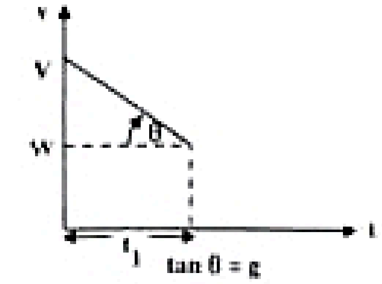
(a) (i) $0 \le t \le t_1$ ප්‍රාන්තරය සඳහා,

$(\text{ක} \overset{\text{ප}}{} E) = \uparrow U \; ; \; (\text{ක} \overset{\text{ත}}{} E) = 0$

$(P \overset{\text{ප}}{} \text{ක}) = \uparrow V \; ; \; (P \overset{\text{ත}}{} E) = \downarrow g$

$\tan\theta = \dfrac{V - W}{t_1} \rightarrow t_1 = \dfrac{V - W}{g} \; \therefore W = V - gt_1$



$\tan\theta = g$

(ii) $t_1 \le t \le t_2$ ප්‍රාන්තරය සඳහා,

$(P \overset{\text{ත}}{} E) = \downarrow g \quad (Q \overset{\text{ත}}{} E) = \downarrow g$

$(Q \overset{\text{ත}}{} P) = (Q \overset{\text{ත}}{} E) + (E \overset{\text{ත}}{} P)$

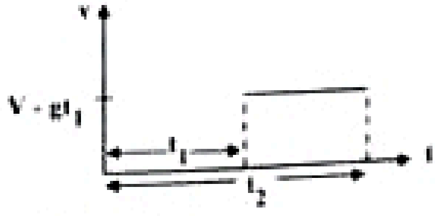
$= \downarrow g + \uparrow g = 0$

$\therefore (Q \overset{\text{ප}}{} P)$ නියතයක් වේ. $(Q \overset{\text{ප}}{} P) = \uparrow (V - gt_1)$

$t = t_1$ වන විට,

$(P \overset{\text{ප}}{} Q) = (P \overset{\text{ප}}{} E) = \frac{1}{2}(V + W)t_1$

$= \frac{1}{2}(V + V - gt_1)t_1$



$t = t_1$ වන විට,

$(Q \overset{\text{ප}}{} P) = (Q \overset{\text{ප}}{} \text{ක}) + (\text{ක} \overset{\text{ප}}{} P)$

$= \uparrow V + \downarrow W$

$= \uparrow V - W = \uparrow V - (V - gt_1)$

$= \uparrow gt_1$

$t_2 - t_1$ කාලයේ දී විස්ථාපනය $= gt_1(t_2 - t_1)$

$t = t_2$ විට P හා Q එකිනෙක හමුවන බැවින්

එවිට $(Q \overset{\text{ප}}{} P) = 0$ විය යුතු ය.

$gt_1(t_2 - t_1) - \frac{1}{2}(2V - 2gt_1)t_1 = 0$

$gt_1(t_2 - t_1) = \frac{t_1}{2}(2V - gt_1)$

$t_2 - t_1 = \frac{1}{2g}(2V - gt_1) \; (t_2 > t_1$ බැවින්)

$t_2 = \frac{V}{g} - \frac{t_1}{2} + t_1$

$= \frac{V}{g} + \frac{t_1}{2}$

$t = t_2$ විට

$(Q \overset{\text{ප}}{} E) = U + V - g(t_2 - t_1)$

$= U + V - g\left(\frac{V}{g} + \frac{t_1}{2} - t_1\right)$

$= U + \frac{gt_1}{2}$

$(P \overset{\text{ප}}{} E) = (P \overset{\text{ප}}{} Q) + (Q \overset{\text{ප}}{} E)$

$= -gt_1 + U + \frac{gt_1}{2}$

$= U - \frac{gt_1}{2}$

(b) $(\text{ක}\; E) = U \quad (\text{ත}\; E) = \uparrow V$

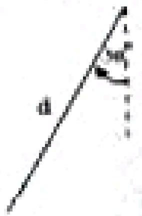
$(\text{ක}\; \text{ත}) = (\text{ක}\; E) + (E\; \text{ත})$

$= u + \downarrow v$

$= \downarrow v + u$

$= \overrightarrow{PQ} + \overrightarrow{QR}$

$= \overrightarrow{PR}$



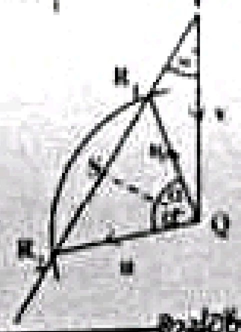
Q කේන්ද්‍රය [illegible] u [illegible] $(u < v < 2u)$ [illegible] P [illegible] R_1 හා R_2 [illegible] $\overrightarrow{QR_1}$ හා $\overrightarrow{QR_2}$ [illegible]

[illegible] $R_1\hat{Q}R_2 = 2\alpha$ වේ.

