01. (අ) α හා β යනු $x^2 + px + 1 = 0$ හි [illegible]

$(x - \alpha)(x - \beta) = x^2 + px + 1 = 0$

$\Rightarrow (\alpha - x)(\beta - x) = x^2 + px + 1 = 0$

[illegible] $(\alpha - \gamma)(\beta - \gamma) = \gamma^2 + p\gamma + 1$ හා

$(\alpha - \delta)(\beta - \delta) = \delta^2 + p\delta + 1$

$\Rightarrow (\alpha - \gamma)(\beta - \gamma)(\alpha - \delta)(\beta - \delta)$

$= (\gamma^2 + p\gamma + 1).(\delta^2 + p\delta + 1)$

[illegible] $\alpha + \beta = -p,\ \alpha\beta = 1,$

$\gamma + \delta = -1/p,\ \gamma\delta = 1$

$(\alpha - \gamma)(\beta - \gamma)(\alpha - \delta)(\beta - \delta)$

$= (\gamma^2 + p\gamma + 1)(\delta^2 + p\delta + 1)$

$= \gamma^2\delta^2 + p\gamma^2\delta + \gamma^2 + p\gamma\delta^2$
$+ p^2\gamma\delta + p\gamma + \delta^2 + p\delta + 1$

$= (\gamma\delta)^2 + p\gamma\delta(\gamma + \delta) + p^2\gamma\delta$
$+ p(\gamma + \delta) + \gamma^2 + \delta^2 + 1$

$= (\gamma\delta)^2 + p(\gamma\delta)(\gamma + \delta) + p^2\gamma\delta$
$+ p(\gamma + \delta) + (\gamma + \delta)^2 - 2\gamma\delta + 1$

$= 1 + p.1\left(\frac{-1}{p}\right) + p^2(1)$

$+ p.\left(\frac{-1}{p}\right) + \left(\frac{-1}{p}\right)^2 - 2.1 + 1$

$= 1 - 1 + p^2 - 1 + \frac{1}{p^2} - 1$

$= p^2 - 2 + \frac{1}{p^2}$

$= \left(p - \frac{1}{p}\right)^2$

(ආ) $\log_a b = x$ හා $\log_b a = y$ [illegible]

[illegible] $b = a^x \Rightarrow a = b^y$ [illegible]

[illegible] $b = \left[b^y\right]^x$

$b = b^{xy}$

[illegible] $xy = 1$ [illegible]

[illegible] $y = \frac{1}{x} \Rightarrow \log_a b = \frac{1}{\log_b a}$

$\frac{1}{\log_2 2001} + \frac{1}{\log_3 2001} + \frac{1}{\log_4 2001}$

$+ \dots\dots + \frac{1}{\log_{100} 2001}$

$= \log_{2001} 2 + \log_{2001} 3$
$+ \dots\dots \log_{2001} 100$

[illegible]

$= \log_{2001} (2.3.4 \dots\dots 100)$

$= \log_{2001} 100!$

$= \frac{1}{\log_{100!} 2001}$ [illegible]

02. (අ) $n = 1$ විට $A_n = 1 - (1 - \beta)\alpha^{n-1}$ [illegible]

$A_1 = 1 - (1 - \beta)\alpha^{1-1} = 1 - (1 - \beta) = \beta$

$\therefore n = 1$ විට [illegible]

$n = p$ විට [illegible]

[illegible] $A_p = 1 - (1 - \beta)\alpha^{p-1}$ [illegible]

$A_{p+1} = (1 - \alpha)(1 - A_p) + A_p$

$= (1 - \alpha)(1 - \beta)\alpha^{p-1}$
$+ (1 - (1 - \beta)\alpha^{p-1})$

$= (1 - \beta)\alpha^{p-1}(1 - \alpha - 1) + 1$

$= 1 - (1 - \beta)\alpha^{p}$

$= 1 - (1 - \beta)\alpha^{p+1-1}$

$\therefore n = p$ [illegible] $n = p + 1$ [illegible]

[illegible] n [illegible]

$A_n = 1 - (1 - \beta)\alpha^{n-1}$ [illegible]

$\sum_{r=1}^{n} A_r = \sum_{r=1}^{n} [1 - (1 - \beta)\alpha^{r-1}]$

$= \sum_{r=1}^{n} 1 - (1 - \beta)\sum_{r=1}^{n} \alpha^{r-1}$

$= n - (1 - \beta)\frac{(1 - \alpha^n)}{(1 - \alpha)}$

(ආ) $k\,{}^nC_k = k\,\frac{n!}{k!(n-k)!}$

$= \frac{n(n-1)!}{(k-1)!(n-k)!}$

$= \frac{n(n-1)!}{(k-1)!((n-1)-(k-1))!}$

$= n\,{}^{n-1}C_{k-1}$

$\sum_{k=0}^{n} k\,{}^nC_k\,x^k(1-x)^{n-k}$

$= \sum_{k=1}^{n} k\,{}^nC_k\,x^k(1-x)^{n-k}$

$= \sum_{k=1}^{n} n\,{}^{n-1}C_{k-1}\,x^k(1-x)^{n-k}$

$= nx\sum_{k=1}^{n} {}^{n-1}C_{k-1}\,x^{k-1}(1-x)^{(n-1)-(k-1)}$

$= nx\sum_{m=0}^{n-1} {}^{n-1}C_m\,x^m(1-x)^{(n-1)-m}$

[illegible] $m = k - 1$

$= nx\,[x + (1 - x)]^{n-1}$ [illegible]

$= nx$

03. (අ) G, B, G, B, G, B, ... G, B [illegible]

[illegible] 7!

[illegible] 7!

[illegible] $= 7! \times 7!$

(ආ) $y = 2|x + 1| - 3, \quad x \in \mathbb{R}$

$= \begin{cases} 2(x+1) - 3 & x + 1 \geq 0 \\ -2(x+1) - 3 & x + 1 < 0 \end{cases}$

$= \begin{cases} 2x - 1 & x \geq -1 \\ -2x - 5 & x < -1 \end{cases}$

$y = x + 2|x - 1|,\ x \in \mathbb{R}$

$= \begin{cases} x + 2(x-1) & x - 1 \geq 0 \\ x - 2(x-1) & x - 1 < 0 \end{cases}$

$= \begin{cases} 3x - 2 & x \geq 1 \\ -x + 2 & x < 1 \end{cases}$

[illegible] x [illegible] $(-7, 1) \cup (1, \infty)$

$y = x + 2|x - 1|$ හා $y = 2|x + 1| - 3$

[illegible]

