WEEKLY TEST OYJ TEST - 30 R & B
SOLUTION Date 01-12-2019

[PHYSICS]

1. We are given that a particle of mass m is located in a one dimensional potential field and the potential energy is given by $V(x) = A(1 - \cos px)$.

So, we can find the force experiened by the particle as

$$F = -\frac{dV}{dx} = -Ap\sin px$$

For small oscillations, we have

$$F \approx -Ap^2 x$$

Hence, the acceleration would be given by

$$a = \frac{F}{m} = -\frac{Ap^2}{m}x$$

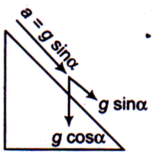
Also we know that

$$a = \frac{F}{m} = -\omega^2 x$$

So, $$\omega = \sqrt{\frac{Ap^2}{m}}$$

or $$T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{m}{Ap^2}}$$

2. We are given that the simple pendulum of length l is hanging from the roof of a vehicle which is moving down the frictionless inclined plane.



So, it's acceleration is $g\sin\theta$. since vehicle is accelerating a pseudo force $m(g\sin\theta)$ will act on bob of pendulum which cancel the $\sin\theta$ component of weight of the bob.
Hence we can say that the effective acceleration would be equal to

$$g_{\text{eff}} = g\cos\alpha$$

Now the time period of oscillation is given by

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

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

3. The radius of particle is 3. Which is maximum, so the amplitude of simple harmonic motion is 3 cm.

4. The average acceleration of a particle performing SHM over one complete oscillation is zero.

5. Total energy in SHM

$$E = \frac{1}{2} m\omega^2 a^2, \text{ (where, } a = \text{amplitude)}$$

Kinetic energy $K = \frac{1}{2} m\omega^2 (a^2 - y^2)$

$$= E - \frac{1}{2} m\omega^2 y^2$$

when $y = \frac{a}{2}$

$$\Rightarrow \quad K = E - \frac{1}{2} m\omega^2 \left(\frac{a^2}{4}\right) = E - \frac{E}{4}$$

$$E = \frac{3E}{4}$$

6. For a body executing SHM, velocity,

$$v = \sqrt{\omega^2 (a^2 - y^2)}$$

we have $10^2 = \omega^2 (a^2 - 4^2)$

and $8^2 = \omega^2 (a^2 - 5^2)$

So, $10^2 - 8^2 = \omega^2 (5^2 - 4^2) = (3\omega)^2$

or $6 = 3\omega$

or $\omega = 2$

$\because$ Time, $t = \frac{2\pi}{\omega}$

$\therefore$ $t = \frac{2\pi}{2} = \pi$ second

7. $\frac{d^2 x}{dt^2} + 16x = 0$

$\therefore$ $\omega^2 = 16 \Rightarrow \omega = 4$

$$T = \frac{2\pi}{\omega} = \frac{2\pi}{4} = \frac{\pi}{2}$$

8. The time period of the iron ball would be given by,

$$P = 2\pi \sqrt{\frac{M}{K}}$$

So, if mass of the ball is increased to 4 times of its initial mass, then the new period becomes

$$P' = 2\pi \sqrt{\frac{4M}{K}} = 2P$$

9.

10. Displacement-time equation of the particle will be,

$$x = A\cos\omega t$$

Given that; $x_1 = A\cos\omega$

$x_2 = A\cos 2\omega$

and $x_3 = A\cos 3\omega$

Now, $\dfrac{x_1 + x_3}{2x_2} = \dfrac{A(\cos\omega + \cos 3\omega)}{2A\cos 2\omega}$

$$= \frac{2A\cos 2\omega\cos\omega}{2A\cos 2\omega} = \cos\omega.$$

$\therefore$ $\omega = \cos^{-1}\left(\dfrac{x_1 + x_3}{2x_2}\right) = \dfrac{2\pi}{T}$

or $T = \dfrac{2\pi}{\omega}$, where $\omega = \cos^{-1}\left(\dfrac{x_1 + x_3}{2x_2}\right)$.

