# MODERATED BASIC APPLIED MATHEMATICS MARKING GUIDE

FORM-SIX INTERISLAMIC MOCK EXAMINATION

YEAR — 2025

BASIC APPLIED MATHEMATICS MARKING SCHEME

FORM SIX INTER-ISLAMIC MOCK EXAMINATION

01. (a) (i) 0.0008 ✓ ~~3.7047408 28~~ ---------- ($02\frac{1}{2}$ marks)

OR, 0.0548 ~~3.2282192569~~ ---------- ($02\frac{1}{2}$ marks)

(ii) ~~-21.4657~~ ---------- ($02\frac{1}{2}$ marks)

(b) 1.5905 ---------- ($02\frac{1}{2}$ marks)

(c) $\theta = 0.0625$ rad. ----------

OR $3^\circ 35' 15''$ $= 3.58374928^\circ$

02. (a) $h(x) = \dfrac{x^2}{x^2-4} + \dfrac{1}{x+2}$

$\dfrac{x^2(x+2)+x+2}{(x-2)(x+2)}$

$\dfrac{x^3+2x^2+x-2}{(x-2)(x+2)}$ ---------- ($0\frac{1}{2}$ mark)

$= \dfrac{x^2+x-2}{x^2-4}$

$= \dfrac{(x+2)(x-1)}{(x-2)(x+2)} = \dfrac{x-1}{x-2}$

$\dfrac{x^3+2x^2+x-2}{x^2-4}$ ---------- ($00\frac{1}{2}$ mark)

$\therefore h(x) = \dfrac{x-1}{x-2}$

Vertical Asymptote, $x-2=0$

$x = 2$. ---------- ($00\frac{1}{2}$ mark)

