Average atomic wt. = $\frac{m_1x_1 \quad m_2x_2}{x_1 \quad x_2}$

or Average atomic wt. = $\frac{x\times 10.01+(100-x)\times 11.01}{100}$

$10.81=\frac{x\times 10.01+(100-x)\times 11.01}{100}$

$x=20$

$\therefore$ % of isotope with atomic wt. 10.01 = 20

% of isotope with atomic wt. 11.01 = 100 – $x$ = 80

**57.** **(80)** $\frac{P^\circ - P}{P} \quad \frac{n_2}{n_1 \quad n_2}$

$\frac{640-600}{640} \quad \frac{2.5/x}{39/78}$

$x \quad \frac{640\times 78\times 2.5}{39\times 40} \quad 80$

**58.** **(11.4)** Given

$NaOH + HNO_3 \rightarrow NaNO_3 \quad H_2O$

1 mol  1 mol  $\Delta H$  57.0 kJ

0.2 mol  0.5 mol  $\Delta H$  ?

Given heat of neutralisation of strong acid by strong base = 57.0 kJ

$\because$ 0.2 mole NaOH is limiting reagent.

$\therefore$ Heat of neutralization = 0.2 × 57 = 11.4 kJ

**59.** **(3)** Calculating the oxidation state of nitrogen in given molecules;

Oxidation state of N in $NH_3$ is $x + 3 \times (+1) = 0$ or $x = -3$

Oxidation state of N in $NaNO_3$ is $1 + x + 3 \times (-2) = 0$ or $x = +5$

Oxidation state of N in $NaN_3$ is $+1 + 3x = 0$ or $x = -\frac{1}{3}$

Oxidation state of N in $Mg_3N_2$ is $3 \times 2 + 2x = 0$ or $x = -3$

Thus 3 molecules (i.e. $NH_3$, $NaN_3$ and $Mg_3N_2$) have nitrogen in negative oxidation state.

**60.** **(18)** Reaction Rate $r_1 = k\,[A]^2\,[B]$

Now increase conc. of A by three times and conc. of B by two times. Then new rate

$r_2 = k\,[3A]^2\,[2B]$

$\frac{r_1}{r_2} \quad \frac{k[A]^2[B]}{k[3A]^2[2B]} \quad \frac{1}{3^2}\times\frac{1}{2} \quad \frac{1}{18}$

$r_2 = 18 \times r_1$

Hence rate increases by 18 times.

## MATHEMATICS

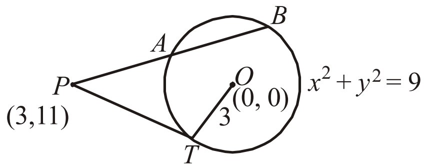
**61.** **(3)** $\lim_{x\to 0}(\sin x)^{1/x} \quad \lim_{x\to 0}\left(\frac{1}{x}\right)^{\sin x}$

$0 \quad \lim_{x\to 0} e^{\log\left(\frac{1}{x}\right)^{\sin x}} \quad \left\{\begin{array}{l}\text{as, (decimal)}^{\infty}\rightarrow 0\\ \lim_{x\to 0}(\sin x)^{1/x}\rightarrow 0\end{array}\right\}$

$e^{\lim_{x\to 0}\frac{\log\left(\frac{1}{x}\right)}{\text{cosec } x}}$, applying L-Hospital's rule, we get

$e^{\lim_{x\to 0}\frac{x\left(-\frac{1}{x^2}\right)}{-\text{cosec } x \cot x}} \quad e^{\lim_{x\to 0}\frac{\sin x}{x}\tan x} \quad e^0 \quad 1$

**62.** **(2)** Given circle, $x^2 \quad y^2 \quad 9$



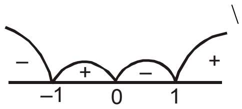

$PA \times PB \quad PT^2$ [By Geometry]

$PA \times PB \quad (3)^2 \quad (11)^2 - 9 = 121$

**63.** **(1)** $f(x) \quad \frac{3}{4-x^2} \quad \log_{10}(x^3 - x)$

$4 - x^2 \neq 0;\ x^3 - x \quad 0;$

$x \neq \pm\sqrt{4}$ and $-1 \quad x \quad 0$ or $1 \quad x \quad \infty$




$\therefore D = (-1, 0) \cup (1, \infty) - \sqrt{4}$

$D = (-1, 0) \cup (1, 2) \cup (2, \infty)$.