11. A

12. For simple harmonic motion, $v = \omega\sqrt{a^2 - x^2}$

When $x = \dfrac{a}{2}, v = \omega\sqrt{a^2 - \dfrac{a^2}{4}} = \omega\sqrt{\dfrac{3}{4}a^2}$

As $\omega = \dfrac{2\pi}{T}$,

$\therefore$ $v = \dfrac{2\pi}{T}.\dfrac{\sqrt{3}}{2}a$

or $v = \dfrac{\pi\sqrt{3}a}{T}$

13. A

14. C

15. $y = 4\cos^2(t/2)\sin(1000t)$

$= 2[2\cos^2(t/2)\sin(1000t)]$

$= 2(1 + \cos t)\sin(1000t)$

$= 2\sin(1000t) + 2\sin(1000t)\cos t$

$= 2\sin(1000t) + \sin(1001t) + \sin(999t)$

i.e., the given wave represents the superposition of three waves.

16. Resultant amplitude,

$$A_R = \sqrt{A_1^2 + A_2^2 + 2A_1A_2\cos\phi}$$

$$= \sqrt{A^2 + A^2 + 2A^2\cos\phi}$$

But $A_R = A$

$\therefore$ $A = \sqrt{2A^2(1 + \cos\phi)}$

$$= \sqrt{4A^2\cos^2\frac{\phi}{2}} = 2A\cos\frac{\phi}{2}$$

or $\cos\dfrac{\phi}{2} = \dfrac{1}{2}$ or $\phi = \dfrac{2\pi}{3}$.

17. (b) Let the line joining AB represents axis ‘r’.By the conditions given ‘r’ coordinate of the particle at time t is

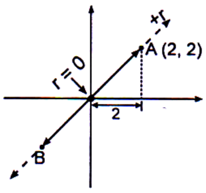
$r = 2\sqrt{2}\cos\omega t$

$$\omega = \frac{2\pi}{T} = \frac{2\pi}{2}\pi$$

$\therefore \quad r = 2\sqrt{2}\cos\pi t$

$$x = r\cos 45^o = \frac{r}{\sqrt{2}} = 2\cos\pi t$$

$\therefore \quad a_x = -\omega^2 x = -\pi^2 2\cos\pi t \qquad \therefore F_x = ma_x = -4\pi^2\cos\pi t$



18. (c) Both the spring are in series

$$\therefore \quad K_{eq} = \frac{K(2K)}{K + 2K} = \frac{2K}{3}$$

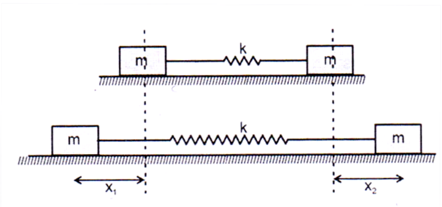
Time period

$$T = 2\pi\sqrt{\frac{\mu}{K_{eq}}} \qquad \text{where } \mu = \frac{m_1 m_2}{m_1 + m_2}$$

$$\text{Here } \mu = \frac{m}{2} \qquad \therefore \qquad T = 2\pi\sqrt{\frac{m}{2}\cdot\frac{3}{2K}}$$

$$= 2\pi\sqrt{\frac{3m}{4K}}$$

Method II



$\therefore \quad mx_1 = mx_2 \Rightarrow x_1 = x_2$

force equation for first block;

$$\frac{2k}{3}(x_1 + x_2) = -m\frac{d^2x_1}{dt^2}$$

$$\text{Put } x_1 = x_2 \Rightarrow \;\Rightarrow \frac{d^2x_1}{dt^2} + \frac{4k}{3m}\times x_1 = 0 \qquad \Rightarrow \; \omega^2 = \frac{4k}{3m}$$

$$\therefore \quad T = 2\pi\sqrt{\frac{3m}{4k}}$$

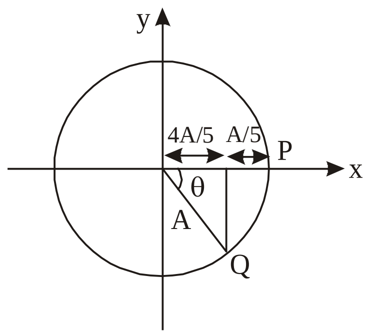
19. (b) $\frac{I_1}{I_2} = \frac{a_1^2 f_1^2}{a_2^2 f_2^2} = \frac{(3)^2(8)^2}{(2)^2(12)^2} = 1$