එවිට $\cos\alpha = \frac{V\sin 30}{u} = \frac{V}{2u}$ වේ.

[illegible] t_1 හා t_2 වේ.

$t_1 = \frac{d}{PR_1}$ හා $t_2 = \frac{d}{PR_2}$ වේ.



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[illegible] $t_1 - t_2 = \frac{d}{PR_1} - \frac{d}{PR_2}$

$= d\left[\frac{PR_2 - PR_1}{PR_1 \cdot PR_2}\right]$

$= d\frac{[PS + SR_1 - (PS - SR_1)]}{(PS - SR_1)(PS + SR_2)}$

$= \frac{d \cdot 2SR_1}{PS^2 - SR_1^2}$

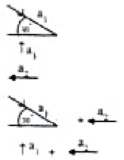
($\because SR_1 = SR_2$ [illegible])

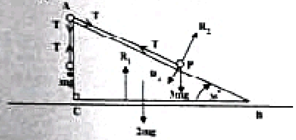
$t_1 - t_2 = \frac{2d\sqrt{u^2 - (v/2)^2}}{(v\sqrt{3}/2)^2 - [u^2 - (v/2)^2]}$

$= \frac{2d\,½\sqrt{4u^2 - v^2}}{¼(3v^2 - 4u^2 + v^2)}$

$= \frac{d\sqrt{4u^2 - v^2}}{v^2 - u^2}$

02. (a)





E = mg [illegible]

↑ Q : $T - mg = ma_1$ ——→ ①

P : $3mg\sin 30^0 - T = 3m(a_1 - a_2\cos 30^0)$ ——— ②

← [illegible] : $0 = 2ma_2 + m.a_2 + 3m(a_2 - a_1\cos 30)$ ——— ③

① + ② $\frac{mg}{2} = 4ma_1 - 3ma_2\frac{\sqrt{3}}{2}$ ——— ④

③ න්, $0 = 6ma_2 - 3ma_1\frac{\sqrt{3}}{2}$ ——— ⑤

⑤ න් $a_1 = \frac{4a_2}{\sqrt{3}}$

④ න් $\frac{g}{2} = 4\times\frac{4a_2}{\sqrt{3}} - \frac{3\sqrt{3}a_2}{2}$

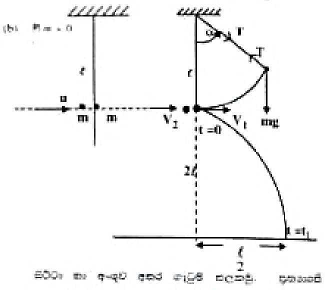
$\sqrt{3}g = 32a_2 - 9a_2$

$a_2 = \frac{\sqrt{3}g}{23}$

$\therefore a_1 = \frac{4}{\sqrt{3}}\times\frac{\sqrt{3}g}{23} = \frac{4g}{23}$

$T = mg + \frac{4mg}{23} = \frac{27mg}{23}$

(b) [illegible]



[illegible]
$mu = mv_1 + mv_2$ ————→ ①
[illegible]
$eu = v_1 - v_2$ ————→ ②
① හා ② විසඳීමෙන්
$v_1 = \frac{u}{2}(1 + e)$ හා $v_2 = \frac{u}{2}(1 - e)$

[illegible] $S = ut + \frac{1}{2}at^2$ යෙදීමෙන්

→ $\frac{\ell}{2} = v_2t_1$ ——— ③

↓ $2\ell = \frac{1}{2}gt_1^2$ ——— ④

t_1 ඉවත් කිරීමෙන් $16v_2^2 = g\ell$ ——— ⑤

[illegible] ශක්ති සංස්ථිති නියමය යෙදීමෙන්

$\frac{1}{2}mv_1^2 - mg\ell = 0 - mg\ell\cos\alpha$

$v_1^2 = 2g\ell(1 - \cos\alpha)$ ——— ⑥

$\frac{⑥}{⑤}$ න් $\frac{v_1^2}{16v_2^2} = \frac{2g\ell(1 - \cos\alpha)}{g\ell}$

$\Rightarrow \frac{v_1^2}{v_2^2} = 32\times 2\sin^2\frac{\alpha}{2}$

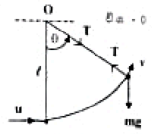
$\frac{v_1}{v_2} = \frac{1 + e}{1 - e}$ [illegible] $\frac{(1 + e)^2}{(1 - e)^2}$

$= 64\sin^2\frac{\alpha}{2}$

$\Rightarrow \frac{1 + e}{1 - e} = 8\sin\frac{\alpha}{2}$ ($\because 0 < e < 1$ නිසා)

$\therefore e = \frac{8\sin\frac{\alpha}{2} - 1}{8\sin\frac{\alpha}{2} + 1}$

03. [illegible] ශක්ති සංස්ථිති නියමය යෙදීමෙන්.



