Linear programming

1.	(a) let the No. of garments of type A be x and those of type B be y		
	(i) $3x + 2\frac{1}{2}y \leq 600$ (material)	**B1**	
	(ii) $x \leq 1000$	**B2**	all✓
	$\quad y \geq 80$	**B1**	any two✓
	$\quad x \geq 0$		
	(b) Lines drawn		
	$3x + 2\frac{1}{2}y = 600$	**B1**	✓lines and shading✓
	$x = 100$		
	$x = 80$	**B1**	✓lines and shading
	$x = 0$		
	(c) The object function is	**B1**	for✓region indicated
	$P = 80x + 60y$ where P = total profit		
	Either drawn a search line by choosing an appropriate value of P	**B1**	✓objective function
	e.g $12000 = 80x + 60y$		
	or inspect for maximum profit using points further from origin	**B1**	Use of search line or inspection
	maximum profit		
	100 garment og type A		
	120 garments of type B	**B1**	✓
		B1	

1. $\qquad 30x + 20y \leq 4800 \ldots\ldots(i)$

$\qquad 30x + 40y \geq 3600 \ldots\ldots(ii)$

$\qquad 10x \langle 30\,y \ldots\ldots\ldots(iii)$

$\qquad\qquad x \rangle 0 \;\; y \rangle 0$

$\qquad$ objective function $10\,x + 12\,y = K$

	$3x + 2y = 480$					$3x + 4y = 360$					$x = 3y$		
X	40	60	80		X	20	40	60		X	30	45	60
y	180	150	120		Y	5	60	45		Y	)	15	20

$\qquad$ (ii) consider (60,40)

$\qquad$ $10\,(60) + 12(40) = 600 + 480$

$\qquad\qquad = 1080$

$\qquad\qquad 10x + 12y = 108\,0$

$\qquad$ $5x + 6y = 540 - $ search line

X	20	40	60
y	73	57	40

$\qquad$ Maximum profit at $(\alpha, 240)$

$\qquad$ No queen cake , 240 marble cakes

(iii) 240 X 12 = sh. 2880

(iv) 10x + 12y ≥ 600 ⇒ 10x + 12y = 600
     5x + 6y = 300

X	α	12	60
y	50	40	0

2. *Machine A*   *Machine B*

   Shirts   Jerseys   Shirts   Jerseys
   No. x   y   x   y
   Hrs. @2hrs   @3hrs   @2hrs   @1hr

                    (i) 2x + 3y = 24
(i) 2x + 3y ≤ 24

x	0	12
y	8	0

(ii) 2x + y ≤ 12
(iii) y > x   **(ii) 2x + y = 12**
(iv) x > 0

x	0	6
y	12	0

   y > 0
Max pt(3,6)
Max profit = 22 x 3 + 200 x 6
           = 600 + 1200   **(iii) y = x**
        = Shs. 1800   **(iv) y = 0**
                                        x = 0

3. (a) $3x + 7y \leq 210$
           $x + y \; 20$
           $x < 2y$
           $x > 15$

    (b) refer

    (c) $120x + 140y = 120 \times 130 + 140 \times 10$
           Profit = shs.5960
           $x = 31$