$x < -1$ විට

$x + 2|x - 1| = 2|x + 1| - 3$

$x - 2(x - 1) = -2(x + 1) - 3$

$x = -7$

$-1 \leq x < 1$ විට

$x - 2(x - 1) = 2(x + 1) - 3 \Rightarrow x = 1$

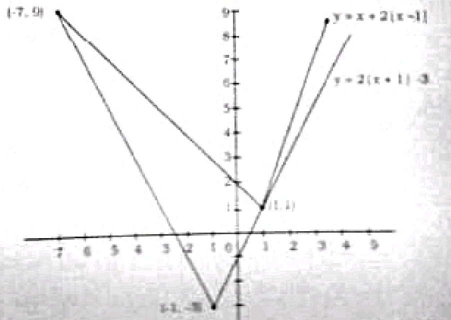
[illegible]

$1 \leq x$ විට $3x - 2 = 2x - 1 \Rightarrow x = 1$

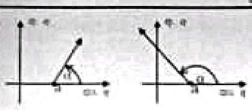
$\therefore x + 2|x - 1| = 2|x + 1| - 3$

[illegible]

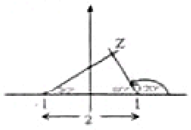
$x = -7$ හා $x = 1$



04. (a)



Z [illegible]



$Z = 1 - 2\cos 60^\circ . \cos 60^\circ + i\,2\cos 60^\circ \sin 60^\circ$

$= 1 - 2 \times \frac{1}{2} \times \frac{1}{2} + i\, 2 \times \frac{1}{2} \times \frac{\sqrt{3}}{2}$

$= \frac{1}{2} + \frac{\sqrt{3}}{2} i$

(b) $\frac{5 - i}{2 - 3i} = \frac{(5 - i)(2 + 3i)}{(2 - 3i)(2 + 3i)}$

$= \frac{10 + 15i - 2i - 3i^2}{13} = \frac{13 + 13i}{13}$

$= 1 + i \quad = \lambda(1 + i) \quad$ [illegible] $\lambda = 1$

$\left(\frac{5 - i}{2 - 3i}\right)^6 = (1 + i)^6$

$= \left[(1 + i)^2\right]^3$

$= \left[1 + 2i + i^2\right]^3$

$= (2i)^3 \quad (\because i^2 = -1)$

$= 8i^3 = -8i$ [illegible]

05. (a) $x = t - \sin t \qquad y = 1 - \cos t$

$\frac{dx}{dt} = 1 - \cos t, \ \frac{dy}{dt} = \sin t$

$\frac{dy}{dx} = \frac{dy}{dt} . \frac{dt}{dx} = \sin t . \frac{1}{1 - \cos t}$

$= \frac{2 \sin t/2 \cos t/2}{2 \sin^2 t/2}$

$= \cot t/2 \quad (\because \sin t/2 \neq 0)$

$\frac{d^2y}{dx^2} = \frac{d}{dx}\left(\frac{dy}{dx}\right)$

$= \frac{d}{dt}\left(\frac{dy}{dx}\right) . \frac{dt}{dx}$

$= -\frac{1}{2} \operatorname{Cosec}^2 t/2 \times \frac{1}{1 - \cos t}$

$= -\frac{1}{2} \operatorname{Cosec}^2 t/2 \times \frac{1}{2 \sin^2 t/2}$

$= -\frac{1}{4} \operatorname{Cosec}^4 t/2$

$\frac{d^3y}{dx^3} = \frac{d}{dt}\left(\frac{d^2y}{dx^2}\right) . \frac{dt}{dx}$

$= -\frac{1}{4} \times 4 \operatorname{Cosec}^3 t/2 \left(-\operatorname{Cosec} t/2 \cot t/2 . \frac{1}{2}\right) \frac{1}{1 - \cos t}$

$= \frac{1}{2} \operatorname{Cosec}^4 t/2 \cot t/2 . \frac{1}{2 \sin^2 t/2}$

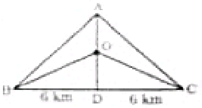
$= \left[-\frac{1}{4} \operatorname{Cosec}^4 t/2\right] \cot t/2 . \frac{-1}{\sin^2 t/2}$

$\frac{d^3y}{dx^3} = -\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right) . \frac{2}{1 - \cos t}$

$\frac{d^3y}{dx^3} = -\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right) \frac{2}{y}$

$\Rightarrow y \frac{d^3y}{dx^3} + 2\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right) = 0$

(b)



OD = x [illegible]

[illegible] OA = 16 - x [illegible] $OC^2 = x^2 + 6^2$

[illegible] l [illegible]

[illegible] $l = (16 - x) + 2\sqrt{x^2 + 36}$

x [illegible]

$\frac{dl}{dx} = -1 + \frac{2}{2}(x^2 + 36)^{-1/2} \times 2x$

$= -1 + \frac{2x}{\sqrt{x^2 + 36}}$

$= \frac{2x - \sqrt{x^2 + 36}}{\sqrt{x^2 + 36}}$

$= \frac{4x^2 - (x^2 + 36)}{\sqrt{x^2 + 36}\,(2x + \sqrt{x^2 + 36})}$

$= \frac{3x^2 - 36}{\sqrt{x^2 + 36}\,(2x + \sqrt{x^2 + 36})}$

$= \frac{3(x - 2\sqrt{3})(x + 2\sqrt{3})}{\sqrt{x^2 + 36}\,(2x + \sqrt{x^2 + 36})}$

$\frac{dl}{dx} = 0, \ (x - 2\sqrt{3})(x + 2\sqrt{3}) = 0$ [illegible]

[illegible] $x = 2\sqrt{3}$ [illegible] $(\because x \neq -2\sqrt{3})$

$\frac{dl}{dx} < 0, \ 0 < x < 2\sqrt{3}$ [illegible]

$\frac{dl}{dx} = 0, \ x = 2\sqrt{3}$ [illegible]

$\frac{dl}{dx} > 0, \ 2\sqrt{3} < x < 16$

[illegible] $0 < x < 2\sqrt{3}$ [illegible] l [illegible]

$2\sqrt{3} < x < 16$ [illegible] l [illegible]

$\therefore x = 2\sqrt{3}$ [illegible] l [illegible]

[illegible]

[illegible] A [illegible] $(16 - 2\sqrt{3})$ km [illegible]

06. (a) $I = \int_1^{\sqrt{2}} \frac{1}{x^2\sqrt{4 - x^2}}\, dx$ [illegible] $x = 2 \sin\theta$

[illegible] $dx = 2 \cos\theta\, d\theta$

$x = 1 \Rightarrow \sin\theta = \frac{1}{2}\ \theta = \pi/6$

$x = \sqrt{2} \Rightarrow \sin\theta = \frac{1}{\sqrt{2}}\ \theta = \frac{\pi}{4}$

[illegible] $I = \int_{\pi/6}^{\pi/4} \frac{2\cos\theta\, d\theta}{4\sin^2\theta\sqrt{4 - 4\sin^2\theta}}$