$x = 2$ or $-2$

~~Horizontal~~ Asymptote,
Oblique

$h(x) = y = \dfrac{x-1}{x-2}$

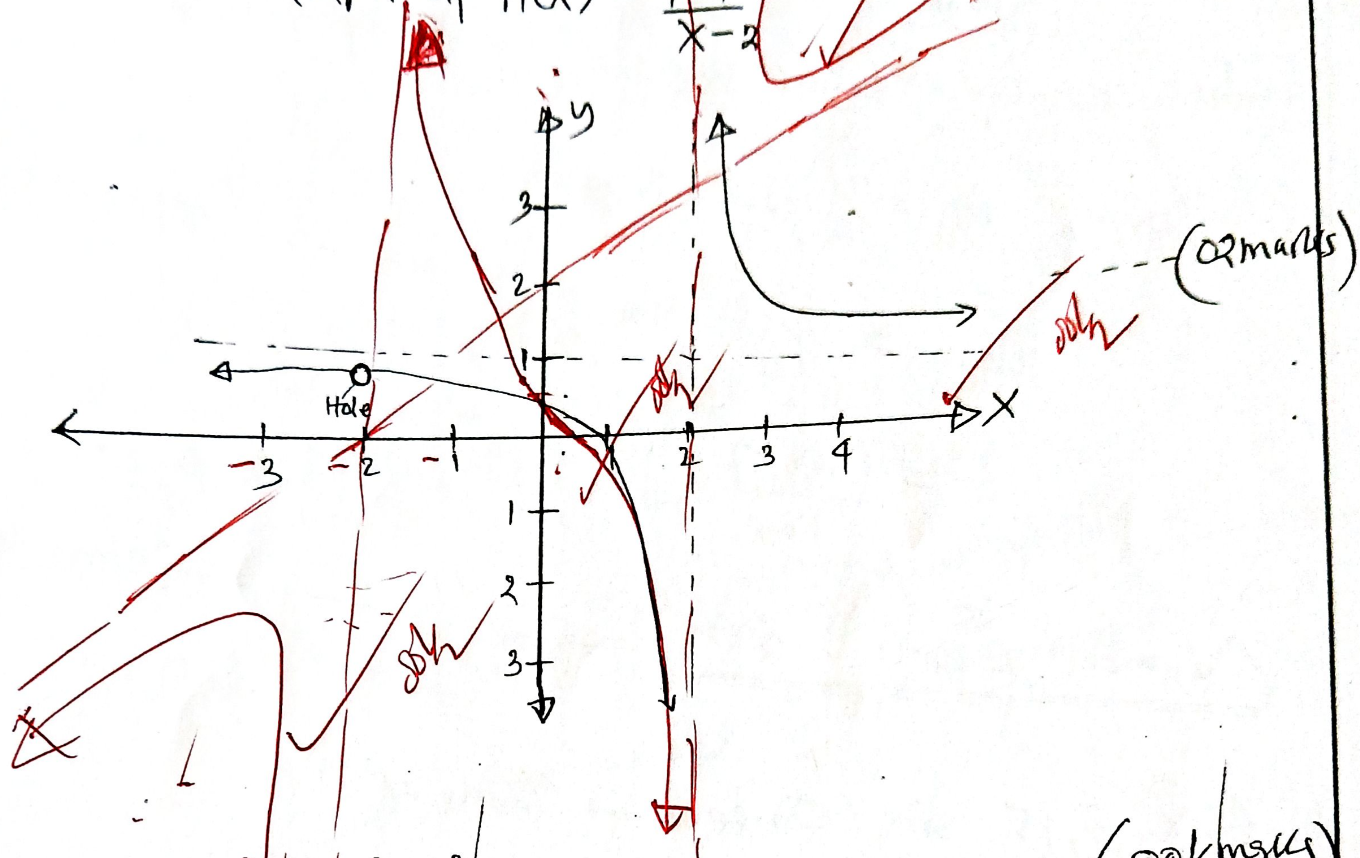
$y = \dfrac{x/x - 1/x}{x/x - 2/x}$

$y = \dfrac{1-1/x}{1-2/x}$, $x \to \infty$; $1/x \approx 0$ and $2/x \simeq 0$.

$\therefore y = \cancel{1} + 2$ ---------- ($00\frac{1}{2}$ mark)

2(a)

Graph of $h(x) = \frac{x-1}{x-2}$




2 (b)(i) $g(x) = -2(x-1)^2 + 3$ ------ (00½ marks)

$= -2(x^2+2x+1)+3$ ------ (00½ mark)

$g(x) = -2x^2 + 4x + 1$ $\quad 2x^2 - 4x + 5$

Turning point $= \left(\frac{-b}{2a}, \frac{4ac-b^2}{4a}\right)$ ------ (00½ mark)

$= \left(\frac{-4}{2(-2)}, \frac{4(-2)(1)-4^2}{4(-2)}\right)$ ------ (00½ mark)

(01 mark)

$\therefore$ Turning point $= (1, 3) = \cancel{\left(1, \frac{25}{8}\right)}$ ------ 00½ mark

(ii) Turning point is maximum.

(iii) Line of symmetry $= \frac{-b}{2a} = \frac{-4}{2(-2)} = +1$ ------ (01 mark)

$\therefore x = 1$. ------ (00½ mark)

(iv) Domain $= \{x;\ x \in R\}$

Range $= y;\ y \leq \frac{4ac-b^2}{4a} = \frac{4(-2)(1)-4^2}{4(-2)}$

$\therefore$ Range $= y \leq 3$ ------ (01 mark)

03 (a) Solution

Let number of boys = B and number of girls = G

Given; $G/B = 7/12$, but : $B = 1380$. ------ (01 mark)

$\frac{G}{1380} = 7/12$

$G = \frac{1380 \times 7}{12}$

$G = 805$ ------ (01 mark)

Number of girls is 805

(b) 6, x, y, 15 are Consecutive terms of AP

$A_2 - A_1 = A_3 - A_2 = A_4 - A_3$

from $A_2 - A_1 = A_3 - A_2$

$x - 6 = y - x$ ------ (01 mark)