    $y = 16$

4. Passengers
    $64x + 48y \geq 384$ i.e. $8x + 6y \geq 48$
           $x > 0$
 $y > 0$
           $x + y \geq 7$

    Cost equation
   Total cost = $2500x + 20000y$

(3,4)
3 type x
4 type y

L₁

4

L₁   3   L₁   L₁

5.   *3x +   4y ≤120*
        400x + 150y ≥ 9000
        x ≥ 8   y >12
        (b)(i) 3x + 4y 20
        (ii) 40x + 15y 900
        (iii) x 8
        (iv) y 12
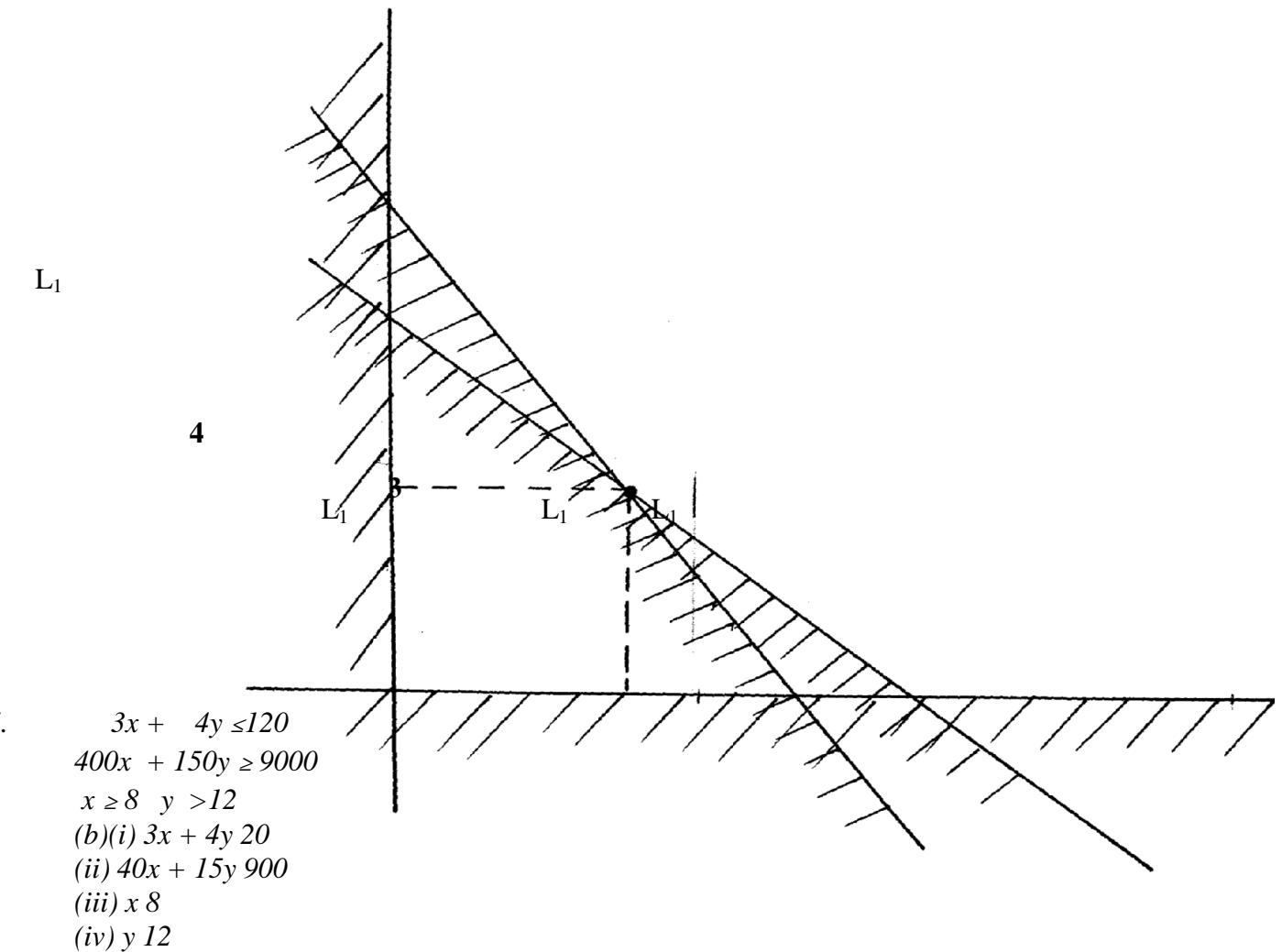
(table showing calculation of profit)

Points	Objective function 40x + 70y	Profit
(i) (8,24)	320 + 1680	2000
(ii) (24, 12)	960 + 840	1800
(iii) (8, 12)	320 + 840	1160