$= \int_{\pi/6}^{\pi/4} \frac{\cos\theta\, d\theta}{4\sin^2\theta \cos\theta}$

$= \frac{1}{4}\int_{\pi/6}^{\pi/4} \operatorname{Cosec}^2\theta\, d\theta$

$= -\frac{1}{4}\left[\cot\theta\right]_{\pi/6}^{\pi/4}$

$= -\frac{1}{4}\left[\cot \pi/4 - \cot \pi/6\right]$

$= -\frac{1}{4}(1 - \sqrt{3}) = \frac{1}{4}(\sqrt{3} - 1)$

(b) $\int_2^4 x \ln x\, dx$

$= \int_2^4 \ln x \frac{d}{dx}(x^2/2)\, dx$

$= \left[(\ln x)\frac{x^2}{2}\right]_2^4 - \int_2^4 \frac{x^2}{2} . \frac{1}{x}\, dx$

$= \left[\frac{x^2}{2}\ln x\right]_2^4 - \frac{1}{2}\left[\frac{x^2}{2}\right]_2^4$

$= \frac{16}{2}\ln 4 - \frac{4}{2}\ln 2 - \frac{1}{2}\left(\frac{16}{2} - \frac{4}{2}\right)$

$= 8\ln 4 - 2\ln 2 - \frac{1}{2} \times \frac{12}{2}$

$= 2(\ln 4^4 - \ln 2) - 3$

$= 2\ln \frac{256}{2} - 3$

$= 2\ln 128 - 3$

(c) $\frac{7x - x^2}{(2 - x)(x^2 + 1)} = \frac{A}{2 - x} + \frac{Bx + C}{x^2 + 1}$

[illegible]

[illegible]

$7x - x^2 = A(x^2 + 1) + (Bx + C)(2 - x)$

$x = 2 \Rightarrow 14 - 4 = 5A \Rightarrow A = 2$

x^2 [illegible]

$-1 = A - B \quad \Rightarrow B = 3$

[illegible] $0 = A + 2C \Rightarrow C = -1$

$\int_0^1 \frac{7x - x^2\, dx}{(2 - x)(x^2 + 1)}$

$= \int_0^1 \frac{2}{2 - x}\, dx + \int_0^1 \frac{3x - 1}{x^2 + 1}\, dx$

$= -2\left[\ln|2 - x|\right]_0^1$

$+ \frac{3}{2}\int_0^1 \frac{2x}{x^2 + 1}\, dx - \int_0^1 \frac{dx}{x^2 + 1}$

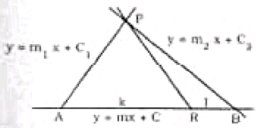
$= -2\left[\ln 1 - \ln 2\right] + \frac{3}{2}\left[\ln(x^2+1)\right]_0^1$

$-\left[\tan^{-1} x\right]_0^1$

$= 2\ln 2 + \frac{3}{2}\left[\ln 2 - \ln 1\right] - \tan^{-1} 1 - 0$

$= \frac{7}{2}\ln 2 - \pi/4$

ආ.



$A = (x_1, y_1)$ හා $B = (x_2, y_2)$ [illegible]

A හා B $y = mx + C$ [illegible]

$\left.\begin{array}{l} y_1 = mx_1 + C \\ y_2 = mx_2 + C \end{array}\right\} \Rightarrow y_1 - y_2 = m(x_1 - x_2)$

A, $y = m_1 x + C_1$ [illegible]

$y_1 = m_1 x_1 + C_1 \Rightarrow y_1 - m_1 x_1 - C_1 = 0$ —— ❶

B, $y = m_2 x + C_2$ [illegible]

$y_2 = m_2 x_2 + C_2 \Rightarrow y_2 - m_2 x_2 - C_2 = 0$ —— ❷

[illegible] $R = \left[\frac{kx_2 + x_1}{k+1}, \frac{ky_2 + y_1}{k+1}\right]$ [illegible]

PR [illegible] $u_1 + \lambda u_2 = 0$ [illegible]

[illegible] $(y - m_1 x - C_1) + \lambda(y - m_2 x - C_2) = 0$

[illegible] R [illegible]

$\left[\frac{ky_2 + y_1}{k+1} - m_1\left(\frac{kx_2 + x_1}{k+1}\right) - C_1\right]$

$+\lambda\left[\frac{ky_2 + y_1}{k+1} - m_2\left(\frac{kx_2 + x_1}{k+1}\right) - C_2\right] = 0$

$\Rightarrow (ky_2 + y_1) - m_1(kx_2 + x_1) - C_1(k+1)$

$+ \lambda\left[(ky_2 + y_1) - m_2(kx_2 + x_1) - C_2(k+1)\right] = 0$

$(y_1 - m_1 x_1 - C_1) + k(y_2 - m_1 x_2 - C_1)$

$+ \lambda\left[(y_1 - m_2 x_1 - C_2) + k(y_2 - m_2 x_2 - C_2)\right] = 0$

$k(y_2 - m_1 x_2 - C_1) + \lambda(y_1 - m_2 x_1 - C_2) = 0$

[illegible] ❶ හා ❷ [illegible]

$\Rightarrow k\left[y_2 - m_1 x_2 - (y_1 - m_1 x_1)\right]$

$+ \lambda\left[y_1 - m_2 x_1 - (y_2 - m_2 x_2)\right] = 0$

$\Rightarrow k\left[y_2 - y_1 - m_1(x_2 - x_1)\right]$

$+ \lambda\left[y_1 - y_2 - m_2(x_1 - x_2)\right] = 0$

$\Rightarrow k\left[-\frac{y_1 - y_2}{x_1 - x_2} + m_1\right]$

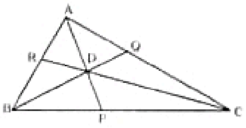
$+ \lambda\left[\frac{y_1 - y_2}{x_1 - x_2} - m_2\right] = 0$

$\Rightarrow k(-m + m_1) + \lambda(m - m_2) = 0$

$\lambda = k\frac{(m - m_1)}{(m - m_2)}$

∴ PR [illegible]

$u_1 + k\left(\frac{m - m_1}{m - m_2}\right) u_2 = 0$



$u_{AB} = y + \frac{3x}{2} - 3 = 0$ —— ❶

$u_{BC} = y + 2x - 2 = 0$ —— ❷

[illegible] $u_{AC} = y + x - 3 = 0$ —— ❸ [illegible]

$m_{AB} = -3/2, \; m_{BC} = -2, \; m_{AC} = -1$

(i) ❶ හා ❷ [illegible] $\frac{1}{2}x = 0 \Rightarrow x = 0$

[illegible] ❷ [illegible] $y = 3$

A $= (0, 3)$

(ii) CR [illegible]

$u_{CA} + k\left(\frac{m_{AB} - m_{CA}}{m_{AB} - m_{BC}}\right) u_{BC} = 0$ [illegible]

[illegible] $k = \frac{1}{2}$, $AR = \frac{1}{2}$ RB [illegible]

[illegible]

$x + y - 3 + \frac{1}{2}\left[\frac{-\frac{3}{2} + 1}{-\frac{3}{2} + 2}\right](2x + y - 2) = 0$