$2x - y = 6$ --- (i)

then $A_3 - A_2 = A_4 - A_3$ ------ (01 mark)

$y - x = 15 - y$

$2y - x = 15$ --- (ii)

solve eqn (i) and (ii) Simultaneously

$\therefore x = 9$ and $y = 12$ ------ (01 mark)

Required, $A_n = ?$

from; $A_n = A_1 + (n-1)d$, but $A_1 = 6$, $d = 9 - 6 = 3$

$A_n = 6 + (n-1) \times 3$ ------ (01 marks)

$= 6 + 3n - 3$

$\therefore A_n = 6 - 3 + 3n = 3 + 3n$ ------ (01 marks)

Solution;

let "$t$" be the number of typists.
"$p$" be the number of pages.
"$d$" be the number of days.

Then $t \propto \frac{p}{d}$ ---- (01 mark)

$t = \frac{kp}{d} \Rightarrow \frac{td}{p} = k$ ------ (01 marke)

$\frac{t_1 d_1}{p_1} = \frac{t_2 d_2}{p_2}$, But $t_1 = 2$, $d_1 = 3$, $p_1 = 210$
$d_2 = 2$, $p_1 = 700$, $t_2 = ?$

$\frac{2 \times 3}{210} = \frac{2t}{700} \Rightarrow t = \frac{2 \times 3 \times 700}{2 \times 2100} = 10$ typists. --- (01 mark)

∴ 10 typists will be needed to type 700 pages in 2 days.

(a)(i) $f(x) = \frac{x^2}{x-1}$

$f(x+h) = \frac{(x+h)^2}{(x+h)-1}$

From first principle;

$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$ ---- (01 marks)

$= \lim_{h \to 0} \left( \frac{\frac{(x-h)^2}{x+h-1} - \frac{x^2}{x-1}}{h} \right)$ ---- (01 marks)

$= \lim_{h \to 0} \left( \frac{x^3 + 2x^2h + xh^2 - x^2 - 2xh - h^2 - x^3 - x^2h + x^2}{h(x-1)(x+h-1)} \right)$ ---- (01 mar

$= \lim_{h \to 0} h \left( \frac{x^2 - 2x - h}{h(x-1)(x+h-1)} \right) = \frac{x^2 - 2x}{(x-1)(x-1)}$

∴ $f'(x) = \frac{x^2 - 2x}{(x-1)^2}$ ------ (01 mark)

F (a)(ii) Given $g(x) = x\cos x$

Required, $g'(x) = ?$

From; Product Rule;

$g'(x) = v\,du/dx + u\,dv/dx$ ---------- (01 mark)

let $u = x \Rightarrow \frac{du}{dx} = 1$

$v = \cos x \Rightarrow dv/dx = -\sin x$. ---------- (01 mark)

$g'(x) = \cos x + (x)(-\sin x)$ ---------- (01 mark)

$\therefore g'(x) = \cos x - x\sin x$

(b) Solution;

Given $A = 4\pi r^2$

$r = 40cm$ and $\frac{dr}{dt} = 0.1\,cm/s$

$\Rightarrow \frac{dA}{dt} = 8\pi r\,dr/dt$ ---------- (01 mark)

$dA/dt = 8\pi(40) \times 0.1\,cm^2/s$ ---------- (01 mark)

$= 32\pi\,cm^2/s.$

$dA/dt = 32\pi\,cm^2/s.$ ---------- (01 mark)

$\therefore$ Rate of change of the area is $32\pi\,cm^2/s$.

Solution;

(i) $\int_1^2 (9x^3 - 4x)\,dx = 9\int_1^2 x^3 dx - 4\int_1^2 x\,dx$

$= \left(\frac{9x^4}{4} - 2x^2\right)\Big]_1^2$ ------ 01 mark

$= \left(\frac{9(2)^4}{4} - 2(2)^2\right) - \left(\frac{9(1)^4}{4} - 2(1)^2\right)$ --- (01 mark)

$= 111/4$ or $27.75$.