**64.** **(1)** We have

$\frac{1}{2}\left\|\begin{array}{ccc} k & -3k & 1 \\ 5 & k & 1 \\ -k & 2 & 1\end{array}\right\| \quad 28$

$\Rightarrow \quad 5k^2 + 13k - 46 = 0 \quad$ or $\quad 5k^2 + 13k + 66 = 0$

Now, $\quad 5k^2 + 13k - 46 = 0$

$\Rightarrow \quad k \quad \frac{-13 \quad \sqrt{1089}}{10} \quad \therefore k \quad \frac{-23}{5}; k \quad 2$

since k is an integer, $\therefore$ k = 2

Also $5k^2 + 13k + 66 = 0$

$\Rightarrow \quad k \quad \frac{-13 \pm \sqrt{-1151}}{10}$. So no real solution exist

For orthocentre $\quad BH \perp AC$

$\therefore \quad \left(\frac{\beta - 2}{\alpha - 5}\right)\left(\frac{8}{-4}\right) = -1 \Rightarrow \alpha - 2\beta \quad 1$ ...(i)

Also $CH \perp AB$

$\therefore \quad \left(\frac{\beta - 2}{\alpha \quad 2}\right)\left(\frac{8}{3}\right) = -1$

$\Rightarrow \quad 3\alpha + 8\beta = 10$ ...(ii)

Solving (i) and (ii), we get $\alpha = 2$, $\beta = \frac{1}{2}$ orthocentre is $\left(2, \frac{1}{2}\right)$.

**65. (1)** $\vec{a}-\vec{b}\ .\left(\vec{c}-\frac{\vec{a}\quad\vec{b}}{2}\right)=\vec{b}.\vec{c}-\vec{b}\left(\frac{\vec{a}\quad\vec{b}}{2}\right)-\vec{a}.\vec{c}\quad\frac{\vec{a}}{2}\ \vec{a}\quad\vec{b}$

and $|\vec{a}-\vec{c}|=|\vec{b}-\vec{c}|\Rightarrow|\vec{a}-\vec{c}|^2\quad|\vec{b}-\vec{c}|^2$

$\therefore\ \vec{a}\quad\vec{b}\quad 2\vec{c}$

Therefore, $(\vec{b}-\vec{a}).\left(\vec{c}-\frac{\vec{a}\quad\vec{b}}{2}\right)\quad 0.$

**66. (2)** Let $\alpha$, $\beta$ be the roots of the equation

$x^2-\ a-2\ x-a\quad 1\quad 0,$

then $\alpha+\beta=a-2,\ \alpha\beta=-a\quad 1$

$\therefore z=\alpha^2+\beta^2=\ \alpha+\beta\ ^2-2\alpha\beta$

$=\ a-2\ ^2+2\ a-1\ =a^2-2a\quad 2$

$\frac{dz}{da}=2a-2=0\Rightarrow a\quad 1$

$\frac{d^2z}{da^2}\quad 2\quad 0$, so $z$ has minima at $a=1$.

So $\alpha^2+\beta^2$ has least value for $a=1$. This is because we have only one stationary value at which we have minima. Hence $a=1$.