$\Rightarrow x + y - 3 + \frac{1}{2}(-1)(2x + y - 2) = 0$

$\not{x} + y - 3 - \not{x} - y/2 + 1 = 0$

$\Rightarrow y - 4 = 0$ [illegible] CR [illegible]

BQ [illegible]

$u_{AB} + k\left(\frac{m_{AC} - m_{AB}}{m_{CA} - m_{BC}}\right) u_{BC} = 0$

[illegible] $k = 2/3$ $(\because AQ = \frac{2}{3} QC)$

[illegible]

$\frac{3}{2}x + y - 3 + \frac{2}{3}\left[\frac{-1 + 3/2}{-1 + 2}\right](2x + y - 2) = 0$

[illegible]

$\frac{3}{2}x + y - 3 + \frac{\not{2}}{3}\left[\frac{1}{\not{2}}\right](2x + y - 2) = 0$

$9x + 6y - 18 + 2(2x + y - 2) = 0$

$13x + 8y - 22 = 0$

(iii) ❶ හා ❷ [illegible]

$x = -2$ හා $y = 6$ ∴ $B = (-2, 6)$

D [illegible]

$u_{BQ} + \lambda u_{CR} = 0$ [illegible]

[illegible] $13x + 8y - 22 + \lambda(y - 4) = 0$ [illegible]

[illegible] AD [illegible] $A = (0, 3)$ [illegible]

$0 + 24 - 22 + \lambda(3 - 4) = 0 \Rightarrow \lambda = 2$

∴ AD [illegible]

$13x + 10y - 30 = 0$ —— ❹

AD හා BC [illegible] P [illegible]

❷ හා ❹ [illegible]

$13x + 10(2 - 2x) - 30 = 0$

$-7x - 10 = 0 \Rightarrow x = \frac{-10}{7}$

[illegible] $y = 2 - 2\left(\frac{-10}{7}\right) = \frac{34}{7}$

∴ $P = \left(\frac{-10}{7}, \frac{34}{7}\right)$

[illegible] $A = (0, 3)$, $B = (-2, 6)$ හා

$P = \left(\frac{-10}{7}, \frac{34}{7}\right)$

$AP^2 = \frac{100}{49} + \frac{169}{49} = \frac{269}{49} \Rightarrow AP = \frac{\sqrt{269}}{7}$

$PB^2 = \frac{16}{49} + \frac{64}{49} = \frac{80}{49} \Rightarrow PB = \frac{\sqrt{80}}{7}$

$AP : PB = \sqrt{269} : \sqrt{80}$

08. [illegible] (x_0, y_0) [illegible] (x_1, y_1) හා (x_2, y_2) [illegible]

[illegible] (x_1, y_1) [illegible]

$xx_1 + yy_1 + g(x + x_1) + f(y + y_1) + c = 0$

හා (x_2, y_2) [illegible]

$xx_2 + yy_2 + g(x + x_2) + f(y + y_2) + c = 0$

[illegible] (x_0, y_0) [illegible]

$x_0 x_1 + y_0 y_1 + g(x_0 + x_1) + f(y_0 + y_1) + c = 0$ —— ❶

$x_0 x_2 + y_0 y_2 + g(x_0 + x_2) + f(y_0 + y_2) + c = 0$ —— ❷

[illegible] ❶ හා ❷ [illegible]

$xx_0 + yy_0 + g(x + x_0) + f(y + y_0) + c = 0$

[illegible] (x_1, y_1) හා (x_2, y_2) [illegible]

[illegible] (x_1, y_1) හා (x_2, y_2) [illegible]

[illegible] (x_0, y_0) [illegible]

[illegible] (x_0, y_0) [illegible]

$xx_0 + yy_0 + g(x + x_0) + f(y + y_0) + c = 0$ [illegible]

$s \equiv x^2 + y^2 + 2x + 6y + 1 = 0$ හා

$l \equiv 4x + 3y - 5 = 0$ [illegible]

$s = 0$ [illegible] $(-1, -3)$ හා $r = \sqrt{1 + 9 - 1} = 3$

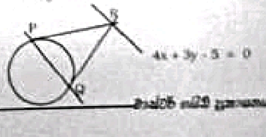
$(-1, -3)$ [illegible] $l = 0$ [illegible] d [illegible]

$d = \frac{|4(-1) + 3(-3) - 5|}{\sqrt{16 + 9}} = \frac{|-18|}{5} = \frac{18}{5}$

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

[illegible] $d > r$

∴ [illegible]



R [illegible] P [illegible] Q [illegible]

R, $4x + 3y - 5 = 0$ [illegible]

$$R \equiv \left[t,\ \frac{5-4t}{3}\right]$$ [illegible]

[illegible] $ax + by + c = 0$ [illegible] R [illegible]

$$xt + y\left(\frac{5-4t}{3}\right) + 1\,(x + t) + 3\left[y + \frac{5-4t}{3}\right] + 1 = 0$$

$$3xt + y(5 - 4t) + 3(x + t) + 9y + 3(5 - 4t) + 3 = 0$$

$$x(3t + 3) + y\,(14 - 4t) + (18 - 9t) = 0$$

[illegible]

$$\frac{3t+3}{a} = \frac{14-4t}{b} = \frac{18-9t}{c}$$

[illegible] $a = \frac{3b(t+1)}{2(7-2t)}$ [illegible] $c = \frac{9b(2-t)}{2(7-2t)}$

[illegible]

$$\frac{3b(t+1)}{2(7-2t)}\,x + by + \frac{9b(2-t)}{2(7-2t)} = 0$$

[illegible] $3b(t + 1)x + 2b(7 - 2t)y + 9b(2 - t) = 0$

$\Rightarrow 3(t + 1)x + 2(7 - 2t)y + 9(2 - t) = 0$

$\Rightarrow 3x + 14y + 18 + t(3x - 4y - 9) = 0$

[illegible] $3x + 14y + 18 = 0$ [illegible]

$3x - 4y - 9 = 0$ [illegible]

[illegible] $(1, -3/2)$ [illegible]

∴ [illegible] $(1, -3/2)$ [illegible] ✓

09. (a) $\text{Sin}^3 2x \,\text{Cos}\, 6x + \text{Cos}^3 2x \,\text{Sin}\, 6x$

$$= \left[\frac{3\,\text{Sin}\,2x - \text{Sin}\,6x}{4}\right]\text{Cos}\,6x + \left[\frac{\text{Cos}\,6x + 3\,\text{Cos}\,2x}{4}\right]\text{Sin}\,6x$$

$$= \frac{1}{4}(3\text{Sin}\,2x \cos 6x - \text{Sin}6x\text{Cos}6x + \cos6x\text{Sin}6x + 3\text{Cos}2x\text{Sin}6x)$$

$$= \frac{3}{4}(\text{Sin}2x\,\text{Cos}6x + \text{Cos}2x\,\text{Sin}6x)$$

$$= \frac{3}{4}\,\text{Sin}\,(2x + 6x)$$

$$= \frac{3}{4}\,\text{Sin}\,8x$$ ✓

$\text{Sin}^3 2x\,\text{Cos}6x + \text{Cos}^3 2x\,\text{Sin}6x = a$

$\Rightarrow \frac{3}{4}\text{Sin}\,8x = a$ [illegible] $\text{Sin}\,8x = \frac{4a}{3}$