------ (01 mark)

$\therefore \int_1^2 (9x^3 - 4x)\,dx = 111/4$.

(ii) $\int \frac{\sqrt{x^3} - 4}{x^2}\,dx = \int \left(\frac{\sqrt{x^3}}{x^2} - \frac{4}{x^2}\right) dx$

$= \int \left(x^{-1/2} - 4x^{-2}\right) dx$ ------ (01 marks)

$= \frac{x^{1/2}}{1/2} - \frac{4x^{-1}}{-1} + c$ ------ (01 marks)

$= 2x^{1/2} + 4/x + c.$

$= 2\sqrt{x} + 4/x + c$

---- (01 mark)

$\therefore \int \frac{\sqrt{x^3} - 4}{x^2}\,dx = 2\sqrt{x} + 4/x + c$

(b) From the graph; The roots of $f(x)$ are $x=-1$ and $x=1$

Then $f(x) = (x-1)(x+1)$

$f(x) = x^2-1$ ---------- (01 mark)

Area under the curve is given by

$$A = \int_a^b y\,dx.$$

$$\text{Area} = \int_0^1 (x^2-1)dx + \int_1^2 (x^2-1)dx$$ ---------- (01 mark)

$$= \left(\frac{x^3}{3} - x\right)\Big|_0^1 + \left[\frac{x^3}{3} - x\right]_1^2$$

$$A = \left(\tfrac{1}{3} - 1 - 0\right) + \left(\left(\tfrac{8}{3} - 2 - \left(\tfrac{1}{3} - 1\right)\right)\right)$$ ---------- (01 mark)

$$\text{Area} = \tfrac{2}{3} + \tfrac{4}{3} = 2.$$

∴ Area under curve is 2 sq. units ---------- (01 mark)

Solution;

06 (a) Frequency Distribution table.

| Class Interval | Frenquency |
|---|---|
| 11 – 20 | 1 |
| 21 – 30 | 3 |
| 31 – 40 | 4 |
| 41 – 50 | 10 |
| 51 – 60 | 4 |
| 61 – 70 | 2 |
| 71 – 80 | 2 |
| 81 – 90 | 4 |

---------- (03 marks)

(i) A = 60

| C.I | f | X | d=X-60 | $d^2$ | fd | $fd^2$ |
|---|---|---|---|---|---|---|
| 11-20 | 1 | 15.5 | -44.5 | 1980.25 | -44.5 | 1980.25 |
| 21-30 | 3 | 25.5 | -34.5 | 1190.25 | -103.5 | 3570.75 |
| 31-40 | 4 | 35.5 | -24.5 | 600.25 | -98 | 2401 |
| 41-50 | 10 | 45.5 | -14.5 | 210.25 | -145 | 2102.5 |
| 51-60 | 4 | 55.5 | -4.5 | 20.25 | -18 | 81 |
| 61-70 | 2 | 65.5 | 5.5 | 30.25 | 11 | 60.5 |
| 71-80 | 2 | 75.5 | 15.5 | 240.25 | 31 | 480.5 |
| 81-90 | 4 | 85.5 | 25.5 | 650.25 | 102 | 2601 |
| Sum(Σ) | 30 | | | | -265 | 13277.5 |
| | | 00½ mark | 00½ mark | 01 mark | 00½ mark | 01 mark |

(i) standard deviation, $\delta = \sqrt{\frac{\Sigma fd^2}{N} - \left(\frac{\Sigma fd}{N}\right)^2}$ ------ (00½ mark)

$\delta = \sqrt{\frac{13277.5}{30} - \left(\frac{265}{30}\right)^2}$ ------ (01 mark)

S.D = 19.09333799

(ii) Median $= L + \left(\frac{\frac{N}{2} - \Sigma f_b}{f_w}\right) \times C$ ------ (00½ mark)

Median class is 41-40, since $\frac{N}{2} = 15$

Median $= 40.5 + \left(\frac{15 - 8}{10}\right) \times 10$ ------ (01 mark)

Median = 47.5 ------ (00½ mark)

1 (a)

Solution

Verify $\frac{3}{7}\left({}^8C_3 + {}^8C_2\right) = {}^9C_2$.