$\frac{1}{2}mu^2 - mg\ell = \frac{1}{2}mv^2 - mg\ell\cos\theta$

$v^2 = u^2 - 2g\ell(1 - \cos\theta)$ ——— ①

E = mg ↖ යෙදීමෙන්,

$T - mg\cos\theta = m\frac{v^2}{\ell}$ ——— ②

[illegible]

(i) $T = mg\cos\theta + \frac{m}{\ell}[u^2 - 2g\ell + 2g\ell\cos\theta]$

$= \frac{m}{\ell}[u^2 - 2g\ell + 3g\ell\cos\theta]$

$T = m[3g\cos\theta - 2g + \frac{u^2}{\ell}]$

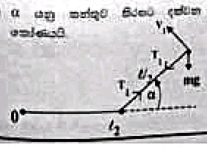
(ii) [illegible]

$\theta = \frac{\pi}{2}$ විට $v \geq 0$ විය යුතු ය

① න් $u^2 - 2g\ell \geq 0 \Rightarrow u^2 \geq 2g\ell$

$\therefore$ අවම $u = \sqrt{2g\ell}$

(iii) α [illegible]



[illegible]

$\frac{1}{2}m(u^2 - 2g\ell) + 0 = \frac{1}{2}mv_1^2 + mg\frac{\ell}{2}\sin\alpha$

$u^2 - 2g\ell = v_1^2 + g\ell\sin\alpha$

$v_1^2 = u^2 - 2g\ell - g\ell\sin\alpha$

E = mg යෙදීමෙන්,

$T_1 + mg\sin\alpha = \frac{mv_1^2}{\ell/2}$

$T_1 = \frac{2m}{\ell}(u^2 - 2g\ell - g\ell\sin\alpha) - mg\sin\alpha$

[illegible] $T_1 = 0$

$\Rightarrow \frac{2m}{\ell}(u^2 - 2g\ell - g\ell\sin\alpha) - mg\ell\sin\alpha = 0$

$2u^2 - 4g\ell - 2g\ell\sin\alpha - g\ell\sin\alpha = 0$

$\sin\alpha = \frac{2u^2 - 4g\ell}{3g\ell}$ වේ.

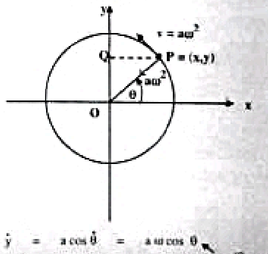
$0 < \sin\alpha < 1$ නිසා

$0 < \frac{2u^2 - 4g\ell}{3g\ell} < 1 \Rightarrow 2g\ell < u^2 < \frac{7g\ell}{2}$

04. $OQ = a\sin\theta$

$\therefore y = a\sin\theta$ ——— ①

[illegible]



$\dot{y} = a\cos\theta\,\dot{\theta} = a\omega\cos\theta$ ($\because \dot{\theta} = \frac{d\theta}{dt} = \omega$)

$\therefore \ddot{y} = -a\omega^2\sin\theta$

$\ddot{y} = -\omega^2 y$ (① න්)

මෙහි $-a \leq y \leq a$ වේ.

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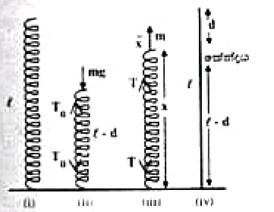
∴ P හි y අක්ෂය මත ප්‍රක්ෂේපණය වන Q , සරල අනුවර්තී චලිතයේ යෙදේ.

∴ ආවර්තකාලය $= \frac{2\pi}{\omega}$ වේ.



(ii) වන රූපයට අනුව සමතුලිත පිහිටීමේ දී,

$T_0 = mg$ ——— ①

හුක් නියමයෙන් $T_0 = \frac{\lambda d}{\ell}$ ——— ②

(ප්‍රත්‍යාස්ථතා මාපාංකය λ නම්)

$\therefore mg = \frac{\lambda d}{\ell} \Rightarrow \frac{\lambda}{\ell} = \frac{mg}{d}$

(iii) වන රූපයට අනුව,

$T = \frac{\lambda(\ell - x)}{\ell} = \frac{mg}{d}(\ell - x)$

$F = ma$ යෙදීමෙන්, $\uparrow T - mg = m\ddot{x}$

$\frac{mg}{d}(\ell - x) - mg = m\ddot{x}$

$-\frac{g}{d}(x - \ell + d) = \ddot{x}$

[illegible] $x = 0$ [illegible] $x = \ell - d$ [illegible] m [illegible]

විස්තාරය සෙවීම.