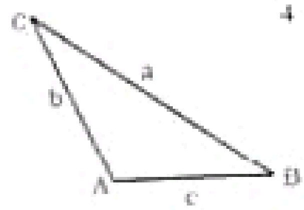
[illegible]

$-1 \le \text{Sin}\,8x \le 1$ [illegible]

[illegible] $-1 \le \frac{4a}{3} \le 1$

∴ [illegible]

$\frac{-3}{4} \le a \le \frac{3}{4}$ [illegible]

(b) 

[illegible] A [illegible] C [illegible] a [illegible] c [illegible]

$A = 2C$ [illegible] $a = \frac{3}{2}c$ [illegible]

ABC Δ [illegible]

$$\frac{\text{Sin}\,A}{a} = \frac{\text{Sin}\,C}{c}$$

[illegible] $$\frac{\text{Sin}\,2C}{\frac{3}{2}c} = \frac{\text{Sin}\,C}{c}$$

$\Rightarrow 2\,\text{Sin}\,C\,\text{Cos}\,C = \frac{3}{2}\text{Sin}\,C$

$\text{Sin}\,C \ne 0$ [illegible] $2\,\text{Cos}\,C = \frac{3}{2}$

$\Rightarrow \text{Cos}\,C = \frac{3}{4} \Rightarrow C = \text{Cos}^{-1}\left(\frac{3}{4}\right)$ ✓

$A = 2C \Rightarrow B = \pi - 3C$

[illegible] $\frac{\text{Sin}\,B}{b} = \frac{\text{Sin}\,C}{c}$

$b = 10$ cm [illegible]

$\frac{\text{Sin}(\pi - 3C)}{10} = \frac{\text{Sin}\,C}{c} \Rightarrow \frac{\text{Sin}\,3C}{10} = \frac{\text{Sin}\,C}{c}$

[illegible]

$$\frac{3\,\text{Sin}\,C - 4\,\text{Sin}^3 C}{10} = \frac{\text{Sin}\,C}{c}$$

$\Rightarrow \frac{\text{Sin}\,C\,[3 - 4\,\text{Sin}^2 C]}{10} = \frac{\text{Sin}\,C}{c}$

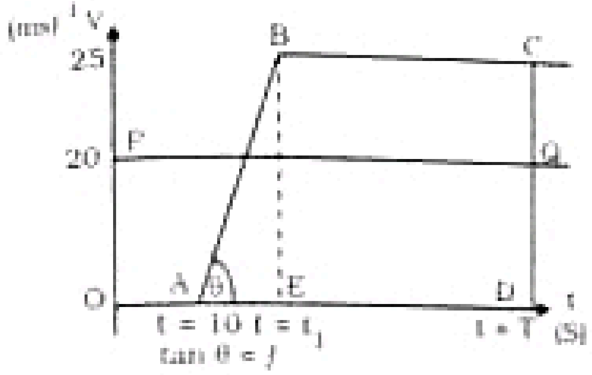
$\Rightarrow 3 - 4(1 - \text{Cos}^2 C) = \frac{10}{c}$ ($\text{Sin}\,C \ne 0$)

$\Rightarrow -1 + 4\,\text{Cos}^2 C = \frac{10}{c} \Rightarrow -1 + 4\cdot\frac{9}{16} = \frac{10}{c}$

$\Rightarrow \frac{5}{4} = \frac{10}{c} \Rightarrow c = 8$ cm ✓ $\Rightarrow a = \frac{3}{2}c$

$= \frac{3}{2} \times 8 = 12$ cm ✓

(a)



$72\ km\ h^{-1} = 20\ ms^{-1}$

$90\ km\ h^{-1} = 25\ ms^{-1}$

200m

ABE Δ = 200

$\frac{1}{2} AE \times BE = ABE\Delta$

$\frac{1}{2}(t_1 - 10) \times 25 = 200$

$\Rightarrow t_1 = 26$

$\tan \theta = f = \frac{BE}{AE} = \frac{25}{t_1 - 10}$

$= \frac{25}{16}\ ms^{-2}$

t = T

ABCD ▱ = OPQD ▭

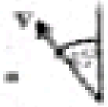
$\frac{1}{2}(AD + BC) \times BE = OP \times OD$

$\frac{1}{2}(T - 10 + T - t_1)\, 25 = 20 \times T$;

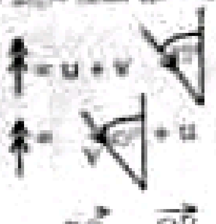
$t_1 = 26$

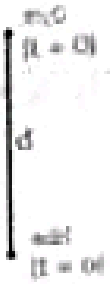
T = 90

(b)



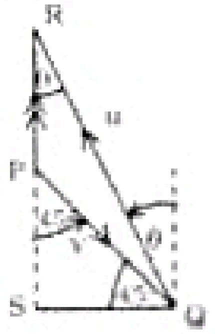
(E) = ; (E) = u





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

$= \vec{PR}$



$QS = v \sin 45° = \frac{v}{\sqrt{2}} = PS$

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

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

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

t_1

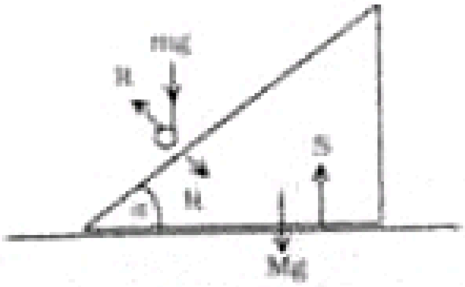
$t_1 = \frac{d}{|\vec{PR}|}$

$t_1 = \frac{\sqrt{2}\, d}{\sqrt{2u^2 - v^2} - v}$

$t_1 = \frac{\sqrt{2}d\,(\sqrt{2u^2 - v^2} + v)}{2(u^2 - v^2)}$

$\sin \theta = \frac{v \sin 45}{u} = \frac{v}{u\sqrt{2}}$

(c)



(m) = a_1 ∠ α

(E) = → a_2

(m E) = (m) + (E)

$= \overset{a_1}{\nearrow_\alpha} + \xrightarrow{a_2}$

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

$\rightarrow ; 0 = Ma_2 + m(a_2 - a_1\cos\alpha)$ —— ❶

[illegible] $\swarrow_\alpha$ $mg\sin\alpha = m(a_1 - a_2\cos\alpha)$ —— ❷

❶ + ❷ × $\cos\alpha$ [illegible]

$a_2 = \dfrac{mg\sin\alpha\cos\alpha}{M + m\sin^2\alpha}$ [illegible]