(c)   12 type x
       12 type y

Profit = 40(24) + 70(12)
         = 1800
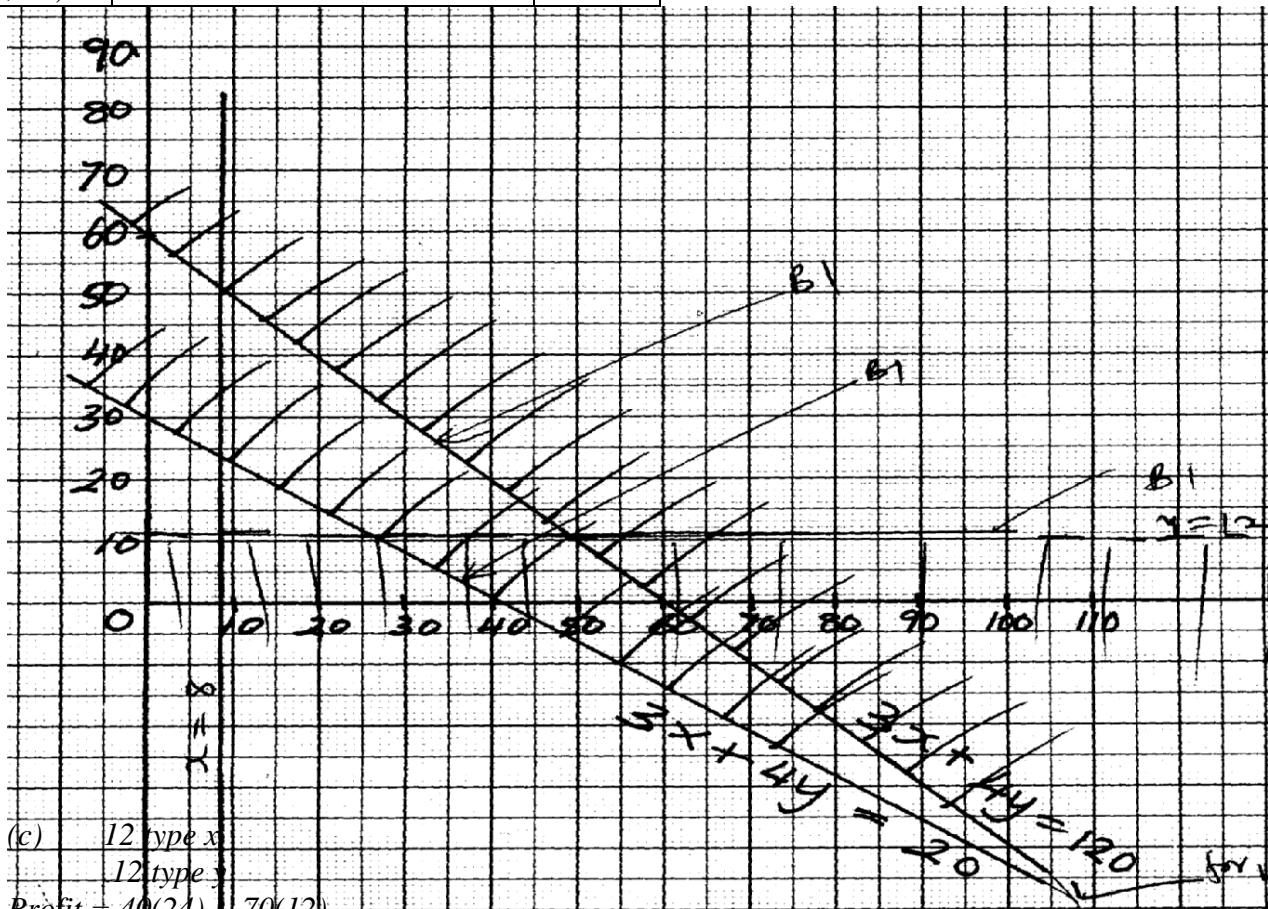
6. $100x = 160y = 16000$ $5 \times 200 + 8 \times 50$
      $= 100 \times 200 + 160 \times 50$ $1000 + 4000$
      $20000 + 8000$ $10 \times 200 + 16 \times 50 =$
      $28000/=$ $10x + 16y = 1600$
                $5x + 8y = 800$
                $5 \times 20 + 100$
                $8y = 800 - 100$
                $y = \dfrac{700}{8}$
                $^{800}/_5 = 160$

a) $y < 2x$, $50 \leq x \leq 200$ $x > 100$
   $y > 0$, $x + y \leq 250$, $100x + 160y \geq 16000$

b) See graph

*c) see graph*

$R \cos 60°$

profit?