**67. (2)** We have

$\sin(300°)=\sin(270+30°)=\sin(3\times 90°+30°)$

$=-\cos 30°\quad-\frac{\sqrt{3}}{2}$

$\tan(330°)=\tan(270°+60°)=\tan(3\times 90°+60°)$

$=-\cot 60°\quad-\frac{1}{\sqrt{3}}$

$\sec(420°)=\sec(4\times 90°+60°)=\sec 60°=2$

$\tan(135°)=\tan(90°+45°)=-\cot 45°=-1$

$\sin(210°)=\sin(2\times 90°+30°)$

$=-\sin 30°\quad-\frac{1}{2}$

$\sec(315°)=\sec(270°+45°)$

$=\text{cosec}\,45°\quad\sqrt{2}$

Now, $\frac{\sin 300\quad\tan 330\ .\sec 420}{\tan 135\quad\sin 210\quad\sec 315}$

$\frac{-\frac{\sqrt{3}}{2}\times\left(-\frac{1}{\sqrt{3}}\right)\times 2}{-1\times\left(-\frac{1}{2}\right)\times\sqrt{2}}\quad\sqrt{2}$

**68. (4)** Given differential equation is

$\log\left(\frac{dy}{dx}\right)\quad 3x\quad 4y,\ y\ 0\quad 0$

$\Rightarrow\ \frac{dy}{dx}\quad e^{3x\ \ 4y}\quad e^{3x}.e^{4y}$

$\Rightarrow\ \int e^{-4y}dy\quad\int e^{3x}dx$

$\Rightarrow\ \frac{e^{-4y}}{-4}\quad\frac{e^{3x}}{3}\quad c$

By using $y=0$ when $x=0$, we get $c=-\frac{7}{12}$

$\therefore$ Particular solution is $4e^{3x}\quad 3e^{-4y}\quad 7$

**69. (2)** We have, $f(x)=\frac{1}{2}x-1$ for $0\le x\le\pi$

$\therefore\ [f(x)]\quad\begin{cases}-1,\ 0\le x\quad 2\\ 0,\ 2\le x\le\pi\end{cases}$

$\Rightarrow\ \tan[f(x)]\quad\begin{cases}\tan(-1),\ 0\le x\quad 2\\ \tan 0,\quad 2\le x\le\pi\end{cases}$

$\therefore\ \lim_{x\to 2^-}\tan[f(x)]=-\tan 1$ and $\lim_{x\to 2}\tan[f(x)]\quad 0$

So, tan f(x) is not continuous at x = 2

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

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

Clearly, $\frac{1}{f(x)}$ is not continuous at x = 2.

So, tan [f(x)] and $\left[\frac{1}{f(x)}\right]$ are both discontinuous at x = 2.

**70. (2)** $\frac{a\quad bx}{a-bx}\quad\frac{b\quad cx}{b-cx}\quad\frac{c\quad dx}{c-dx}$

$\Rightarrow\frac{a}{bx}\quad\frac{b}{cx}\quad\frac{c}{dx}$

(using componendo and dividendo)

$\Rightarrow\frac{a}{b}\quad\frac{b}{c}\quad\frac{c}{d}$

**71. (3)** $\int_2^4\{|x-2|+|x-3|\}dx$

$=\int_2^3\{(x-2)-(x-3)\}dx\ +\int_3^4\{(x-2)+(x-3)\}dx$

$=\int_2^3 dx+\int_3^4(2x-5)dx\quad x\,{}_2^3\quad\left[\frac{2x^2}{2}-5x\right]_3^4$

$=(3-2)+[(16-20)-(9-15)]=1-4+6=3$

**72.** **(4)** Given $x \quad \frac{1}{x} \quad 2\cos\theta$ .... (i)

Cubing on both side of equation (i), we get

$$\left(x \quad \frac{1}{x}\right)^3 \quad 8\cos^3\theta$$

$$\Rightarrow \quad x^3 \quad \frac{1}{x^3} \quad 3x\frac{1}{x^2} \quad 3x^2\frac{1}{x} \quad 8\cos^3\theta$$

[Using $(a+b)^3 = a^3 + b^3 + 3a^2b + 3b^2a$]

$$\Rightarrow \quad x^3 \quad \frac{1}{x^3} \quad 3\left(x \quad \frac{1}{x}\right) \quad 8\cos^3\theta$$