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

$R\sin\alpha = M \times a_2$

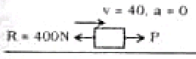
$R = \dfrac{M\,mg\cos\alpha}{M + m\sin^2\alpha}$

(ආ) $144\ kmh^{-1} = 40\ ms^{-1}$

[illegible] P [illegible]

$Pv = H$ [illegible]

$P = \dfrac{H}{40}$



[illegible]

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

$P - R = m \times 0$

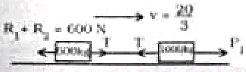
$P = R$

$\dfrac{H}{40} = 400 \Rightarrow H = 16000\ W$

$H = 16\ kW$

$24\ km\,h^{-1} = \dfrac{20}{3}\ ms^{-1}$

[illegible] $P_1 = \dfrac{16 \times 1000}{20/3}\ N$



[illegible] a_1 [illegible]

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

$P_1 - R_1 - R_2 = 1600 \times a_1$

$\dfrac{16 \times 1000}{20} \times 3 - 600 = 1600\ a_1$

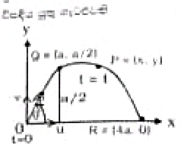
$\Rightarrow a_1 = \dfrac{18}{16} = \dfrac{9}{8}\ ms^{-2}$

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

$T - R_2 = 600 \times a_1$

$\Rightarrow T = \left(600 \times \dfrac{9}{8}\right) + 200 = 875\ N$

03. (අ) [illegible]



$O \rightarrow P$ [illegible]

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

$\rightarrow x = ut$ —— ❶

$\uparrow y = vt - \dfrac{1}{2}gt^2$ —— ❷

❶ හා ❷ න් t [illegible]

$y = \dfrac{vx}{u} - \dfrac{g}{2u^2}x^2$ [illegible]

$Q = \left(a, \dfrac{a}{2}\right)$ හා $R = (4a, 0)$ [illegible]

[illegible]

$\dfrac{a}{2} = \dfrac{va}{u} - \dfrac{ga^2}{2u^2}$ —— ❸

$\Rightarrow \dfrac{1}{2} = \dfrac{v}{u} - \dfrac{ga}{2u^2}$ —— ❸^1

$0 = 4a\dfrac{v}{u} - \dfrac{g}{2u^2}16a^2$ —— ❹

$\Rightarrow 0 = \dfrac{v}{u} - \dfrac{4ga}{2u^2}$ —— ❹^1

❸^1 - ❹^1 [illegible] $\dfrac{1}{2} = \dfrac{3ga}{2u^2}$

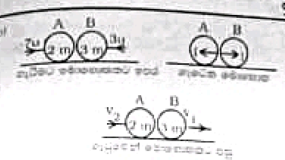
$\Rightarrow u^2 = 3ga \Rightarrow u = \sqrt{3ga}$

[illegible] ❹^1 [illegible] $v = 2\sqrt{\dfrac{ga}{3}}$

[illegible] θ [illegible]

$\tan\theta = \dfrac{v}{u} \Rightarrow \theta = \tan^{-1}\left(\dfrac{2}{3}\right)$

(ආ)



[illegible] $\longrightarrow$

$(2m \times 7u) + (3m \times -3u) = 2mv_2 + 3mv_1$

$5u = 2v_2 + 3v_1$ —— ❶

[illegible]

$v_1 - v_2 = e\,(7u + 3u)$ —— ❷

❶ හා ❷ [illegible] $v_1 = u\,(1 + 4e)$

B [illegible] $I = \Delta(mv)$ [illegible]

$I = 3mv_1 - 3m(-3u)$

$= 3mu\,(1 + 4e) + 9mu$

$= 12mu\,(1 + e)$

❶ හා ❷ [illegible] $v_2 = u - 6eu$ [illegible]

[illegible] A [illegible] $v_2 = 0$ [illegible]

$u - 6eu = 0 \Rightarrow e = \dfrac{1}{6}$

[illegible]

$= \dfrac{1}{2} \times 2m \times 49u^2 + \dfrac{1}{2} \times 3m \times 9u^2$

$= \dfrac{125}{2}\ mu^2$

[illegible]

$= \dfrac{1}{2} \times 3m \times v_1^2 \left(e = \dfrac{1}{6}\right)$

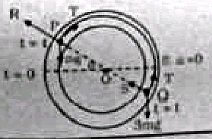
$= \dfrac{1}{2} \times 3m \times \dfrac{25u^2}{9}$

[illegible]

$= \dfrac{\dfrac{1}{2} \times 3m \times \dfrac{25u^2}{9}}{\dfrac{1}{2}\,125\,mu^2}$

$= \dfrac{1}{15}$ [illegible]

04. (අ)



[illegible]

P [illegible] $\dot\theta$ [illegible] P [illegible] $a\dot\theta$ [illegible]

Q [illegible]

[illegible]

$\dfrac{1}{2}m(a\dot\theta)^2 + \dfrac{1}{2}3m(a\dot\theta)^2 + mg\,a\sin\theta - 3\,mg\,a\sin\theta = 0$

$2a\dot\theta^2 = 2\,g\sin\theta$

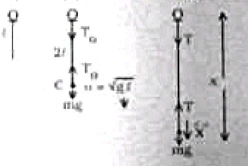
$a\dot\theta^2 = g\sin\theta$

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

$R - mg\sin\theta = m(-a\dot\theta^2) \Rightarrow$

$R = mg\sin\theta - mg\sin\theta = 0$

(ආ) (I) (II) (III)



(II) [illegible]

[illegible]

$T_0 = mg$ —— ❶

[illegible] λ [illegible]

$T_0 = \dfrac{\lambda l}{l}$ —— ❷

❶ = ❷ න් $\lambda = mg$ [illegible]

(III) [illegible]

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

[illegible]

$mg - T = m\ddot{x}$ —— ❸

$T = \dfrac{mg \times (x - l)}{l}$ —— ❹

$\therefore mg - \dfrac{mg\,(x - l)}{l} = m\ddot{x} \Rightarrow$

$\ddot{x} = -\dfrac{gx}{l} + 2g$

$\ddot{x} = -\dfrac{g}{l}(x - 2l) \Rightarrow \ddot{x} + \dfrac{g}{l}(x - 2l) = 0$

$\therefore$ [illegible]

[illegible] $\overline{\dot{x}} = 0$ [illegible] $x = 2l$ [illegible]

[illegible] C [illegible]

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

$$\omega = \sqrt{\frac{g}{l}}$$

[illegible] $T = 2\pi\sqrt{\frac{l}{g}}$ [illegible]

$\dot{x}^2 = \omega^2(a^2 - x^2)$ [illegible] A [illegible]

[illegible] $gl = \frac{g}{l}(a^2 - 0)$

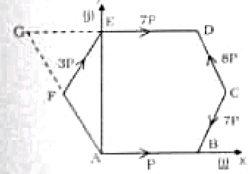
[illegible] C [illegible] $= \sqrt{gl}$ [illegible]

$\therefore a = l$ [illegible]

[illegible] $x = 2l + l = 3l$ [illegible]

[illegible] $x = 2l - l = l$ [illegible]

05.



