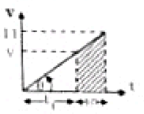
01. (අ) [illegible]

[illegible] B [illegible] V [illegible] B [illegible] 11 ms^{-1} [illegible] 10 [illegible] 100 m [illegible]



$\therefore \frac{1}{2}(V + 11)10 = 100 \Rightarrow V = 9$

[illegible] B [illegible] t_1 [illegible]

$\tan\theta = \frac{V}{t_1} = \frac{11 - V}{10} \Rightarrow t_1 = 45$

$V = 9$ [illegible]

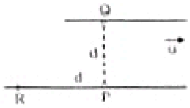
[illegible] $= \frac{9}{45} = \frac{1}{5}\ ms^{-2}$

[illegible] $(45 + 10)$ [illegible]

$= \frac{1}{2} \times 55 \times 11$

$= \underline{302.5\ m}$

(ආ)



(B, J) $= v$

(J, E) $= \underset{\rightarrow}{u}$

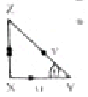
(B, E) $=$ [illegible]

(B, E) $=$ (B, J) + (J, E)

$= v + \underset{\rightarrow}{u} = \underset{\rightarrow}{u} + v$

$= \overrightarrow{XY} + \overrightarrow{YZ}$

$= \overrightarrow{XZ}$



$XZ = \sqrt{v^2 - u^2}$

$\therefore$ P [illegible] Q [illegible] $T = \frac{d}{\sqrt{v^2 - u^2}}$

$PQ = PR = d$ වේ

[illegible] $= v - u$

[illegible] $= v + u$

$P \rightarrow R \rightarrow P$ [illegible]

$T_1 = \frac{d}{v - u} + \frac{d}{v + u}$

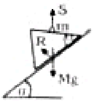
$= \frac{dv + du + dv - du}{(v - u)(v + u)}$

$= \frac{2dv}{v^2 - u^2} = \frac{d}{\sqrt{v^2 - u^2}} \times \frac{2v}{\sqrt{v^2 - u^2}}$ [illegible]

$T_1 = \frac{2Tv}{\sqrt{v^2 - u^2}}$

$v > u$ [illegible]

02. (අ) [illegible]



(W, P) $= \overset{a_1}{\longrightarrow}$

(P, E) $=$ a_2 α

(W, E) $=$ (W, P) + (P, E)

$= \overleftarrow{a_1} +$ a_2 α

$\underline{F} = m\,\underline{a}$

(m) $\rightarrow$ $0 = m(a_1 - a_2 \cos\alpha)$ — ❶

(m+M) α

$(M + m)g\sin\alpha$

$= Ma_2 + m(a_2 - a_1\cos\alpha)$ — ❷

❶ න් $a_1 = a_2\cos\alpha$; ❷ ට [illegible]

$(M + m)g\sin\alpha$

$= a_2[M + m - m\cos\alpha\cos\alpha]$

$a_2 = \frac{(M + m)g\sin\alpha}{M + m\sin^2\alpha}$

[illegible] (m, E) $= \overset{a_1}{\longrightarrow} +$ a_2 α

[illegible] $= a_1 - a_2\cos\alpha$

$= 0$ ❶ [illegible]

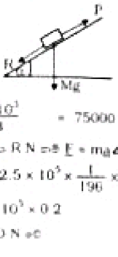
[illegible] $= a_2\sin\alpha$

[illegible] $[(M + m)g\sin^2\alpha]/[M + m\sin^2\alpha]$ වේ.

(ආ) [illegible] $= 24\ km\,h^{-1} = \frac{20}{3}\ ms^{-1}$ වේ

[illegible] P [illegible] $H = 500 \times 10^3\ W$

[illegible] $PV = H$ [illegible]



$P = \frac{500 \times 10^3}{20/3} = 75000\ N$ වේ

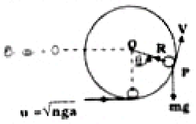
[illegible] R N [illegible] $\underline{F} = m\underline{a}$ [illegible]

$75000 - R - 2.5 \times 10^5 \times \frac{1}{196} \times 9.8$

$= 2.5 \times 10^5 \times 0.2$

$R = 12500\ N$ වේ

03. [illegible]