Since $^nC_r = \frac{n!}{(n-r)!r!}$

$$\frac{3}{7}\left(\frac{8!}{(8-3)!3!} + \frac{8!}{(8-2)!2!}\right) = \frac{9!}{(9-2)!2!} \text{ ------ (01 mark)}$$

$$\frac{3}{7}\left(\frac{8!}{5!3!} + \frac{8!}{6!2!}\right) = \frac{9!}{7!2!}$$

$$\frac{3 \times 8!}{7 \times 5!2!}\left(\frac{1}{3} + \frac{1}{6}\right) = \frac{9 \times 8!}{7!2!} \text{ ------ (01 mark)}$$

$$\frac{9 \times 8!}{7 \times 6 \times 5! \times 2!} = \frac{9 \times 8!}{7!2!}$$

$$\frac{9!}{7!2!} = \frac{9!}{7!2!} \text{ ------ (01 mark)}$$

Since L.H.S = R.H.S

Hence, verified that $\frac{3}{7}\left({}^8C_3 + {}^8C_2\right) = {}^9C_2$

(i) Solution;

Given $P(A)=\frac{1}{3}$, $P(B)=\frac{2}{7}$

$P(A\cup B)=?$ If A and B are mutually exclusive, $P(A\cap B)=0$.

from $P(A\cup B)=P(A)+P(B)$. ------(01 mark)

$$P(A\cup B)=\frac{1}{3}+\frac{2}{7}=\frac{13}{21}$$

------(00½ mark)

$\therefore$ $P(A\cup B)=\frac{13}{21}$

(ii) If A and B are independent events.

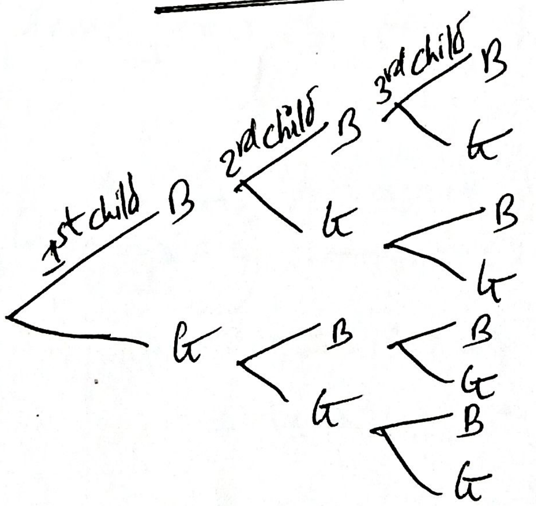
$P(A\cap B)=P(A)\times P(B)$ ------(01 mark)

$P(A\cap B)=\frac{1}{3}\times\frac{2}{7}=\frac{2}{21}$

------(00½ mark)

$\therefore$ $P(A\cap B)=\frac{2}{21}$

7(i).




------(01 mark)

$S=\{BBB, BBG, BGB, BGG, GBB, GBG, GGB, GGG\}$ $\Rightarrow n(S)=8$ --(01 mark)

$E=$ one boy and Two girls $=\{BGG, GBG, GGB\}$ $\Rightarrow n(E)=3$

From, $P(E)=\frac{n(E)}{n(S)}=\frac{3}{8}$ ------(01 mark)

$P(E)=3/8$.