20. (b) Particle is strating from rest i.e., from one of its extreme position.
As particles moves a distance $A/5$, we can represent it on a circle as shown.

$$\cos\theta = \frac{4A/5}{A} = \frac{4}{5}$$

$$\theta = \cos^{-1}\left(\frac{4}{5}\right)$$

$\omega t = \cos^{-1}\left(\frac{4}{5}\right)$



$t = \frac{1}{\omega}\cos^{-1}\left(\frac{4}{5}\right) = \frac{T}{2\pi}\cos^{-1}\left(\frac{4}{5}\right)$

Alternatively

As starts from rest i.e., from extreme position x = A sin ($\omega t + \phi$)

At $t = 0$; $x = A$

$\Rightarrow \phi = \frac{\pi}{2}$

$\therefore \quad A - \frac{A}{5} = A\cos\omega t$

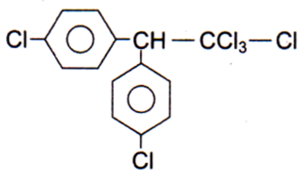
$\frac{4}{5} = \cos\omega t$

$\Rightarrow \omega t = \cos^{-1}\frac{4}{5}$;

$t = \frac{T}{2\pi}\cos^{-1}\left(\frac{4}{5}\right)$

[CHEMISTRY]

21. **(a)**



DDT

22. **(d)** Its vapours are non-inflammable (i.e. do not catch fire). Hence used as fire extinguishers under the name pyren.

23. **(d)** SN_1 reaction gives racemic mixture with slight predominance of that isomer which corresponds to inversion because SN_1 also depends upon the degree of 'shielding' of the front side of the reacting carbon.

24. **(b)** Chloroform is oxidised to a poisonous gas, phosgene ($COCl_2$) by atmospheric gas.

$CHCl_3 + O \longrightarrow COCl_2 + HCl$

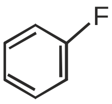
25. **(b)** Vinyl chloride shows resonance,

$$\overset{\frown}{CH_2 = CH} - \ddot{\underset{..}{Cl}}: \longleftrightarrow :\bar{C}H_2 - CH = \ddot{Cl}^{+}:$$

Due to resonance C—Cl bond has partial double bond character so bond is broken with difficulty.

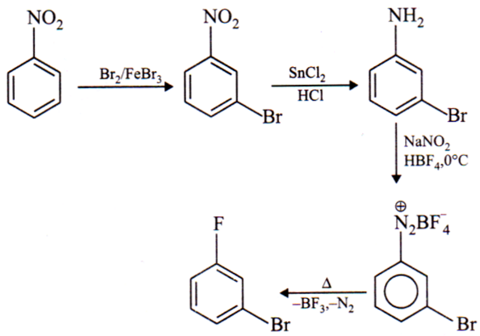
26. **(c)** $C_6H_5.CH_2Br \xrightarrow{Mg/ether} C_6H_5.CH_2MgBr$

$$\xrightarrow{H_3O^+} C_6H_5 . CH_3 + Mg\begin{matrix} Br \\ OH \end{matrix}$$

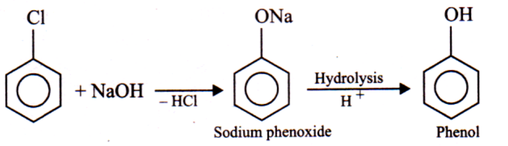
27. (A) Fluoro benzene 

28. **(b)** Sandmeyer's reaction.

29. **(d)**



30. **(c)** Gammaxane

31. **(c)** 

32. **(d)** Resonance stablization and the hybridisation of C attached to halide cis sp^2.

33. **(c)** With ethoxide base, most substituted alkene (I) is formed as the major product. In the formation of (II), $C_2H_5O^-$ takes proton from less hindered β-carbon, hence less activation energy and greater rate of reaction although stability of product determines it content at equilibrium. Also, since E2 reaction is an elementary reaction in which halogen leaves in the rate determining step, iodide leaves most easily and fluoride with maximum difficulty.

