THE PRESIDENT'S OFFICE
REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT
CHAMWINO DISTRICT COUNCIL
FORM FOUR PRE-NATIONAL EXAMINATION - 2019
MARKING SCHEME: BASIC MATHEMATICS

SECTION A

Qn 1

a) Let $k = 0.2\dot{3}$

$10xk = 0.2\dot{3} \times 10$

$10k = 2.2\dot{3}$ 0½

$10k - k = 2.3\dot{3} - 0.2\dot{3}$

$9k = 2.1$.....0½

$K = \frac{2.1}{9}$

$K = \frac{21}{90}$

$= 7/_{30}$ 0½

$L = 0.\dot{3}$

$10L = 0.\dot{3} \times 10$

$10L = 3.\dot{3}$.....0½

$10L - L = 3.\dot{3} - 0.\dot{3}$.....0½

$9L = 3$

$L = {}^{3}/_{9}$

L = ⅓ 0½

(i) 2k + L = $2x^{7}/_{30}$ + ⅓

= 14/30 + ⅓ 0½

$\frac{= 14 + 10}{30}$

= 24/30

2k + L = $^{4}/_{5}$ 0½

(ii) k - ½ L = $\frac{7}{30}$ - ½ x ⅓

= $\frac{7}{30}$ - $^{1}/_{6}$ 0½

= $\frac{7-5}{30}$

= $^{2}/_{30}$

∴k - ½L = $^{1}/_{15}$ 0½

(b) 60098 = 6.0098 x 10^{4}----------01

Qn 2

(a) (i) $(3+\sqrt{2})(4-2\sqrt{2}) = 3(4-2\sqrt{2}) + \sqrt{2}(4-2\sqrt{2})$

$= 12 - 6\sqrt{2} + 4\sqrt{2}$ - 2x2 .....0½

$= 12 - 6\sqrt{2} + 4\sqrt{2}$ - 4 .....0½

$= 12-4\ (-6 + 4)\ \sqrt{2}$

$\therefore$ ¿) $(4-2\sqrt{2}\ )$ $= 8-2\sqrt{2}$----------01

(ii) $(27)^{¼}$x $(3)^{¼}$ x $(\sqrt{3}\ )^{-2}$ $= (3^{3})\ ¼$ x $(3)\ ¼$ x $(3½)^{-2}$ 0½