7. $x + y < 10$
    $y < 3x$
    $y > 3$
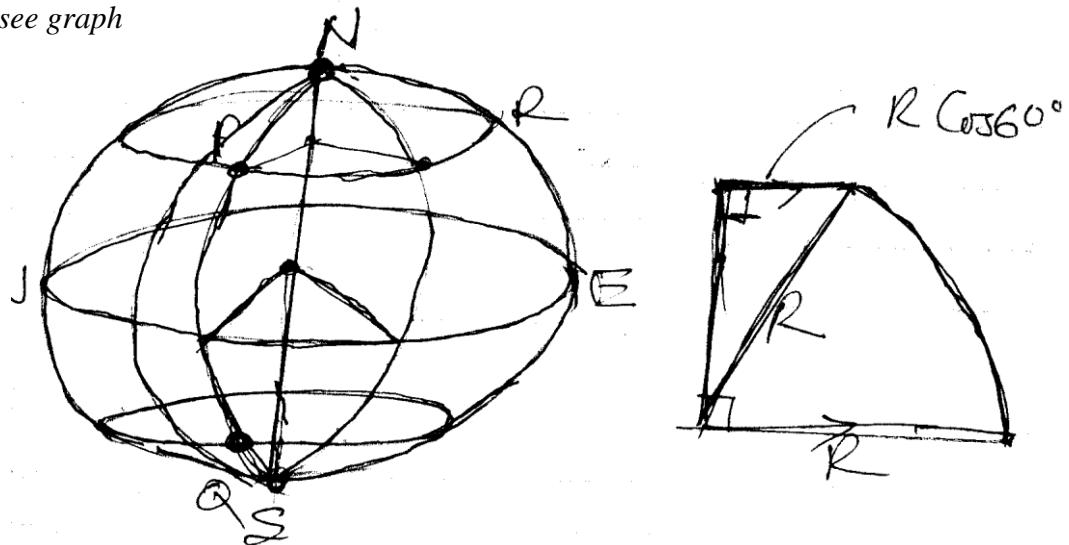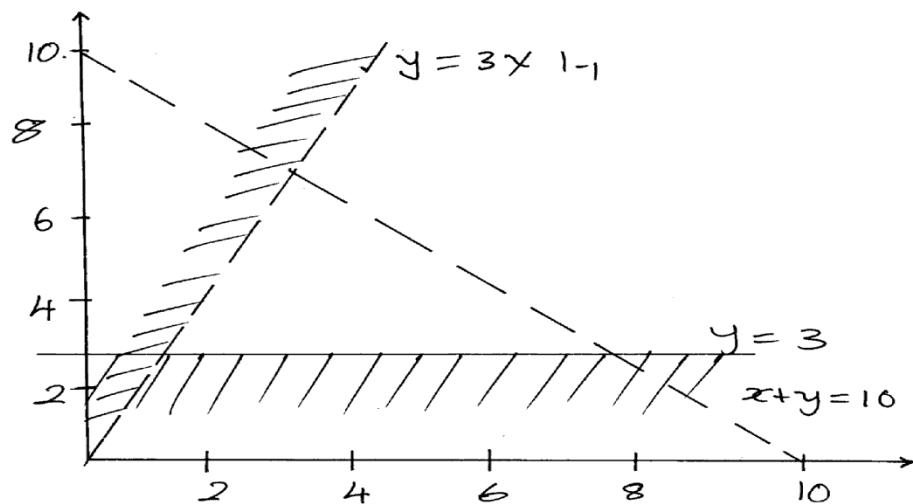
(c) *Obejctive function $3x = 2y = I$ or use of serach line*
    5 packets of cups and 4packets of stucks

x	y	Profit
2	4	14
2	5	16
3	4	17
3	5	19
3	6	21
4	4	20
4	5	22
5	4	23

8. *Panga – P, Jembe J*
    (a) $50P + 30J = 4260$
    $50P + 15J = 1290$
    $50P + 30J = 4260$
    $10P + 30J = 1290$

$40P = 1680$

$P = \underline{168} = 42$

      4

$50(42) + 30J = 4260$

$2100 + 30J = 4260$

$30J = 2160$

$J = \underline{(2160)}$

     30

$J = 72$

Wholesaler

$\underline{110} \times 42 = shs.46.50 = pangas$

100

$\underline{85} \times 72 = shs\ 60 = jembes$

100

For B

$50 \times 46.50 + 30 \times 61.2$

$2310 + 1836 = 4146$

Saving =   4260

               <u>4116</u>

               144

(b) *Discount* $5000 - 3500 = 1500$

    % discount $= \underline{1500} \times 100$

                 5000

             $= 30\%$

9.   a) $X \geq 0,\ y = \geq 0$

          $10x + 20y \geq 120$

          $4x + y \geq 20$

    b) *On the graph.*

    c) i) (4,4)

         $4 \times 100 + 4 \times 300$

         $400 + 1200 = 1600$

10.   *Distance Covered* $= (3t^2 - 3t - 6)dt$

                     $= t^3 - {}^3/_2\, t^2 - 6t\ 4\ {}^4_1$

$$\left\{ 4^3 - \frac{3}{2}(4)^2 - 6(4) \right\} - \left\{ 1^3 - 3(1)^2 - 6(1) \right\}$$

$16 - {}^{-13}/_2 =$