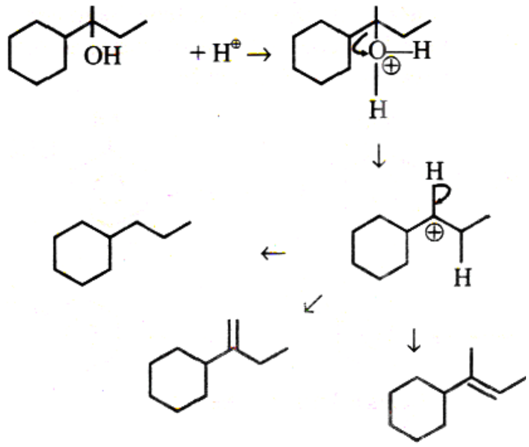
34. **(b)** $CH_3 - \underset{\underset{Br}{|}}{CH} - CH_2 - CH_3 + \underset{(alc)}{KOH} \xrightarrow{\text{Saytzeff's rule}}$

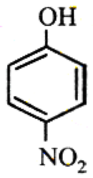
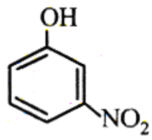
35. $CH_3CH_2OH \xrightarrow{PBr_3} CH_3CH_2Br \xrightarrow{alc.KOH} CH_2 = CH_2$

$CH_2 = CH_2 \xrightarrow{H_2SO_4} CH_3 - CH_2 - HSO_4$

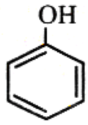
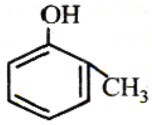
$CH_3CH_2OH \xleftarrow[heat]{H_2O} CH_3 - CH_2 - HSO_4$

36. Electron withdrawing $-NO_2$ group has very strong –I and –R effects so, compound 3 will be most acidic.

37. 

38.  > 

(iv) (– I and – M effects, both increase acidity) (iii) (only – I effect)

>  > 

(i) (ii)

(+ I effect of CH_3 group decreases acidity)

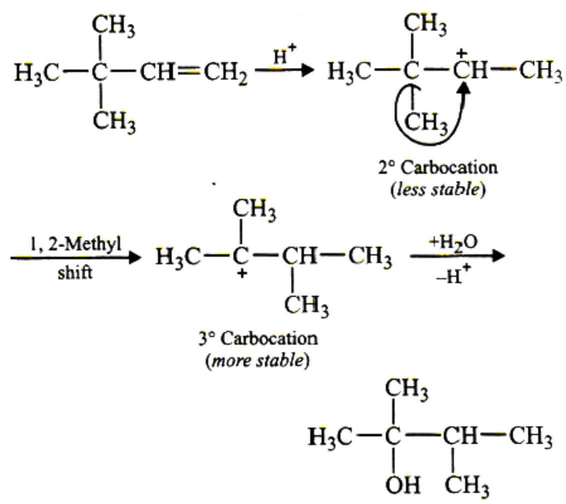
∴ Correct choice : (b)

39. $CH_3—CH_2—CH=CH_2 \xrightarrow[\text{(Peroxide effect)}]{HBr/H_2O_2}$

$\underset{(Y)}{CH_3—CH_2—CH_2—CH_2—Br}$

↓

$\underset{(Z)}{CH_3—(CH_2)_3—O—CH_2—CH_3}$

40. 

[MATHEMATICS]

41. (a) Do yourself.

42. (b) $\int \frac{\sin^8 x - \cos^8 x}{1-2\sin^2 x\cos^2 x}dx$

$= \int \frac{(\sin^4 x + \cos^4 x)(\sin^4 x - \cos^4 x)}{(\sin^2 x + \cos^2 x)^2 - 2\sin^2 x\cos^2 x}dx$

$= \int (\sin^4 x - \cos^4 x)\,dx$

$= \int (\sin^2 x + \cos^2 x)(\sin^2 x - \cos^2 x)\,dx$

$= \int (\sin^2 x - \cos^2 x)\,dx = \int -\cos 2x\,dx = -\frac{\sin 2x}{2} + c.$

43. (d) $I = \int \frac{dx}{\sin x - \cos x + \sqrt{2}}$

$= \int \frac{dx}{\sqrt{2}(\sin x.\sin\frac{\pi}{4} - \cos x\cos\frac{\pi}{4} + 1)}$

$= \frac{1}{\sqrt{2}}\int \frac{dx}{1-\cos(x+\frac{\pi}{4})} = \frac{1}{\sqrt{2}}\int \frac{dx}{1-\cos 2\left(\frac{x}{2}+\frac{\pi}{8}\right)}$