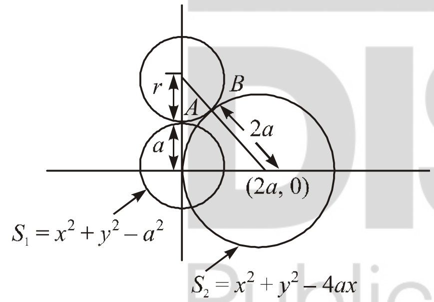
$$\Rightarrow \quad x^3 \quad \frac{1}{x^3} \quad 6\cos\theta = 8\cos^3\theta$$ [From (i)]

$$\therefore \quad x^3 \quad \frac{1}{x^3} \quad 2\cos 3\theta$$

**73.** **(1)** Let centre of the circle is, $C = (h, k)$ and radius $= r$

Co-ordinates of $A \equiv \left[\frac{ah}{a \quad r}, \frac{ak}{a \quad r}\right]$

Co-ordinates of $B \equiv \left[\frac{2ar \quad 2ah}{2a \quad r}, \frac{2ak}{2a \quad r}\right]$




Putting co-ordinates of $A$ and $B$ in $S_1$, $S_2$ respectively and eliminating $r$,

$12x^2 - 4y^2 - 24ax + 9a^2 = 0$.

**74.** **(1)** Given equation of line is

$$x \quad 5 \quad \frac{1}{4}(y \quad 3) \quad -\frac{1}{9}(z-6)$$

or $\frac{x \quad 5}{1} \quad \frac{y \quad 3}{4} \quad \frac{z-6}{-9} \quad \lambda(say)$

$x = \lambda - 5, y = 4\lambda - 3, z = -9\lambda + 6$

$(x, y, z) \equiv (\lambda - 5, 4\lambda - 3, -9\lambda + 6)$ ...(i)

Let it is foot of perpendicular

So, d.r.'s of $\perp$ line is

$(\lambda - 5 - 2, 4\lambda - 3 - 4, -9\lambda + 6 + 1)$

$\equiv (\lambda - 7, 4\lambda - 7, -9\lambda + 7)$

D.r.'s of given line is $(1, 4, -9)$ and both lines are $\perp$

$\therefore \quad (\lambda - 7).1 + (4\lambda - 7).4 + (-9\lambda + 7)(-9) = 0$

$\Rightarrow \quad 98\lambda = 98 \Rightarrow \lambda = 1$

$\therefore$ Point is $(-4, 1, -3)$. [Substituting $\lambda = 1$ in (i)]

**75.** **(1)** $\because r \quad \max_{i \neq j} |x_i - x_j|$ and $S^2 \quad \frac{1}{n-1}\sum_{i \quad 1}^{n}(x_i - \bar{x})^2$

Now, consider $(x_i - \bar{x})^2 \quad \left(x_i - \frac{x_1 \quad x_2 \quad .... \quad x_n}{n}\right)^2$

$$\frac{1}{n^2}[(x_i - x_1) \quad (x_i - x_2) \quad .... \quad (x_i - x_i - 1)$$

$$(x_i - x_i \quad 1) \quad ... \quad (x_i - x_n)]^2 \leq \frac{1}{n^2}[(n-1)r]^2$$

$[\because |x_i - x_j| \leq r]$

$$\Rightarrow (x_i - \bar{x})^2 \leq r^2 \Rightarrow \sum_{i \quad 1}^{n}(x_i - \bar{x})^2 \leq nr^2$$

$$\Rightarrow \frac{1}{n-1}\sum_{i \quad 1}^{n}(x_i - \bar{x})^2 \leq \frac{nr^2}{(n-1)} \Rightarrow S^2 \leq \frac{nr^2}{(n-1)}$$

$$\Rightarrow S \leq r\sqrt{\frac{n}{n-1}}$$

**76.** **(2)** If $\vec{a} \quad \vec{b} \quad \vec{c} \quad 0, |\vec{a}| \quad 3, |\vec{b}| \quad 5, |\vec{c}| \quad 7$

$\Rightarrow \quad \vec{a} \quad \vec{b} \quad -\vec{c} \Rightarrow \vec{a} \quad \vec{b}^{\,2} \quad \vec{c}^{\,2}$