විස්තාරය a ද, [illegible] t කාලයේ දී විස්ථාපනය y ද නම්,

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

[illegible] h [illegible]

[illegible] v_1 නම්, $v_1^2 = 2gh$ [illegible]

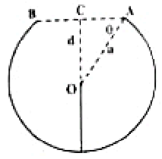
$y = d$ විට, $v = v_1$ නිසා

$2gh = \frac{g}{d}(a^2 - d^2) \Rightarrow a^2 = 2dh + d^2$

∴ [illegible] $a = \sqrt{2dh + d^2}$ [illegible]

[illegible] $d < a$ [illegible]

(iv [illegible]) $\ell \geq a + d$ [illegible]



[illegible]

$O\hat{A}C = \theta$ නම්

$\tan\theta = \frac{d}{\sqrt{a^2 - d^2}}$

[illegible] T නම්

$T = 2\left(\frac{\pi/2 + \theta}{\omega}\right)$

$= 2\sqrt{\frac{d}{g}}\left(\frac{\pi}{2} + \tan^{-1}\frac{d}{\sqrt{a^2 - d^2}}\right)$

$= \sqrt{\frac{d}{g}}\left(\pi + 2\tan^{-1}\frac{d}{\sqrt{2dh + d^2 - d^2}}\right)$

$= \sqrt{\frac{d}{g}}\left(\pi + 2\tan^{-1}\sqrt{\frac{d}{2h}}\right)$

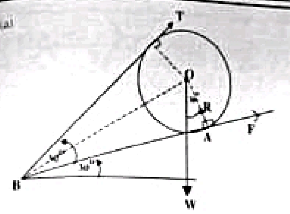
[illegible] $\frac{3\pi}{2}\sqrt{\frac{d}{g}}$ [illegible]

$\sqrt{\frac{d}{g}}\left(\pi + 2\tan^{-1}\sqrt{\frac{d}{2h}}\right) \geq \frac{3\pi}{2}\sqrt{\frac{d}{g}} \Rightarrow \tan^{-1}\sqrt{\frac{d}{2h}} \geq \frac{\pi}{4}$

$\Rightarrow \sqrt{\frac{d}{2h}} \geq 1 \Rightarrow \frac{h}{d} \leq \frac{1}{2}$

$\therefore$ [illegible] $\frac{h}{d} = \frac{1}{2}$

05. (a)



[illegible] a නම්. [illegible] O වටා [illegible]

$F \times a = T \times a$ ——— ①

A වටා [illegible]

$W \times a \sin 30 = T \times a \tan 75 \times \sin 30$

$W = T\left(\frac{\sqrt{3}+1}{\sqrt{3}-1}\right)\left(\frac{\sqrt{3}+1}{\sqrt{3}+1}\right)$

$W = T\frac{(4 + 2\sqrt{3})}{2}$

$T = \frac{W}{2 + \sqrt{3}}$

$T = W(2 - \sqrt{3}) = F$ (① ට අනුව)

B: $R \times a \tan 75 = W \times a \sec 75^\circ \times \cos 45^\circ$

$R\frac{\sin 75}{\cos 75} = W\frac{1}{\cos 75} \times \frac{1}{\sqrt{2}}$

$R = \frac{W}{\sqrt{2}\sin 75} = \frac{W}{\sqrt{2}\cos 15}$

[illegible] $\frac{F}{R} \leq \mu$ [illegible]

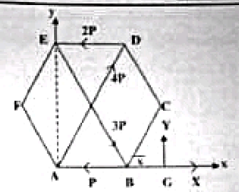
$\frac{W(2 - \sqrt{3})}{\frac{W}{\sqrt{2}\cos 15}} = \sqrt{2}(2 - \sqrt{3})\cos 15 \leq \mu$ [illegible]

(μ [illegible])

(b) [illegible] x හා y [illegible]

$\rightarrow X = -P - 2P + 3P\cos 60 + 4P\cos 60$

$= \frac{P}{2}$



$\uparrow Y = 4P\cos 30 - 3P\cos 30$

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

$R = \sqrt{X^2 + Y^2} = P$

R [illegible] x [illegible] θ [illegible]

$\tan\theta = \frac{Y}{X} = \sqrt{3} \Rightarrow \theta = 60^\circ$

[illegible] AB [illegible] G හි දී [illegible] A වටා [illegible] (BG = $\bar{x}$ [illegible])

$2P \times 2a\cos 30 - 3P \times a\sin 60 = \frac{P\sqrt{3}}{2}(a + \bar{x})$

$\bar{x} = 0$ [illegible]

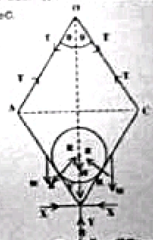
∴ [illegible] P, BC [illegible]

CB [illegible] P [illegible] FE [illegible] P [illegible] FE [illegible] BC [illegible] P [illegible] FE [illegible] P [illegible]

[illegible] AFEDCB [illegible] $P \times 2a\cos 30 = Pa\sqrt{3}$ වේ.