$= \frac{1}{\sqrt{2}}\int \frac{dx}{2\sin^2\left(\frac{x}{2}+\frac{\pi}{8}\right)} = \frac{1}{2\sqrt{2}}\int \text{cosec}^2\left(\frac{x}{2}+\frac{\pi}{8}\right)dx$

44. (c) $\int \frac{dx}{4\sin^2 x + 5\cos^2 x} = \int \frac{\sec^2 x\,dx}{4\tan^2 x + 5} = \frac{1}{4}\int \frac{\sec^2 x\,dx}{\tan^2 x + \frac{5}{4}}$

Put $\tan x = t \Rightarrow \sec^2 x\,dx = dt$, then it reduces to

$\frac{1}{4}\int \frac{dt}{t^2 + \left(\frac{\sqrt{5}}{2}\right)^2} = \frac{2}{4\sqrt{5}}\tan^{-1}\left(\frac{2t}{\sqrt{5}}\right) + c$

$= \frac{1}{2\sqrt{5}}\tan^{-1}\left(\frac{2\tan x}{\sqrt{5}}\right) + c.$

45. (c) $\int (\log x)^2 dx$. Put $\log x = t \Rightarrow e^t = x \Rightarrow dx = e^t dt$, then it reduces to $\int t^2 . e^t dt = t^2 e^t - 2te^t + 2e^t + c$

$$= x(\log x)^2 - 2x\log x + 2x + c.$$

46. (d) $I = \int \frac{4e^x + 6e^{-x}}{9e^{2x} - 4e^{-x}} dx = \frac{4}{9}\int \frac{9e^{2x}dx}{9e^{2x} - 4} + 6\int \frac{dx}{9e^{2x} - 4}$

$\therefore \int \frac{dx}{9e^{2x} - 4} = \frac{1}{8}\log(9e^{2x} - 4) - \frac{1}{4}\log 3 - \frac{1}{4}x + \text{const.}$

$\therefore I = \frac{35}{36}\log(9e^{2x} - 4) - \frac{3}{2}x - \frac{3}{2}\log 3 + \text{const.}$

Comparing with the given integral, we get

$A = -\frac{3}{2},\ B = \frac{35}{36},\ C = -\frac{3}{2}\log 3 +$ const.

47. (d) We know that

$\log\left(\frac{\cos\theta + \sin\theta}{\cos\theta - \sin\theta}\right) = \log\left(\frac{1 + \tan\theta}{1 - \tan\theta}\right) = \log\tan\left(\frac{\pi}{4} + \theta\right)$

$\int \sec\theta\, d\theta = \log\tan\left(\frac{\pi}{4} + \frac{\theta}{2}\right)$

$\therefore \int \sec 2\theta\, d\theta = \frac{1}{2}\log\tan\left(\frac{\pi}{4} + \theta\right)$

$\therefore 2\sec 2\theta = \frac{d}{d\theta}\log\tan\left(\frac{\pi}{4} + \theta\right)$ .....(i)

Integrating the given expression by parts, we get

$I = \frac{1}{2}\sin 2\theta \log\tan\left(\frac{\pi}{4} + \theta\right) - \frac{1}{2}\int \sin 2\theta . 2\sec 2\theta\, d\theta$ by (i)

$= \frac{1}{2}\sin 2\theta \log\tan\left(\frac{\pi}{4} + \theta\right) - \int \tan 2\theta\, d\theta$

$= \frac{1}{2}\sin 2\theta \log\tan\left(\frac{\pi}{4} + \theta\right) - \frac{1}{2}\log\sec 2\theta$.

48. (b) $y = C_1 e^{2x + C_2} + C_3 e^x + C_4 \sin(x + C_5)$

$= C_1 . e^{C_2} e^{2x} + C_3 e^x + C_4(\sin x \cos C_5 + \cos x \sin C_5)$

$= Ae^{2x} + C_3 e^x + B\sin x + D\cos x$

Here, $A = C_1 e^{C_2}$, $B = C_4 \cos C_5$, $D = C_4 \sin C_5$

(Since equation consists of four arbitrary constants)

$\therefore$ order of differential equation = 4.