$\Rightarrow \vec{a}^2 \quad \vec{b}^2 \quad 2\vec{a}.\vec{b}\cos\theta \quad \vec{c}^2$

$\Rightarrow 3^2 + 5^2 + 2 \times 3 \times 5\cos\theta = 7^2$

$\Rightarrow 9 + 25 + 30\cos\theta = 49$

$\Rightarrow 30\cos\theta = 49 - 34$

$\Rightarrow 30\cos\theta = 15 \Rightarrow \cos\theta \quad \frac{15}{30}$

$\Rightarrow \cos\theta \quad \frac{1}{2} \Rightarrow \cos\theta = \cos\frac{\pi}{3}$

$\Rightarrow \theta = \frac{\pi}{3}$

**77.** **(1)** If $z = x + iy$ is a complex number satisfying the given conditions, then

$a^2 - 3a + 2 = |z + \sqrt{2}| = |z + i\sqrt{2} + \sqrt{2} - i\sqrt{2}|$

$\leq |z + i\sqrt{2}| + \sqrt{2}|1 - i| < a^2 + 2$

$\Rightarrow -3a < 0 \Rightarrow a > 0$ ...(i)

Since $|z + \sqrt{2}| = a^2 - 3a + 2$ represents a circle with centre at $A(-\sqrt{2}, 0)$ and radius $\sqrt{a^2 - 3a \quad 2}$, and $|z + i\sqrt{2}| < a^2$ represents the interior of the circle with centre at $B(0, -\sqrt{2})$ and radius $a$.

Therefore there will be a complex number satisfying the given condition and the given inequality if the distance $AB$ is less than the sum or difference of the radii of the two circles, *i.e.*, if

$\sqrt{(-\sqrt{2}-0)^2 \quad (0 \quad \sqrt{2})^2} \quad \sqrt{a^2-3a \quad 2} \quad a$

$\Rightarrow 2 \quad a \quad \sqrt{a^2-3a+2} \Rightarrow 4 \quad a^2 \quad 4a \quad a^2-3a \quad 2$

$\Rightarrow -a < -2$ or $7a < -2 \Rightarrow a \quad 2$ or $a \quad -\frac{2}{7}$

But $a > 0$ from (i), therefore $a > 2$.

**78. (2)** We define the following events:

$A_1$ : Selecting a pair of consecutive letter from the word LONDON.

$A_2$ : Selecting a pair of consecutive letters from the word CLIFTON

$E$ : Selecting a pair of letters 'ON'.

Then $P(A_1 \cap E) = \frac{2}{5}$; as there are 5 pairs of consecutive letters out of which 2 are ON.

$P(A_2 \cap E) = \frac{1}{6}$; as there are 6 pairs of consecutive letters of which one is ON.

$\therefore$ the required probability is

$$P\left(\frac{A_1}{E}\right) \quad \frac{P(A_1 \cap E)}{P(A_1 \cap E)+P(A_2 \cap E)} \quad \frac{\frac{2}{5}}{\frac{2}{5} \quad \frac{1}{6}} \quad \frac{12}{17}$$

**79. (1)** $\int f(x)\sin x \cos x\, dx \quad \frac{1}{2(b^2-a^2)}\log f(x) \quad C$ therefore

$f(x)\sin x \cos x \quad \frac{1}{2(b^2-a^2)}.\frac{1}{f(x)}f'(x)$

[by differentiating both the sides]

$\Rightarrow 2(b^2-a^2)\sin x \cos x \quad \frac{f'(x)}{f(x)^{\;2}}$

$\int (2b^2 \sin x \cos x - 2a^2 \sin x \cos x)\,dx \quad \int \frac{f'(x)}{f(x)^{\;2}}dx$

[by integrating both the sides]

$\Rightarrow -b^2\cos^2 x - a^2 \sin^2 x - C = -\frac{1}{f(x)}$

**80. (3)** Let $L = \lim_{x\to 0}\frac{f(x^2)-f(x)}{f(x)-f(0)}$

Using L.H. Rule, we get

$L = \lim_{x\to 0}\frac{f'(x^2).2x - f'(x)}{f'(x)}$

$= \lim_{x\to 0}\frac{f'(x^2).2x}{f'(x)} - 1 \quad \left[\because f'(a) \quad 0, f \text{ being strictly increasing}\right]$