$\therefore$ The probability of one boy and two girls is $3/8$ ---(01 mark)

08(a) $\sec 2\alpha + \tan 2\alpha = \dfrac{\cos\alpha + \sin\alpha}{\cos\alpha - \sin\alpha}$

Consider RHS

Rationalize the denominator

$\dfrac{\cos\alpha + \sin\alpha}{\cos\alpha - \sin\alpha} \times \dfrac{\cos\alpha + \sin\alpha}{\cos\alpha + \sin\alpha}$ — (01 mark)

$\dfrac{\cos^2\alpha + 2\cos\alpha\sin\alpha + \sin^2\alpha}{\cos^2\alpha - \sin^2\alpha}$ — (01 mark)

$\dfrac{1 + \sin 2\alpha}{\cos 2\alpha}$ — (01 mark)

$= \dfrac{1}{\cos 2\alpha} + \dfrac{\sin 2\alpha}{\cos 2\alpha}$ — (01/2 mark)

$= \sec 2\alpha + \tan 2\alpha$ proved (01 mark)

(b) $\tan 2\alpha = 1$

$2\cdot\alpha = \tan^{-1}(1)$ — (00 1/2 mark)

$\dfrac{2\alpha}{2} = \dfrac{45^\circ}{2}$

$\alpha = \dfrac{45^\circ}{2}$ — (00 1/2 mark)

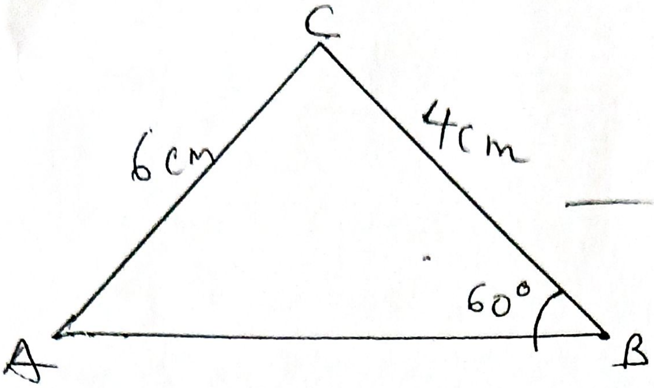
For tangent to be positive

$360^\circ - \dfrac{45^\circ}{2}$

$337.5^\circ$ (01 mark)

$\therefore 22.5^\circ$ and $337.5^\circ$

c)




— (01 mark)

By sine rule

$$\frac{AC}{\sin \hat{B}} = \frac{CB}{\sin \hat{A}} \quad — \left(0\tfrac{1}{2} \text{ mark}\right)$$

$$\frac{6cm}{\sin 60°} = \frac{4cm}{\sin \theta} \quad — \left(01 \text{ mark}\right)$$

$$\frac{6cm \sin \theta}{6cm} = \frac{4cm \times \sin 60°}{6cm} \quad \left(0\tfrac{1}{2} \text{ mark}\right)$$

$$\sin \theta = 0.5773$$

$$\theta = \sin^{-1}(0.5773) \quad \cancel{0 \tfrac{1}{2}}$$

$$\theta = 35° \quad — \left(00\tfrac{1}{2} \text{ mark}\right)$$

09 i) coordinate of A and B

At point A $y = 0$

$y = \ln x$ — (01 mark)

$0 = \ln x$

$x = e^0$

$x = 1$

$A(1, 0)$ — (01 mark)

At point B

$y = 2\ln(x - 6)$ — (01 mark)

$y = 2\ln(x-6)$

$y = 2\ln(x-6)$ — (01 mark)

$\frac{0}{2} = \frac{2}{2}\ln(x-6)$

$e^0 = x-6$

$x-6 = 1$

$x = 7$

$B(7,0)$ — (00½ mark)

9(ii) $\left.\begin{array}{l} y = \ln x \\ y = 2\ln(x-6) \end{array}\right\}$

$\ln x = 2\ln(x-6)$ — (01 mark)

$\ln x = \ln(x-6)^2$

$x = (x-6)^2$

$x = x^2 - 12x + 36$

$x = 9$ — (00½ mark)