49. (b) $y = Ae^{3x} + Be^{5x}$

$\Rightarrow \frac{dy}{dx} = 3Ae^{3x} + 5Be^{5x} \Rightarrow \frac{d^2y}{dx^2} = 9Ae^{3x} + 25Be^{5x}$

$\Rightarrow \frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 15y = 0$ (By inspection)

50. (a) $\frac{dx}{dy}+\frac{x^2-xy+y^2}{y^2}=0$

$\frac{dx}{dy}+\left(\frac{x}{y}\right)^2-\left(\frac{x}{y}\right)+1=0$

Put $v=x/y \Rightarrow x=vy \Rightarrow \frac{dx}{dy}=v+y\frac{dv}{dy}$

$v+y\frac{dv}{dy}+v^2-v+1=0 \Rightarrow \frac{dv}{v^2+1}+\frac{dy}{y}=0$

$\Rightarrow \int\frac{dv}{v^2+1}+\int\frac{dy}{y}=0 \Rightarrow \tan^{-1}(v)+\log y+C=0$

$\Rightarrow \tan^{-1}(x/y)+\log y+c=0$.

51. (a) $\frac{dy}{dx}+(2x-1)y=0$; I.F. $=e^{\int(2x-1)dx}=e^{x^2-x}$

Required solution is $ye^{x^2-x}=c$ or $y=ce^{x-x^2}$.

52. (c) We have $\frac{dy}{dx}=\frac{y}{x}-\cos^2\left(\frac{y}{x}\right)$

Putting $y=vx$ so that $\frac{dy}{dx}=v+x\frac{dv}{dx}$, we get

$v+x\frac{dv}{dx}=v-\cos^2 v$ or $\frac{dv}{\cos^2 v}=-\frac{dx}{x}$

On integrating, we get $\tan v=-\log x+\log c$

$\Rightarrow \tan\left(\frac{y}{x}\right)=-\log x+\log C$

This passes through $\left(1,\frac{\pi}{4}\right)$, therefore $1=\log c$

$\Rightarrow \tan\left(\frac{y}{x}\right)=-\log x+\log e \Rightarrow y=x\tan^{-1}\left[\log\left(\frac{e}{x}\right)\right]$.

53. (c) Applying $R_1\to R_1-\sec xR_3$, we get

$f(x)=-\sin^2 x-\cos^5 x$

Thus $\int_0^{\pi/2} f(x)dx=-\int_0^{\pi/2}(\sin^2 x+\cos^5 x)dx$

$=-\left[\frac{\pi}{4}+\frac{8}{15}\right]=\frac{-\pi}{4}-\frac{8}{15}$.

54. (a) $I_{n+1}=\int_0^{\pi/4}\tan^{n+1}\theta\, d\theta=\int_0^{\pi/4}\tan^{n-1}\theta\,(\sec^2\theta-1)d\theta$

$=\int_0^{\pi/4}\tan^{n-1}\theta\sec^2\theta\, d\theta-\int_0^{\pi/4}\tan^{n-1}\theta\, d\theta$

$=\int_0^{\pi/4}\tan^{n-1}\theta\sec^2\theta\, d\theta-I_{n-1}$

$\Rightarrow I_{n+1}+I_{n-1}=\frac{1}{n}\Rightarrow n(I_{n+1}+I_{n-1})=1$.

55. (b) $\int_0^{\pi/4} \frac{\sqrt{\tan x}}{\sin x \cos x} dx = \int_0^{\pi/4} \frac{\sec^2 x}{\sqrt{\tan x}} dx = \int_0^1 \frac{1}{\sqrt{t}} dt$

$= [2\sqrt{t}]_0^1 = 2 - 0 = 2$.

56. (a) We have $\int_0^a f(x)g(x)dx = \int_0^a f(a-x)g(a-x)dx$

$= \int_0^a f(x)[2 - g(x)]dx$

$\Rightarrow 2\int_0^a f(x)g(x)dx = 2\int_0^a f(x)dx \Rightarrow \int_0^a f(x)g(x)dx = \int_0^a f(x)dx$.