06. (a) [illegible] O [illegible]

∴ Y = 0



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[illegible] ↑ [illegible]

$2R\sin\theta = W \Rightarrow R = \frac{W}{2\sin\theta}$

[illegible] ↑ [illegible]

$2T\cos\theta = 3W \Rightarrow T = \frac{3W}{2\cos\theta}$

AB [illegible] B [illegible]

$R \times \frac{a}{3}\cot\theta + W \times a\sin\theta = (T\cos\theta \times 2a\sin\theta) + (T\sin\theta \times 2a\cos\theta)$

$\frac{W}{2\sin\theta}\cdot\frac{a}{3}\frac{\cos\theta}{\sin\theta} + W \times a\sin\theta = 2 \times \frac{3W}{2\cos\theta} \times 2a\sin\theta\cos\theta$

$\cos\theta + 6\sin^3\theta = 36\sin^3\theta$

$\frac{\cos\theta}{\sin^3\theta} = 30\frac{\sin^3\theta}{\sin^3\theta}$

$\cot\theta\,\text{cosec}^2\theta = 30$

$\cot\theta(1+\cot^2\theta) = 30$

$\cot^3\theta + \cot\theta - 30 = 0$

$(\cot\theta - 3)(\cot^2\theta + 3\cot\theta + 10) = 0$

$\cot\theta = 3$ [illegible] $\cot^2\theta + 3\cot\theta + 10 = 0$

[illegible] $\Delta = 9 - 40 < 0$

$\therefore$ θ [illegible] $\cot^{-1}3$ [illegible]

AB [illegible]

$T\sin\theta + X = R\cos\theta$

$\frac{3W}{2\cos\theta}\sin\theta + X = \frac{W}{2\sin\theta} \times \cos\theta$

$X = \frac{W}{2}\cot\theta - \frac{3W}{2}\tan\theta$

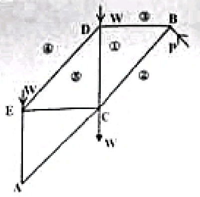
$= \frac{W}{2} \times 3 - \frac{3W}{2} \times \frac{1}{3} = W$

(b) [illegible] a [illegible]
[illegible] A [illegible]

$W \times 4a + W \times 4a = P \times 2a\sec 45^\circ$

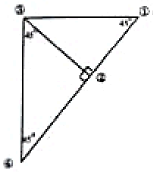
$8W = 4P\sqrt{2}$

$P = \frac{W}{\sqrt{2}}$

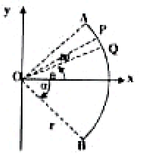


[illegible]

දණ්ඩ	ප්‍රත්‍යාබලය	විශාලත්වය
BD	තෙරපුම	W
BC	ආතතිය	W / √2
DE	තෙරපුම	√2 W



07. [illegible] G, x- [illegible]



$P\hat{O}Q = \delta\theta$ [illegible]

PQ [illegible] $= r\,\delta\theta$

ρ_1 [illegible]

PQ [illegible] $= r\,\delta\theta\,\rho_1$

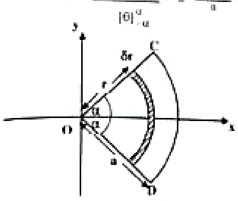
PQ [illegible]

y [illegible] $= r\cos\theta$

[illegible]

$$\bar{x} = \frac{\int_{-\alpha}^{\alpha} r^2\cos\theta\,.\,d\theta\,.\,\rho_1}{\int_{-\alpha}^{\alpha} r\,d\theta\,\rho_1}$$

$$= \frac{r[\sin\theta]_{-\alpha}^{\alpha}}{[\theta]_{-\alpha}^{\alpha}} = \frac{r\sin\alpha}{\alpha}$$



[illegible] r [illegible] δ r [illegible]

[illegible] $= r\,2\alpha\,\delta r\,\rho_2$

[illegible] ρ_2 [illegible]

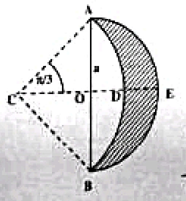
[illegible] y [illegible] $= \frac{r\sin\alpha}{\alpha}$

$\therefore$ [illegible] y [illegible]

$$\bar{x} = \frac{\int_0^a r.\,2\alpha\,dr\,\rho_2 \times \frac{r\sin\alpha}{\alpha}}{\int_0^a r.\,2\alpha dr\,\rho_2}$$

$$= \frac{\sin\alpha}{\alpha}\left\{\frac{\left[\frac{r^3}{3}\right]_0^a}{\left[\frac{r^2}{2}\right]_0^a}\right\} = \frac{2}{3}\,\frac{a\sin\alpha}{\alpha}$$

07.