From $y = \ln x$

$y = \ln 9$

$y = 2\ln 3$

$C = (9, 2\ln 3)$

or

$(9, 2.2)$ — (00½ mark)

9(b) $9^x - 3^x - 6 = 0$

$(3^2)^x - 3^x - 6 = 0$

$(3^x)^2 - 3^x - 6 = 0$ — (01 mark)

$u = 3^x$ — (00½ mark)

$$u^2 - u - 6 = 0$$

$u = 3$ and $u = -2$ — (01 mark)

$$3^x = 3$$

Apply log both sides

$$\log 3^x = \log 3$$

$$\frac{x \log 3}{\log 3} = \frac{\log 3}{\log 3}$$ — (01 mark).

$$x = 1$$

0(a) soln

let X be number of adult tickets sold

Y be the number of student tickets

Z be number of children tickets — (00 1/2 mark)

$$X + Y + Z = 400$$

$$40x + 20y + 10z = 10600$$ — (00 1/2 mark)

Matrix D: $\begin{bmatrix} 1 & 1 & 1 \\ 40 & 20 & 10 \\ 1 & 1 & -1 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 400 \\ 10600 \\ 200 \end{bmatrix}$ — (00 1/2 mark)

Determinant of matrix D $\begin{bmatrix} 1 & 1 & 1 \\ 40 & 20 & 10 \\ 1 & 1 & -1 \end{bmatrix} = 40$

$$D_x = \begin{bmatrix} 400 & 1 & 1 \\ 10600 & 20 & 10 \\ 200 & 1 & -1 \end{bmatrix}$$

Determinant of $D_x = 700$ — (00 1/2 mark)

10(a) Determinant of Y from

$$\begin{bmatrix} 1 & 400 & 1 \\ 40 & 10600 & 10 \\ 1 & 1 & -1 \end{bmatrix}$$ — (00½ mark)

$D_y = 4800$

Determinant of Z $\begin{bmatrix} 1 & 1 & 400 \\ 40 & 20 & 10600 \\ 1 & 1 & 200 \end{bmatrix}$

$D_z = 4000$ — (00½ mark)

$x = \frac{Dx}{D} = \frac{7200}{40} = 180$ — (00½ mark)

$y = \frac{Dy}{D} = \frac{4800}{40} = 120$ — (00½ mark)

$z = \frac{Dz}{D} = \frac{4000}{40} = 100$ — (00½ mark)

There are 180 adults, 120 students and 100 children in attendance — (00½ mark)

10(b) let X be units of food. ---- (00½ mark)
y be units of drinks. --- (00½ mark)

| | food | Drinks | minimum requirement |
|---|---|---|---|
| Vitamin B | 2 | 4 | 8 |
| Iron | 5 | 10 | 60 |
| Cost (Tsh) | 2000 | 1600 | |

10 (b) Constraints

$2x+4y \geq 8$

$x+2y \geq 4$ ---- (i) ---- ($00\frac{1}{2}$ mark)

$5x+10y \geq 60$

$x+2y \geq 12$ -- (ii) ------ ($00\frac{1}{2}$ mark)

$x \geq 0, y \geq 0$ -- (iii) ---- ($00\frac{1}{2}$ mark)

objective function, $f(x,y) = 2000x + 1600y$ --- ($00\frac{1}{2}$ mark)

| Corner Point | $f(x,y) = 2000x + 1600y$ | Minimize value. |
|---|---|---|
| A(0,6) | 2000(0) + 1600(6) | 9600 |
| B(12,0) | 2000(12) + 1600(0) | 24000 |

--- ($00\frac{1}{2}$ mark)

optimum solution is (0,6) with 9600/= --- ($00\frac{1}{2}$ mark)

$\therefore$ 0 units of food and 6 units of drinks should be consumed in order to minimize cost of 9600/=

10(b): GRAPH OF LINEAR PROGRAMMING

Scale: V.scale: 1cm represents 1 unit.
H.scale: 1cm represent 1 unit.