57. (d) $I = \int_0^\pi \frac{xdx}{a^2\cos^2 x + b^2 \sin^2 x}$ .....(i)

and $I = \int_0^\pi \frac{(\pi - x)dx}{a^2\cos^2(\pi - x) + b^2\sin^2(\pi - x)}$,

$\left[\int_0^a f(x)dx = \int_0^a f(a-x)dx\right]$

$I = \int_0^\pi \frac{(\pi - x)dx}{a^2\cos^2 x + b^2\sin^2 x}$ .....(ii)

Adding (i) and (ii), we get $2I = \int_0^\pi \frac{(x + \pi - x)dx}{a^2\cos^2 x + b^2\sin^2 x}$

$2I = \pi\int_0^\pi \frac{dx}{a^2\cos^2 x + b^2\sin^2 x}$

$\therefore I = \frac{\pi}{2}\int_0^\pi \frac{dx}{a^2\cos^2 x + b^2\sin^2 x}$

$= 2.\frac{\pi}{2}\int_0^{\pi/2} \frac{dx}{a^2\cos^2 x + b^2\sin^2 x}$

Divide above and below by $\cos^2 x$

$\therefore I = \pi\int_0^{\pi/2} \frac{\sec^2 xdx}{a^2 + b^2\tan^2 x}$

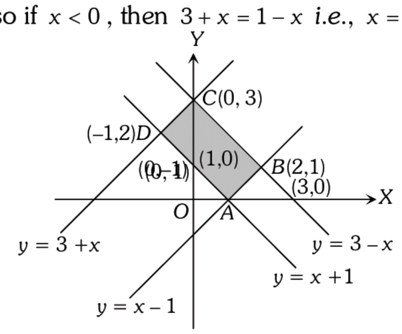
Put $b\tan x = t$, $\therefore b\sec^2 xdx = dt$

$\therefore I = \frac{\pi}{b}\int_0^\infty \frac{dt}{a^2 + t^2} = \frac{\pi}{b}.\frac{1}{a}\left[\tan^{-1}\frac{t}{a}\right]_0^\infty = \frac{\pi}{ab}\left[\frac{\pi}{2} - 0\right] = \frac{\pi^2}{2ab}$.

58. (c) If $x \ge 1$, then $3 - x = x - 1 \Rightarrow x = 2$

If $0 \le x \le 1$, then $3 - x = 1 - x$, which is not possible.

Also if $x < 0$, then $3 + x = 1 - x$ *i.e.*, $x = -1$



Thus required area $= \int_{-1}^{2}(3 - |x| - |x-1|)dx$

$= \int_{-1}^{0}[3 + x - (1 - x)]dx + \int_{0}^{1}[(3 - x) - (1 - x)]dx$

$+ \int_{1}^{2}[(3 - x) - (x - 1)]dx$

$= 1 + 2 + 1 = 4$ *sq. unit.*

59. (b) We have $\int_0^2 f(x)dx = \int_0^1 f(x)dx + \int_1^2 f(x)dx$,

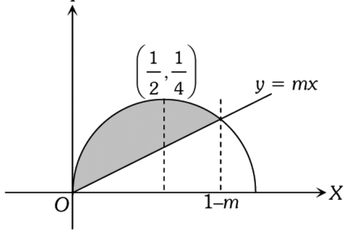
where $f(x) = (ax^2 + bx + c)(1 + \cos^8 x)$

If $f(x) > 0(< 0) \forall x \in (1,2)$ then $\int_1^2 f(x)dx > 0(< 0)$. Thus $f(x) = (1 + \cos^8 x)(ax^2 + bx + c)$ must be positive for some value of x in [1, 2] and must be negative for some value of x in [1, 2]. As $(1 + \cos^8 x) \ge 1$ it follows that if $g(x) = ax^2 + bx + c$, then there exist some $\alpha, \beta \in (1,2)$ such that $g(\alpha) > 0$ and $g(\beta) < 0$. Since g is continuous on R, therefore there exist some c between α and β such that $g(c) = 0$. Thus $ax^2 + bx + c = 0$ has at least one root in (1, 2) and hence in (0, 2).

60. (b) The equation of curve is $y = x - x^2$

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

This is a parabola whose vertex is $\left(\frac{1}{2}, \frac{1}{4}\right)$



Hence point of intersection of the curve and the line $x - x^2 = mx \Rightarrow x(1 - x - m) = 0$ *i.e.*, $x = 0$ or $x = 1 - m$