BC [illegible]

$$= \cos 60\, i + \sin 60\, j$$
$$= \frac{1}{2}i + \frac{\sqrt{3}}{2}j$$

$\therefore \overrightarrow{CB}$ [illegible] $= -\frac{1}{2}i - \frac{\sqrt{3}}{2}j$

$\overrightarrow{CD}$ [illegible] $= -\frac{1}{2}i + \frac{\sqrt{3}}{2}j$

$\overrightarrow{FE}$ [illegible] $= \frac{1}{2}i + \frac{\sqrt{3}}{2}j$

[illegible]	[illegible]	[illegible]
$\overrightarrow{AB}$	P	Pi
$\overrightarrow{CB}$	7P	$-7P\left(\frac{1}{2}i + \frac{\sqrt{3}}{2}j\right)$
$\overrightarrow{CD}$	8P	$8P\left(-\frac{1}{2}i + \frac{\sqrt{3}}{2}j\right)$
$\overrightarrow{ED}$	7P	$\frac{1}{2}7Pi$
$\overrightarrow{FE}$	3P	$3P\left(\frac{1}{2}i + \frac{\sqrt{3}}{2}j\right)$

$$\overrightarrow{R} = Pi - 7P\left(\frac{1}{2}i + \frac{\sqrt{3}}{2}j\right) + 8P\left(-\frac{1}{2}i + \frac{\sqrt{3}}{2}j\right) + 7Pi + 3P\left(\frac{1}{2}i + \frac{\sqrt{3}}{2}j\right)$$

$= 2P(i + \sqrt{3}j) \neq 0$ [illegible]

$\overrightarrow{R} = 4P\left(\frac{1}{2}i + \frac{\sqrt{3}}{2}j\right)$ [illegible]

$\frac{1}{2}i + \frac{\sqrt{3}}{2}j$ [illegible] $\overrightarrow{BC}$ [illegible]

$\therefore$ [illegible] BC [illegible]

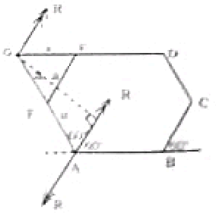
$$|\overrightarrow{R}| = \left\{4P^2\left[\left(\frac{1}{2}\right)^2 + \left(\frac{\sqrt{3}}{2}\right)^2\right]\right\}^{1/2} = 4P$$ [illegible]

DE [illegible] AF [illegible] G [illegible] G [illegible]

$$\underset{G}{\curvearrowleft} : P(2a)\frac{\sqrt{3}}{2} - 7P(3a)\frac{\sqrt{3}}{2} + 8P(2a)\frac{\sqrt{3}}{2} + 3P(a)\frac{\sqrt{3}}{2}$$

$= 0$ [illegible]

$\therefore$ [illegible] BC [illegible] G [illegible]

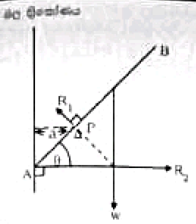


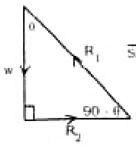
[illegible] A [illegible] R [illegible] G [illegible] R [illegible] A [illegible] -R [illegible] AFEDCB [illegible]

$R \times 2a \sin 60$ [illegible]

[illegible] $4P \times 2a \times \frac{\sqrt{3}}{2} = 4\sqrt{3}Pa$ Nm

06. (a) [illegible]





$$\frac{R_1}{\sin \pi/2} = \frac{w}{\sin(90 - \theta)}$$

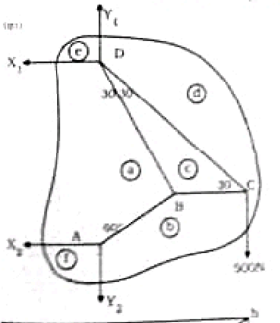
$R_1 = w\sec\theta$

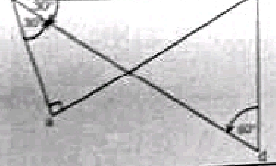
[illegible] A [illegible]

$w \times 3a\cos\theta = w\sec\theta \times a\sec\theta$

$\Rightarrow 3\cos^3\theta = 1$ [illegible]

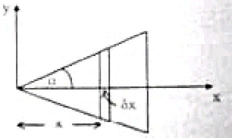
(b)





[illegible]	[illegible]	[illegible]
CD	[illegible]	1000N
BC	[illegible]	$500\sqrt{3}$ N
BD	[illegible]	$250\sqrt{3}$ N
AB	[illegible]	750N

07.



[illegible] α [illegible] x [illegible] y [illegible] x [illegible] δx [illegible]

[illegible] $x\tan\alpha$ [illegible]

[illegible] $= \pi(x\tan\alpha)^2\,\delta x$ [illegible]

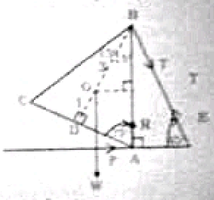
[illegible] ρ [illegible] $\pi(x\tan\alpha)^2\,\delta x\,\rho$ [illegible]

[illegible] y [illegible] x [illegible]

$$\bar{x} = \frac{\int_0^h \pi x^2\tan^2\alpha\,dx\,\rho x}{\int_0^h \pi x^2\tan^2\alpha\,dx\,\rho} = \frac{\int_0^h x^3\,dx}{\int_0^h x^2\,dx}$$

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

$\therefore$ [illegible] $= \left(\frac{3h}{4}, 0\right)$



[illegible]

$\rightarrow T\cos 45 = F$ —— ①

$\uparrow T\sin 45 + R = W$ —— ②

[illegible]

$F = \mu R$ —— ③

BD = h [illegible]

$BG = \frac{3}{4}h$ [illegible] $AB = h \, Sec \, 15$

$AE = AB \quad = h \, Sin \, 15$

E [illegible]

$W\left[h \, Sec \, 15 + \frac{3h}{4} \, Sin 15\right]$

$= R \times h \, Sec \, 15$ —— ❶

$W\left[\frac{h}{Cos \, 15} + \frac{3h}{4} \, Sin \, 15\right] = \frac{Rh}{Cos \, 15}$

$W/h + \frac{3}{4} W/h \, Sin \, 15 \, Cos \, 15 = R/h$

$W + \frac{3}{8} W \, Sin \, 30 = R$

$W + \frac{3}{8} W \times \frac{1}{2} = R$

$R = \frac{19w}{16}, \; F = \frac{19w}{16} \mu$

❷ [illegible] $-T \times \frac{1}{\sqrt{2}} + \frac{19w}{16} = w \Rightarrow$

$\frac{-T}{\sqrt{2}} = \frac{-3w}{16} \Rightarrow T = \frac{3\sqrt{2}w}{16}$

❶ [illegible] $F = \frac{3\sqrt{2}w}{16} \times \frac{1}{\sqrt{2}} = \frac{3w}{16}$