$OA = a$

$OC = \frac{a}{\sqrt{3}}$

$AC = \frac{2a}{\sqrt{3}}$

ABE ◗ $= \frac{\pi a^2}{2}$

ABC △ $= \frac{1}{2} \times 2a \times \frac{a}{\sqrt{3}}$

ACBD◁ $= \frac{1}{2} \times \left(\frac{2a}{\sqrt{3}}\right)^2 \times \frac{2\pi}{3}$

වස්තුව	ස්කන්ධය	ස්කන්ධ කේන්ද්‍රයට C සිට දුර
ABE [illegible]	$\frac{\pi a^2\rho}{2}$	$\frac{a}{\sqrt{3}} + \frac{4a}{3\pi}$
ABC [illegible]	$\frac{a^2\rho}{\sqrt{3}}$	$\frac{2}{3} \cdot \frac{a}{\sqrt{3}}$
OADB [illegible]	$\frac{4\pi a^2}{9}\rho$	$\frac{2a}{\pi}$
ADBE [illegible]	$a^2\rho\left(\frac{\pi}{18} + \frac{1}{\sqrt{3}}\right)$	$\bar{x}$

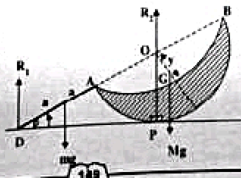
C [illegible]

$$\frac{\pi a^2\rho}{2}\left(\frac{a}{\sqrt{3}} + \frac{4a}{3\pi}\right) + \frac{a^2\rho}{\sqrt{3}} \times \frac{2a}{3\sqrt{3}} - \frac{4\pi a^2\rho}{9} \times \frac{2a}{\pi} = a^2\rho\left(\frac{\pi}{18} + \frac{1}{\sqrt{3}}\right)\bar{x}$$

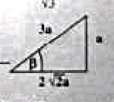
$$\frac{\pi a}{2\sqrt{3}} + \frac{2a}{3} + \frac{2a}{9} - \frac{8a}{9} = \left(\frac{\pi + 6\sqrt{3}}{18}\right)\bar{x}$$

$$\frac{\pi a}{2\sqrt{3}} \times \frac{18}{(\pi + 6\sqrt{3})} = \bar{x}$$

$$\therefore \bar{x} = \frac{3\sqrt{3}\pi a}{(\pi + 6\sqrt{3})} = ka$$



$\bar{y} = ka - \frac{a}{\sqrt{3}}$



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[illegible] P [illegible]

$R_1 \times 3a\cos\beta + Mg\left(ka - \frac{a}{\sqrt{3}}\right)\sin\beta - mg \cdot 2a\cos\beta = 0$

[illegible] R_1 [illegible] D [illegible] D [illegible] $R_1 > 0$ [illegible]

[illegible] $mg \cdot 2a\cos\beta > Mg\left(ka - \frac{a}{\sqrt{3}}\right)\sin\beta$

$2m > M\frac{(\sqrt{3}k - 1)}{\sqrt{3}} \tan\beta$

$2m > M\frac{(\sqrt{3}k - 1)}{\sqrt{3}} \times \frac{1}{2\sqrt{2}}$

$4\sqrt{6}m > M(\sqrt{3}k - 1)$

08. B [illegible] A [illegible]

$P(B|A) = \frac{P(A\cap B)}{P(A)}$ [illegible] $P(A) > 0$ [illegible]

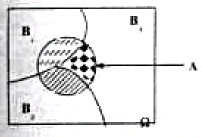
[illegible]

$P(C|A\cap B) = \frac{P(C\cap A\cap B)}{P(A\cap B)}$ [illegible]

$\therefore P(A)\,P(B|A)\,P(C|A\cap B) = P(A)\cdot\frac{P(B\cap A)}{P(A)}\cdot\frac{P(C\cap A\cap B)}{P(A\cap B)}$

$= P(A\cap B\cap C)$

[illegible]



$A = (B_1\cap A)\cup(B_2\cap A)\cup(B_3\cap A)$

$P(A) = P[(B_1\cap A)\cup(B_2\cap A)\cup(B_3\cap A)]$

$= P(B_1\cap A) + P(B_2\cap A) + P(B_3\cap A)$

$\because$ [illegible] $B_1\cap A$, $B_2\cap A$, $B_3\cap A$ [illegible]