[illegible]

$\frac{1}{2}m \cdot nga - mga = \frac{1}{2}mV^2 - mga\cos\theta$

$V^2 = ga(n - 2 + 2\cos\theta)$ — ❶

[illegible] $\underline{F} = m\,\underline{a}$ [illegible]

$R - mg\cos\theta = m\frac{V^2}{a}$ — ❷

❶ [illegible]

$R = mg\cos\theta + \frac{m}{a}ga(n - 2 + 2\cos\theta)$

$R = mg(n - 2 + 3\cos\theta)$

[illegible] $R = 0$ [illegible]

$R = 0 \Rightarrow \cos\alpha = \frac{2 - n}{3}$; [illegible] $\theta = \alpha$ [illegible]

$2 < n < 5$ [illegible] $\alpha > \pi/2$ වේ

$(\because \cos\alpha < 0$ [illegible]$)$

[illegible] ❶ [illegible]

$V_0^2 = ga\left[n - 2 + 2\frac{(2 - n)}{3}\right]$

$= ga\left[\frac{3n - 6 + 4 - 2n}{3}\right]$

$= ga\frac{(n - 2)}{3}$

[illegible] V_0 [illegible] $\theta = \alpha$ [illegible]

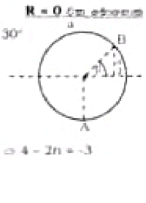
(ii) O θ [illegible] $\frac{\beta}{2}$ [illegible]

R = 0 [illegible]

$\sin\beta = \frac{1}{2}$ වේ $\Rightarrow \beta = 30^\circ$

$\alpha = \frac{\pi}{2} + \beta$

[illegible] $\cos\alpha = -\frac{1}{2}$



$\cos\alpha = \frac{2 - n}{3} = -\frac{1}{2} \Rightarrow 4 - 2n = -3$

$\Rightarrow \underline{n = \frac{7}{2}}$

t_1 [illegible] $V_0^2 = \frac{ga}{3}\left[\frac{7}{2} - 2\right] = \frac{ga}{2}$ වේ

[illegible] $a\cos 30 = \frac{a\sqrt{3}}{2}$ [illegible] t_1 [illegible]

$S = ut + \frac{1}{2}at^2$ [illegible] $\frac{a\sqrt{3}}{2} =$

$\sqrt{\frac{ga}{2}}\cos 60\, t_1 \Rightarrow t_1 = \sqrt{\frac{6a}{g}}$ [illegible]

t_1 [illegible] h [illegible]

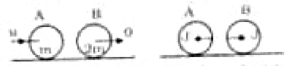
$h = \sqrt{\frac{ga}{2}}\sin 60 \cdot t_1 - \frac{1}{2}g \cdot t_1^2$

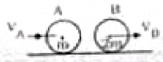
$h = \sqrt{\frac{ga}{2}} \cdot \frac{\sqrt{3}}{2} \cdot \sqrt{\frac{6a}{g}} - \frac{1}{2}g \cdot \frac{6a}{g}$

$= \frac{3}{2}a - 3a = -\frac{3a}{2}$

[illegible] B [illegible] A [illegible]
[illegible] A [illegible]

04. (අ) [illegible]





(i) [illegible]

$mu = 2mV_B + mV_A$ — ❶

[illegible]

$eu = V_B - V_A$ — ❷

❶+❷ [illegible] $V_B = \frac{u}{3}(1+e)$; ❶-❷ × 2 [illegible]

$V_A = \frac{u}{3}(1-2e)$

$I = \Delta(m\underline{V})$, Ⓑ [illegible]

$J = 2m\,V_B = \frac{2mu}{3}(1+e)$

Ⓐ [illegible] $J = m(-V_A) - m(-u)$

$= mu - mV_A$

$= m(u - V_A)$

(ii) [illegible] E = [illegible]