❸ [illegible] $\frac{3w}{16} = \frac{19w\mu}{16} \Rightarrow \mu = \frac{3}{19}$

08. (a) $P(A \cup B)$ [illegible] A [illegible] B [illegible]
$P(A \cap B)$ [illegible] A [illegible] B [illegible]

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

(b) $P(A) = 0.6 \; ; \; P(B) = 0.2$
$= P(A|B) = 0.1$
[illegible]

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

$0.1 = \frac{P(A \cap B)}{0.2} \Rightarrow$

$P(A \cap B) = 0.02$

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

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

$P(A \cap B') = P(A) - P(A \cap B)$

$P(A' \cap B) = 0.2 - 0.02 = 0.18$

$P(A \cap B') = 0.6 - 0.02 = 0.58$

$\therefore P(A' \cap B) + P(A \cap B')$

$= 0.18 + 0.58 = 0.76$

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

$P(A' \cap B') = P(A \cup B)' = 1 - P(A \cup B)$

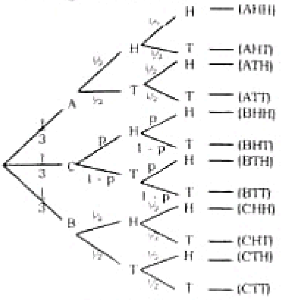
$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ [illegible]

$= 0.6 + 0.2 - 0.02$

$= 0.78$

$\therefore P(A' \cap B)' = 1 - 0.78 = 0.22$

(c) A : [illegible]
B : [illegible]
C : [illegible]



[illegible]
AHH, BHH, CHH
[illegible]

$= P(AHH \cup BHH \cup CHH)$
$= P(AHH) + P(BHH) + P(CHH)$
[illegible]
$= P(A) \, P(H) \, P(H) + P(B) P(H) \, P(H) + P(C) \, P(H) \, P(H)$
A, B, C, H [illegible]

$= \left(\frac{1}{3} \times \frac{1}{2} \times \frac{1}{2}\right) + \left(\frac{1}{3} \times \frac{1}{2} \times \frac{1}{2}\right) + \left(\frac{1}{3} \times p \times p\right)$

$= \frac{1}{12} + \frac{1}{12} + \frac{p^2}{3}$

[illegible] $\frac{17}{54}$ [illegible]

$\frac{1}{12} + \frac{1}{12} + \frac{p^2}{3} = \frac{17}{54} \Rightarrow p = \frac{2}{3}$ [illegible]

[illegible]

$P(C|HH) = \frac{P(C \cap HH)}{P(HH)} = \frac{\frac{1}{3} \times p \times p}{\frac{17}{54}}$

$= \frac{1}{3} \times \frac{2}{3} \times \frac{2}{3} \times \frac{54}{17} = \frac{8}{17}$

(d) [illegible] $\bar{x} = \frac{\sum_{i=1}^{n} f_i x_i}{\sum_{i=1}^{n} f_i}$; f_i [illegible]

[illegible] x_i [illegible]

$y = \frac{x - a}{c}$ [illegible] $yc = x - a$ [illegible]
$x = a + cy$ [illegible]

[illegible] $\bar{x} = \frac{\sum_{i=1}^{n} f_i (a + cy_i)}{\sum f_i}$

$= \frac{a \sum_{i=1}^{n} f_i}{\sum_{i=1}^{n} f_i} + \frac{c \sum_{i=1}^{n} f_i y_i}{\sum_{i=1}^{n} f_i}$

$= a + c\bar{y}$ [illegible]

$\sigma^2 = \frac{\sum f(x - \bar{x})^2}{\sum f}$

$= \frac{\sum f(x^2 - 2x\bar{x} + \bar{x}^2)}{\sum f}$

$= \frac{\sum fx^2}{\sum f} - 2\bar{x} \frac{\sum fx}{\sum f} + \bar{x}^2 \frac{\sum f}{\sum f}$

$= \frac{\sum fx^2}{\sum f} - 2\bar{x}\,\bar{x} + \bar{x}^2$ [illegible]

$= \frac{\sum fx^2}{\sum f} - \bar{x}^2$

$x = a + cy \Rightarrow \bar{x} = a + c\bar{y}$ [illegible]

$\sigma^2 = \frac{\sum f(a + cy)^2}{\sum f} - (a + c\bar{y})^2$

$= a^2 \frac{\sum f}{\sum f} + 2ac \frac{\sum fy}{\sum f} + c^2 \frac{\sum fy^2}{\sum f} - a^2 - 2ac\bar{y} - c^2\bar{y}^2$

$= a^2 + 2ac\bar{y} + c^2 \frac{\sum fy^2}{\sum f} - a^2 - 2ac\bar{y} - c^2\bar{y}^2$

$\sigma^2 = c^2 \left[\frac{\sum fy^2}{\sum f} - \bar{y}^2\right]$

$\therefore$ [illegible] $\sigma = c\sqrt{\frac{\sum fy^2}{\sum f} - \bar{y}^2}$

$\sum fy = -23.5$ [illegible] $\sum fy^2 = 155.9$

[illegible] $x = 10y + 45$ [illegible]
$\bar{x} = 10\bar{y} + 45$ [illegible]

$\therefore a = 45$ [illegible] $c = 10$ [illegible]

[illegible] $= a + c\bar{y}$

$= 45 + 10\left(\frac{-23.5}{25}\right)$

$= 45 - 9.4 = 35.6$ [illegible]

[illegible] $\sigma^2 = c^2 \left[\frac{\sum fy^2}{\sum f} - \bar{y}^2\right]$

$\bar{y} = \frac{\sum fy}{\sum f} = \frac{-23.5}{25} = -0.94$

$\sigma^2 = 100 \left[\frac{155.9}{25} - (0.94)^2\right]$

$= 535.24$ [illegible]

[illegible] $\sigma = \sqrt{535.24} = 23.1$ [illegible]

[illegible] (l)	[illegible] (x)	[illegible] (f)	[illegible] $(d = x - 5)$	$y = \frac{x - 45}{10}$	fy	fy^2
$0 \le x < 10$	5	4.2	-40	-4	-16.8	67.2
$10 \le x < 20$	15	3.9	-30	-3	-11.7	35.1
$20 \le x < 30$	25	3.4	-20	-2	-6.8	13.6
$30 \le x < 40$	35	3.2	-10	-1	-3.2	3.2
$40 \le x < 50$	45	2.8	0	0	0	0
$50 \le x < 60$	55	2.8	10	1	2.8	2.8
$60 \le x < 70$	65	2.5	20	2	5.0	10.0
$70 \le x < 80$	75	1.6	30	3	4.8	14.4
$80 \le x < 90$	85	0.6	40	4	2.4	9.6
	Total	25.0			-23.5	155.9

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