$P(A) = P(B_1)P(A|B_1) + P(B_2)P(A|B_2) + P(B_3)P(A|B_3)$ ——— ①

([illegible])

$P(B_i|A) = \frac{P(A\cap B_i)}{P(A)}$ $i = 1, 2, 3$ [illegible]

$= \frac{P(B_i)P(A|B_i)}{P(B_1)P(A|B_1) + P(B_2)P(A|B_2) + P(B_3)P(A|B_3)}$

X_i ; [illegible] $(i = 1, 2, 3)$ [illegible]

Y_i ; [illegible] $(i = 1, 2, 3)$ [illegible]

Z_i ; [illegible] $(i = 1, 2, 3)$ [illegible]

$P(X_i) = \frac{50}{100} = 0.5$, $P(Y_i) = \frac{20}{100} = 0.2$,

$P(Z_i) = \frac{30}{100} = 0.3$

(i) [illegible]
$= Z_1\cap Z_2\cap Z_3$

[illegible] $= P(Z_1\cap Z_2\cap Z_3)$

$= P(Z_1)P(Z_2)P(Z_3)$

($\because$ Z_1, Z_2, Z_3 [illegible])

$= 0.3\times0.3\times0.3 = 0.027$

(ii) [illegible]
$= (X_1\cap X_2\cap X_3)\cup(Y_1\cap Y_2\cap Y_3)\cup(Z_1\cap Z_2\cap Z_3)$

[illegible]
$= P[(X_1\cap X_2\cap X_3)\cup(Y_1\cap Y_2\cap Y_3)\cup(Z_1\cap Z_2\cap Z_3)]$

$= P(X_1\cap X_2\cap X_3) + P(Y_1\cap Y_2\cap Y_3) + P(Z_1\cap Z_2\cap Z_3)$

($\because$ [illegible])

$= P(X_1)P(X_2)P(X_3) + P(Y_1)P(Y_2)P(Y_3) + P(Z_1)P(Z_2)P(Z_3)$

($\because$ [illegible])

$(0.5)^3 + (0.2)^3 + (0.3)^3 = 0.125 + 0.008 + 0.027$

$0.160 = \underline{0.16}$

(iii) [illegible]
$= (X_1\cap Y_2\cap Y_3)\cup(Y_1\cap X_2\cap Y_3)\cup(Y_1\cap Y_2\cap X_3)$

[illegible]
$= P(X_1\cap Y_2\cap Y_3) + P(Y_1\cap X_2\cap Y_3) + P(Y_1\cap Y_2\cap X_3)$

([illegible])

$= P(X_1)P(Y_2)P(Y_3) + P(Y_1)P(X_2)P(Y_3) + P(Y_1)P(Y_2)P(X_3)$

$= 0.5\times0.2\times0.2 + 0.2\times0.5\times0.2 + 0.2\times0.2\times0.5$

$= 3\times0.5\times0.2\times0.2$

$= 0.060$

(iv) [illegible]

$(X_1\cap Y_2\cap Z_3)\cup(Y_1\cap Z_2\cap X_3)\cup(Z_1\cap X_2\cap Y_3)$

[illegible] $= (0.5\times0.2\times0.3) + (0.2\times0.3\times0.5) + (0.3\times0.5\times0.2)$

$= 3\times0.5\times0.2\times0.3$

$= \underline{0.090}$

A ; [illegible]

(a) [illegible]

[illegible] $= P[(X_1\cap X_2\cap X_3)|A]$

$= \frac{P(X_1\cap X_2\cap X_3\cap A)}{P(A)}$

$= \frac{P(X_1\cap X_2\cap X_3)}{P(A)}$

[$\because X_1\cap X_2\cap X_3\cap A = X_1\cap X_2\cap X_3$ [illegible]]

$= \frac{0.125}{0.16} = \frac{125}{160}$

$= \frac{25}{32} = 0.78125$

(b) [illegible]

$= \frac{0.008}{0.16} = \frac{1}{20}$

$= 0.05$

(c) [illegible]

$= \frac{0.027}{0.16} = \frac{27}{160}$

$= 0.16875$

[illegible]

09. (a) $\sum_{i=1}^{n}(x_i - \bar{x})^2 = \sum_{i=1}^{n}(x_i^2 - 2\bar{x}x_i + \bar{x}^2)$