$E = \frac{1}{2}mu^2 - \left[\frac{1}{2}mV_A^2 + \frac{1}{2}\,2m V_B^2\right]$

$= \frac{1}{2}m\left[u^2 - V_A^2\right] - \frac{1}{2}\,2m V_B^2$

$= \frac{1}{2}m(u - V_A)(u + V_A) - \frac{1}{2}2m\,V_B.V_B$

$= \frac{1}{2}J(u + V_A) - \frac{1}{2}J V_B$

$= \frac{1}{2}Ju + \frac{1}{2}J(V_A - V_B)$

$= \frac{1}{2}Ju + \frac{1}{2}J(-eu)$

$= \frac{1}{2}J(1-e)u$

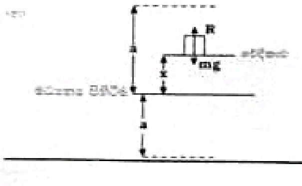
(iii) [illegible] A [illegible] $V_A < 0$ [illegible]

$1 - 2e < 0 \Rightarrow e > \frac{1}{2}$ [illegible]

$E = \frac{1}{2}\,\frac{2mu}{3}(1+e)(1-e)u$

$= \frac{mu^2}{3}(1-e^2) < \frac{mu^2}{3}\left[1-\left(\frac{1}{2}\right)^2\right]$

$E < \frac{mu^2}{3}\left(1-\frac{1}{4}\right) \Rightarrow E < \frac{1}{4}mu^2$



[illegible]

$\underline{F} = m\underline{a}$

$R - mg = m\ddot{x}$ — ❶

[illegible]

$\ddot{x} = -\omega^2 x$ — ❷

[illegible] T [illegible] $T = \frac{2\pi}{\omega}$

❷ [illegible] $\ddot{x} = -\frac{4\pi^2}{T^2}x$

❶ [illegible]

$R = mg - m\frac{4\pi^2 x}{T^2} = m\left[g - \frac{4\pi^2 x}{T^2}\right]$

R [illegible] x [illegible]

[illegible] x = [illegible] = a, [illegible] R ≥ 0 [illegible]

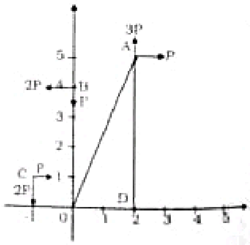
$m\left[g - \frac{4\pi^2 a}{T^2}\right] \geq 0$ [illegible]

$\pi^2 = g = 9.8$ [illegible] $T = 1$ [illegible]

$9.8\,m\left[1 - \frac{4a}{T}\right] \geq 0$ [illegible] $a \leq 0.25$ m [illegible]

∴ [illegible] 0.25 m [illegible]

05. [illegible]



$\vec{X} = P + P - 2P = 0$

$\uparrow Y = 3P - P - 2P = 0$

∴ R = 0 [illegible]

O [illegible] G [illegible]

$G = (2P\times4) + (2P\times1) + (3P\times2) - (P\times5) - (P\times1)$ Nm

$= 10\,P$ Nm

[illegible] ABC [illegible]

OAD Δ [illegible] $\lambda\overrightarrow{OA}, \lambda\overrightarrow{AD}, \lambda\overrightarrow{DO}$ [illegible]

$\lambda\overrightarrow{OA} + \lambda\overrightarrow{AD} = \lambda\overrightarrow{OD}$. [illegible] A [illegible]

$\lambda\overrightarrow{OA} + \lambda\overrightarrow{AD} + \lambda\overrightarrow{DO}$

$=$ A [illegible] $\lambda\overrightarrow{OD}$ + D [illegible] $\lambda\overrightarrow{DO}$

[illegible] ADO [illegible] $5 \times 2\lambda$ [illegible]

[illegible]

$\circlearrowleft 10P - 10\lambda = 0 \Rightarrow \lambda = P$

[illegible] OA [illegible] $= P\overrightarrow{OA}$

$= P(2\underline{i} + 5\underline{j})$

AD [illegible] $= P\overrightarrow{AD} = P(-5\underline{j})$

$= -5P\underline{j}$

DO [illegible] $= P\overrightarrow{DO} = P(-2\underline{j})$

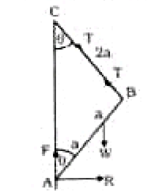
$= -2P\underline{i}$

06. [illegible]

(a) [illegible]

[illegible] $T\sin\theta = R$ — ❶

[illegible] $F + T\cos\theta = W$ — ❷



A [illegible]

