarrow$ Range $\Rightarrow$ (–1, 0]

84. Answer (2)

$-1 \le \cos x \le 1$



sin(1) maximum.

85. Answer (3)

$\sqrt{2 + \sqrt{4\cos^2 2\theta}} = \sqrt{2 + |2\cos 2\theta|}$

$\pi. < 2\theta < \frac{3\pi}{2} \Rightarrow \sqrt{2 - 2\cos 2\theta} = \sqrt{4\sin^2\theta} = |2\sin\theta|$

$\frac{\pi}{2} < \theta < \frac{3\pi}{4} \Rightarrow$ = 2 sinθ

86. Answer (3)

Statement-2 is false.

$R = \frac{abc}{4\Delta}$ $r = \frac{\Delta}{S}$

$\frac{R}{r} = \frac{Sabc}{4\Delta^2} = \frac{4 \times 5 \times 6}{4\left(\frac{15}{2} - 4\right)\left(\frac{15}{2} - 5\right)\left(\frac{15}{2} - 6\right)} = \frac{16}{7}$

87. Answer (4)

$f\left(\frac{2\tan x}{1 + \tan^2 x}\right) = \frac{2}{2\cos^2 x\left(1 + \tan^2 x + 2\tan x\right)}$

$= \frac{1 + \tan^2 x}{1 + \tan^2 x + 2\tan x}$

$= \frac{1}{1 + \frac{2\tan x}{1 + \tan^2 x}}$

$f(\sin 2x) = \frac{1}{1 + \sin 2x}$

$f(x) = \frac{1}{1 + x}$, $f(x) \ne 0$

88. Answer (4)

89. Answer (4)

90. Answer (1)

$f(x) = a\sin^2 x + b\,\text{cosec}^2 x$

$\frac{a\sin^2 x + \frac{b}{\sin^2 x}}{2} \ge \sqrt{ab}$

$a\sin^2 x + \frac{b}{\sin^2 x} \ge 2\sqrt{ab}$

$f_m(4, 9) = 2\sqrt{4 \times 9} = 12$

$f_m(9, 4) = 2\sqrt{4 \times 9} = 12$