$= \sum_{i=1}^{n}x_i^2 - 2\bar{x}\sum_{i=1}^{n}x_i + \sum_{i=1}^{n}\bar{x}^2$

$= \sum_{i=1}^{n}x_i^2 - 2\bar{x}\cdot n\bar{x} + n\bar{x}^2$

$\left(\because \bar{x} = \frac{1}{n}\sum_{i=1}^{n}x_i\right)$

$= \sum_{i=1}^{n}x_i^2 - n\bar{x}^2$

[illegible] 200

[illegible] x_i [illegible] $\sum x_i = 920$

$\sum x_i^2 = 5032$

$n = 200$ [illegible]

[illegible] $\bar{x} = \frac{1}{n}\sum_{i=1}^{n}x_i$

$= \frac{1}{200}\times920$

$= \underline{4.6}$

[illegible] $= \frac{1}{n}\sum_{i=1}^{200}x_i^2 - \bar{x}^2$

$= \frac{1}{200}\times5032 - (4.6)^2$

$= 25.16 - 21.16 = 4$

$\therefore$ [illegible] $= \underline{2}$

[illegible] 50

[illegible] y_i [illegible] $\bar{y} = 4.4$

[illegible] $= 2.2$

$\therefore$ [illegible] $= 4.84$

$\sum_{i=1}^{n}y_i = n\bar{y}$

$= 50\times4.4$

$= 220$

[illegible] $4.84 = \frac{1}{50}\sum_{i=1}^{50}y_i^2 - \bar{y}^2$

$= \frac{1}{50}\sum_{i=1}^{50}y_i^2 - (4.4)^2$

$4.84\times50 = \sum_{i=1}^{50}y_i^2 - 19.36\times50$

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$$\sum_{i=1}^{50} y_i^2 = 24.2 \times 50$$

$$= 1210$$

මුළු 250 සැලකූ විට, අදාළ අගයන් z_i නම්.

$$\sum_{i=1}^{250} z_i = 920 + 220$$

$$= 1140$$

$$\therefore \bar{z} = \frac{1140}{250}$$

$$= \underline{4.56}$$

$$\text{විචලතාව} = \frac{1}{250} \sum_{i=1}^{n} z_i^2 - \bar{z}^2$$

$$= \frac{1}{250}[5032 + 1210] - (4.56)^2$$

$$= 24.968 - 20.7936 = 4.1744$$

∴ සම්මත අපගමනය $= \sqrt{4.1744} \approx \underline{2.04}$

(b) මුල් ලකුණ x ද, පරිවර්තිත ලකුණ y ද යැයි ගනිමු.
a හා b නියත විට, රේඛීය පරිණාමය

$y = a + bx$ —— ① යැයි සිතමු.

එවිට, $\bar{y} = a + b\bar{x}$ —— ② වේ.

$\bar{x} = 45$ ද, $\bar{y} = 50$ ද, $x = 70$ ද $y = 80$ ද බව දී ඇත.

② න් $50 = a + 45b$ —— ③

① න් $80 = a + 70b$ —— ④

③ හා ④ විසඳීමෙන් $a = -4$ හා $b = 1.2$ බව ලැබේ.

(i) ∴ රේඛීය පරිණාමය $y = -4 + 1.2x$ වේ.

(ii) විචලතාවයේ අර්ථ දැක්වීමට අනුව,

$$\text{Var } x = \frac{1}{n} \sum_{i=1}^{n} (x_i - \bar{x})^2 \text{ නිසා}$$

$$\text{Var } y = \frac{1}{n} \sum_{i=1}^{n} (y_i - \bar{y})^2$$

$$= \frac{1}{n} \sum_{i=1}^{n} [a + bx_i - (a + b\bar{x})]^2$$

$$= \frac{1}{n} \sum_{i=1}^{n} b^2 (x_i - \bar{x})^2$$

$$= b^2 \frac{1}{n} \sum_{i=1}^{n} (x_i - \bar{x})^2$$

∴ සම්මත අපගමනය y = b × (සම්මත අපගමනය x)

සම්මත අපගමනය y = 15 නිසාත් හා b = 1.2 නිසාත්,

$$15 = 1.2 \times (\text{ස.අ.}x)$$

∴ මුල් ලකුණුවල (x) සම්මත අපගමනය

$$= \frac{15}{1.2} = 12.5$$

(iii) පරිවර්තනය මගින් ලකුණු වෙනස් නොවේ නම් $x = y$ විය යුතු ය.

$$\therefore ① \text{ න් } x = a + bx$$

$$x = -4 + 1.2x$$

$$4 = 0.2x$$

$$\underline{x = 20}$$

පරිවර්තනය කරන ලද අවම ලකුණ 2 නම් ① න්

$$2 = -4 + 1.2x_{min} \Rightarrow x_{min} = 5$$

උපරිම ලකුණ 92 නම්.

$$92 = -4 + 1.2_{max} \Rightarrow x_{max} = 80$$

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