$T \times 2a\sin 2\theta = W.\,a\sin\theta$

$T = \frac{W}{4\cos\theta}$

[illegible] ❶ [illegible] $R = \frac{W}{4}\tan\theta$

❷ [illegible] $F = \frac{3}{4}W$

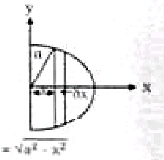
[illegible] $\frac{F}{R} \leq \mu$ [illegible]

[illegible] $\cot\theta \leq \frac{\mu}{3}$ [illegible]

[illegible] $\theta \leq \cot^{-1}\left(\frac{\mu}{3}\right)$

(b) [illegible] G [illegible] X [illegible] $G \equiv (\bar{x}, 0)$

Y [illegible] x [illegible] δx [illegible]



[illegible] $= \sqrt{a^2 - x^2}$

[illegible] ρ [illegible]

$= \pi(a^2 - x^2)\rho\,\delta x$

[illegible] Y [illegible] X [illegible]

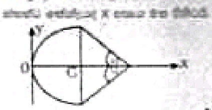
$\bar{x} = \frac{\int_0^a \pi(a^2 - x^2)\rho x\,dx}{\int_0^a \pi(a^2 - x^2)\rho\,dx}$

[illegible] $\bar{x} = \frac{3}{8}a$

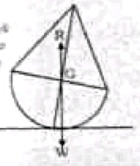
∴ $G \equiv (\frac{3}{8}a, 0)$

[illegible]

[illegible] X [illegible]



[illegible]



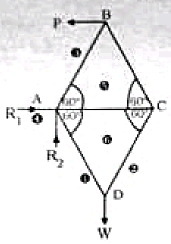
$\overline{G}$ [illegible]

$\frac{2}{3}\pi a^3\rho.\frac{3}{8}a$

$= \frac{1}{3}\pi a^2 a\cot\alpha\rho \times \frac{1}{4}a\cot\alpha$

$\cot^2\alpha = 3 \Rightarrow \tan^2\alpha = \frac{1}{3} \Rightarrow \alpha = 30°$

07. [illegible] R_1 හා R_2 [illegible]



A වටා ඝූර්ණ ගැනීමෙන්

$W \times a \cos 60^\circ = P \times a \sin 60^\circ \Rightarrow$

$P = W/\sqrt{3}$ [illegible]

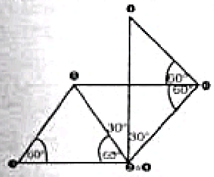
$\uparrow$; $R_2 = W$ $\leftarrow$ $R_1 = P = W/\sqrt{3}$

[illegible] $\overrightarrow{AC}$ [illegible] θ [illegible]

$$\tan\theta = \frac{R_2}{R_1} = \frac{W}{W/\sqrt{3}} = \sqrt{3} \Rightarrow \theta = 60^\circ$$

A [illegible] AB [illegible]

දණ්ඩ	ප්‍රත්‍යාබලය	විශාලත්වය
AD	ආතතිය	$W/\sqrt{3}$
CD	ආතතිය	$W/\sqrt{3}$
BC	ආතතිය	$W/\sqrt{3}$
AB	තෙරපුම	$W/\sqrt{3}$
AC	තෙරපුම	$W/\sqrt{3}$



08. (අ) [illegible]

(ආ) [illegible]

$P(A \cap B) = \frac{1}{4}$; $P(A) = \frac{5}{12}$;

$P(A | B') = \frac{5}{12}$

(i) $P(B|A) = \frac{P(B \cap A)}{P(A)} = \frac{\frac{1}{4}}{\frac{5}{12}} = \frac{3}{5}$

(ii) $P(A | B') = \frac{P(A \cap B')}{P(B')} \Rightarrow P(A \cap B')$

$= P(A | B') \, P(B')$

$P(A \cap B') = \frac{5}{12} P(B')$ — ❶

$P(A) = P(A \cap B) + P(A \cap B')$ [illegible]

$\frac{5}{12} = \frac{1}{4} + P(A \cap B') \Rightarrow P(A \cap B')$

$= \frac{1}{6}$

❶ න් $\frac{1}{6} = \frac{5}{12} P(B') \Rightarrow P(B') = \frac{2}{5}$

$P(B) = 1 - P(B') \Rightarrow P(B) = \frac{3}{5}$

(iii) $P(A | B) = \frac{P(A \cap B)}{P(B)}$

$P(A | B) = \frac{\frac{1}{4}}{\frac{3}{5}} = \frac{5}{12}$

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

$P(A \cup B) = \frac{5}{12} + \frac{3}{5} - \frac{1}{4} = \frac{23}{30}$

$P(A \cap B) = \frac{1}{4} \neq 0$ නිසා $A \cap B \neq \phi$ වේ.