$= 0 - 1 = -1$

**81. (879)** Number of white balls = 10

Number of green balls = 9

and number of black balls = 7

$\therefore$ Required ways

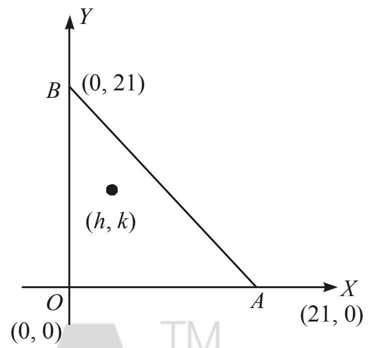
$= (10+1)(9+1)(7+1) - 1$

$= 11.10.8 - 1 = 879$

[$\because$ The total number of ways of selecting one or more items from $p$ identical items of one kind, $q$ identical items of second kind; $r$ identical items of third kind is $(p+1)(q+1)(r+1) - 1$ ]

**82. (190)** Equation of $AB$ is,

$\frac{x}{21} \quad \frac{y}{21} \quad 1 \Rightarrow x \quad y \quad 21$




Let $(h, k)$ be any point inside the $\Delta OAB$ then

$h < 21, h > 0$ ...(i)

$k < 21, k > 0$ ...(ii)

and $h + k < 21$ ...(iii)

For integral values of $(h, k)$ satisfying (i), (ii) and (iii) simultaneously, let

Total number of points

$h = 1$ then $k = 1, 2, 3 \ldots 19$ 19

$h = 2$ then $k = 1, 2, 3 \ldots 18$ 18

$h = 3$ then $k = 1, 2, 3 \ldots 17$ 17

: : :

: : :

$h = 19$ then $k = 1$ 1

$\therefore$ Total number of integral points

$= 19 + 18 + 17 + \ldots + 1$

$= \frac{19 \times 20}{2} \quad 190.$

**83. (60)** Let $z \quad \frac{1-i\sqrt{3}}{1 \quad i\sqrt{3}} \quad \frac{(1-i\sqrt{3})}{(1 \quad i\sqrt{3})} \times \frac{(1-i\sqrt{3})}{(1-i\sqrt{3})}$

$\frac{1+3i^2-2\sqrt{3}i}{1-3i^2} \quad \frac{1-3-2\sqrt{3}i}{1 \quad 3} \quad [\because i^2 = -1]$

$\frac{-1-i\sqrt{3}}{2} \quad -\frac{1}{2}-\frac{\sqrt{3}}{2}i$

$\because \tan\theta \quad \frac{\sqrt{3}/2}{1/2} \quad \sqrt{3} \quad \left[\begin{array}{l}\because \tan\theta \quad \frac{y}{x} \\ \text{where } z \quad x \quad iy\end{array}\right]$

$\therefore$ Argument of $z = \theta \quad \tan^{-1}(\sqrt{3}) \quad \frac{\pi}{3} = 60° = k°$

$\Rightarrow \quad k = 60$

**84.** **(97)** $t_{r+1} = {}^{100}C_r(\sqrt[8]{5})^{100-r} \cdot (\sqrt[6]{2})^r$

As 2 and 5 are coprime, $t_{r+1}$ will be rational if $100 - r$ is a multiple of 8 and $r$ is a multiple of 6.

Also $0 \le r \le 100$

$\therefore \quad r = 0, 6, 12, ....., 96$

$\therefore \quad 100 - r = 4, 10, 16, ....., 100$ ....... (i)

But $100 - r$ is to be a multiple of 8.

So, $100 - r = 0, 8, 16, 24, ..... 96$ ....... (ii)

The common terms in (i) and (ii) are 16, 40, 64, and 88

$\therefore \quad r = 84, 60, 36, 12$ give rational terms.