∴ A හා B [illegible]

$P(A)\,P(B) = \frac{5}{12} \times \frac{3}{5} = \frac{1}{4}$

$= P(A \cap B)$ නිසා

A හා B ස්වායත්ත සිද්ධීන් වේ

(ආ) B - පිරිමි ළමයෙකු ඉපදීම

G - ගැහැණු ළමයෙකු ඉපදීම

B හා G [illegible]

$P(B) = P(G) = \frac{1}{2}$ වේ.

A [illegible]

[illegible] $= P(B|A)$

(i) $P(B|A) = \frac{P(B \cap A)}{P(A)}$ — ❶

$P(A)$

$= P(BB) + P(BG) + P(GB)$

$= P(B)P(B) + P(B)P(G) + P(G)P(B)$

$= \frac{1}{2} \cdot \frac{1}{2} + \frac{1}{2} \cdot \frac{1}{2} + \frac{1}{2} \cdot \frac{1}{2}$

$= \frac{3}{4}$

$P(B \cap A)$ [illegible]

∴ $P(B \cap A) = \frac{1}{4}$

❶ න් $P(B|A) = \frac{\frac{1}{4}}{\frac{3}{4}} = \frac{1}{3}$

(ii) $P(G|A) = 1 - P(B|A)$

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

($G|A$ හා $B|A$ [illegible])

09. [illegible]

ලකුණු පන්තිය	මධ්‍ය අගය	$\frac{x - 72}{5} = d$	f	fd	fd^2	සමුච්චිත සංඛ්‍යාතය
50-54	52	-4	3	-12	48	3
55-59	57	-3	7	-21	63	10
60-64	62	-2	15	-30	60	25
65-69	67	-1	38	-38	38	63
70-74	72	0	41	0	0	104
75-79	77	1	35	35	35	139
80-84	82	2	21	42	84	160
85-89	87	3	16	48	144	176
90-94	92	4	14	56	224	190
95-99	97	5	10	50	250	200
			200	130	946	

(අ) (i) [illegible] 100 [illegible]

[illegible] 70 - 74 [illegible] 69.5 - 74.5 [illegible]

$$\text{මධ්‍යස්ථය} = L + \left(\frac{\frac{N}{2} - c.f.}{f}\right) \times i$$

(C. F. සමුච්චිත සංඛ්‍යාතය)

$$= 69.5 + \frac{\frac{200}{2} - 63}{41} \times 5$$

$= 74.01 \triangleq 74.0$

(ii) [illegible] Q_1 [illegible]

[illegible] 65 - 69 [illegible] 64.5 - 69.5

$$Q_1 = 64.5 + \left(\frac{\frac{200}{4} - 25}{38}\right) \times 5$$

$= 67.79 \triangleq 67.8$

(iii) [illegible] 80 - 84 [illegible] 79.5 - 84.5

$$Q_3 = 79.5 + \frac{\frac{200}{4} \times 3 - 139}{21} \times 5$$

$= 82.12 \triangleq 82.1$

(ආ) [illegible]

(i) මධ්‍යන්‍යය $\overline{x}$

$= $ [illegible] $+ \frac{i \sum fd}{\sum f}$

[illegible] $i = 5$

$\overline{x} = 72 + 5 \times \frac{130}{200}$

$= 75.25 \triangleq 75.3$

(ii) සම්මත අපගමනය $= \sqrt{\frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2} \times i$

$= \sqrt{\frac{946}{200} - \left(\frac{130}{200}\right)^2} \times 5$

$= 10.377 \triangleq 10.4$

(iii) [illegible]

$= \frac{3(\text{[illegible]} - \text{[illegible]})}{\text{සම්මත අපගමනය}}$

$= \frac{3(75.25 - 74)}{10.377} \triangleq 0.4$

[illegible]

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