$\therefore$ the number of irrational terms = 101 – 4 = 97

**85.** **(12)** $2|x| + 3|y| \le 6$ can be written as

$l_1 : 2x - 3y \quad 6$, points are (3,0), (0, –2)

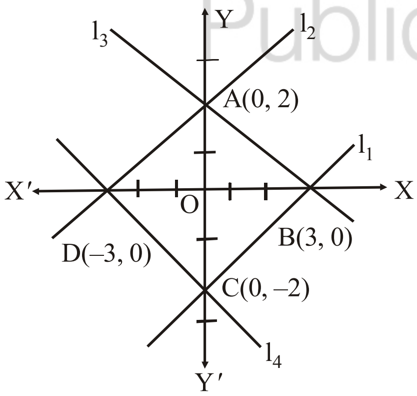
$l_2 : -2x \quad 3y \quad 6$, points are (–3, 0), (0, 2)

$l_3 : 2x \quad 3y \quad 6$, points are (3, 0), (0, 2)

$l_4 : -2x - 3y \quad 6$, points are (–3, 0), (0, –2)

Required area = area of quadrilateral $ABCD$

$= \text{area } (\Delta ADC) + \text{area } (\Delta ABC)$




$= \frac{1}{2} AC \times DO + \frac{1}{2} \times BO \times AC$

$\frac{1}{2} AC(BO \quad OD) \quad \frac{1}{2} \times 4(3 \quad 3)$

$= 2 \times 6 \quad 12$ square units.

**86.** **(0.5)** $\cos^{-1}\sqrt{p} = \frac{\pi}{4}, \cos^{-1}\sqrt{1-p}$ and $\cos^{-1}\sqrt{1-q} \quad \frac{\pi}{4}$

$\Rightarrow \quad \sqrt{1-q} \quad \cos\frac{\pi}{4} \quad \frac{1}{\sqrt{2}} \Rightarrow q \quad \frac{1}{2} \quad 0.5$

**87.** **(1.25)** $1 \quad x \quad 1 \begin{bmatrix} 1 & 2 & 3 \\ 0 & 5 & 1 \\ 0 & 3 & 2 \end{bmatrix} \begin{bmatrix} x \\ 1 \\ -2 \end{bmatrix} \quad O$

$\Rightarrow 1 \quad 2 \quad 5x \quad 3 \quad 3 \quad x \quad 2 \begin{bmatrix} x \\ 1 \\ -2 \end{bmatrix} \quad O$

$\Rightarrow x + (2 + 5x + 3) + (-2)(3 + x + 2) = 0 \Rightarrow x = \frac{5}{4}.$

**88.** **(2)** $f \quad x \quad \begin{cases} 2 + x \quad ^3, -3 < x \le -1 \\ x^{2/3}, \qquad -1 \quad x \quad 2 \end{cases}$

$\Rightarrow f' \quad x \quad \begin{cases} 3 \quad 2 + x \quad ^2; -3 < x \le -1 \\ \frac{2}{3} x^{-1/3}; \qquad -1 \quad x \quad 2 \end{cases}$

For $-3 < x \le -1$, $f' \quad x \quad 0$.

But $-1 \quad x \quad 0$, $f' \quad x \quad 0$

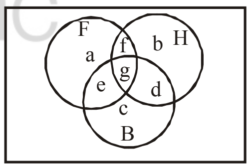
So, we have one local max. at $x = -1$

Further for $0 \quad x \quad 2$, $f' \quad x \quad 0$

$\therefore$ also, we have one local minima.

**89.** **(0.25)** $P$ (tail in 3rd) . $P$ (tail in 4th) = $\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$

**90.** **(325)**




a + e + f + g = 285, b + d + f + g = 195

c + d + e + g = 115, e + g = 45, f + g = 70, d + g = 50

a + b + c + d + e + f + g = 500 – 50 = 450

We obtain a + f = 240, b + d = 125, c + e = 65

a + e = 215, b + f = 145; b + c + d = 165

a + c + e = 255; a + b + f = 335

Solving we get

b = 95, c = 40, a = 190, d = 30, e = 25, f = 50 and g = 20

Desired quantity = a + b + c = 325