$3¾$ x $3¼$ x 3^{-1} 0½

$= (3¾ + ¼+ -1)$

$=3$

$= 3^{1-1}$

$=3^{0}$

$\therefore (27)¼$ x $(3)¼$ x $(\sqrt{3}\ )^{-2} = 1$----------01

2 (b) Given n $\log_5 125$ $= \log_2 64$

n$\log_5 5^3$ $= \log_2 2^6$.....½

$3n\log_5 5$ $= 6\log_2 2$, but $\log_a a$ $=$ 1.....0½

3n x 1 = 6x1

3n = 6

n $= {}^{6}/_{3}$

n = 2.....01

Qn 3

(a) Given U $= \{$ x : $2< x \leq 10\}$ $=$ 3,4,5,6,7,8,9,10.....0½

A $= \{$ X: $2< X \leq 7\}$ $=$ 3,4,5,6,7 .....0½

B $= \{$ X: $4< X \leq 8\}$ $=$ 5,6,7,8

$\{\quad\}$

(i) AUB = 3,4,5,6,7,8 .....0½

(ii) A 'nB'=

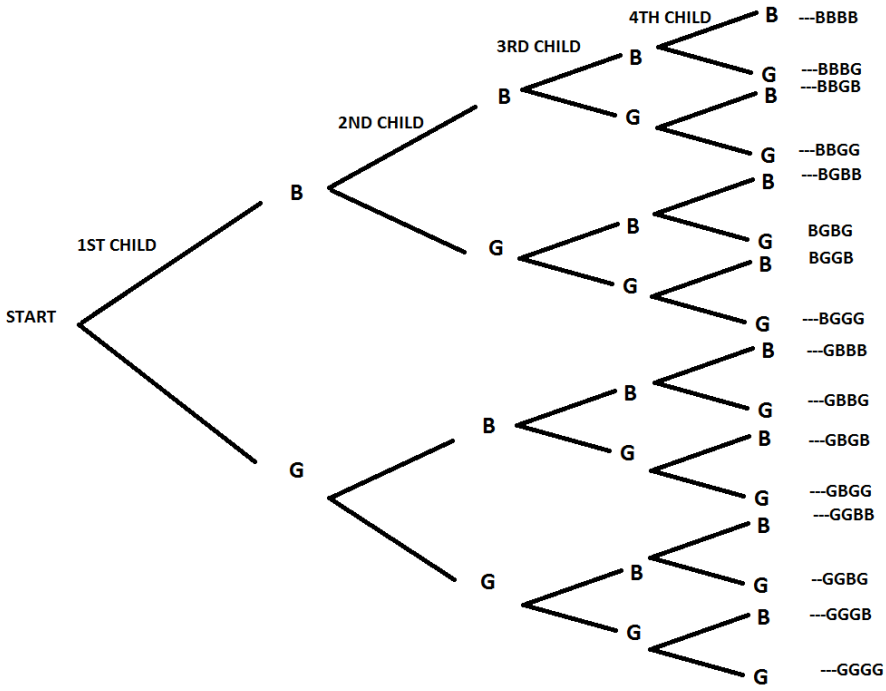
A' = { 8,9,10 .....0½

B' = { 3,4,9,10 .....0½

Then,

A' n B' = { 9,10 .....0½

3 (b)



Then;

n (s) =16

n (E) = 15

p (E) = $\frac{n(E)}{n(S)}$ = $\frac{15}{16}$.....01

Qn 4

(a) Given C = 4a + b

= 4(3i -j) + 5i - 2j

= 12i - 4j + 5i -2j

= 12i + 5i - 4j - 2j

∴C = 17i - 6j.....0½

(i) (C) =$\sqrt{17^2+(-6)^2}$

=$\sqrt{289+36}$weka marks

=$\sqrt{325}$

4(a)

$|C|$ = $\sqrt{5X5X13}$

∴$|C|$=$5\sqrt{13}$.....0½

(ii) Direction means to find the bearing (Q) of the vector

thus,

∅ = $\tan^{-1}(\frac{y}{x})$

= $\tan^{-1}(\frac{-6}{17})$ 0½

∅ = $\tan^{-1}$(-0.3529)

∅ = 19^0 2ǵ, but tan is -ve in 2^{nd} and 4^{th}

Quadrants then

$\varnothing = 180^0 - 19^0 26\acute{}$ and $\varnothing = 360^0 - 19^0\ 26\acute{}$

$\therefore \varnothing = 160^0\ 34\acute{}$, and $\varnothing = 340^0\ 34\acute{}$, ...0½

(iii) Unit vector C = $\frac{C}{ICI}$ 0½

$= \frac{17i - 6j}{5\sqrt{13}}$

$= \frac{17i}{5\sqrt{35}\sqrt{13}} - \frac{6j}{}$ 0½

4(b)

Given A (2, 3), B (4,2),

Slope MAB $= \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{2-3}{4-2}$

$\therefore$ MAB = $^{-}$½.....0½

4(b)

Mid point (AB) = $\frac{(x_1 + x_2, y_1 + y_2)}{2}$

$= (\frac{2+4}{2}, \frac{3+2}{2})$

$\therefore$ Mid point AB = (3, ^{5}/$_2$) 0½

For perpendicular lines

$M_1M_2 = -1$

$-½\ M_2 = -1$

$M_2 = 2$

Now,

Slope (M2) = $\frac{y-y_o}{x-xo}$

$2 = \frac{y - 5/2}{x-3}$

$y-5/2 = 2x-6$

$y = 2x + 5/2 - 6$

$y = 2x - 7/2$

∴ The equation is $y= 2x - 7/2$ 0½

Qn 5

(a) Area of regular polygon $A = ½ nr^2 \sin(\frac{360^0}{n})$

but n =6

$A = 720\ m^2$

r =?

Then $720m^2 = ½ \times 6 \times r^2 \sin(\frac{360^0}{6})$ 0½

$720\ m^2 = 3r^2 \sin 60^0$

$720m^2 = 3r^2 \times 0.8660$ 0½

$720m^2 = 2.598r^2$

$r^2 = \frac{720m^2}{2.598}$

$r^2 = 277.13m^2$ 0½

$r = +\sqrt{277.13m^2}$

$= +\sqrt{2.771 x 100 m}$

$= +\sqrt{2.771 x 10 m}$

= + 1.664 x 10m 0½

= + 16.64m

∴ r =17≈ 17m into whole number 01

5(b)

Given AB//DE,

<ECD = <ACB (vertically opposite angles 0½

Hence JCDE DCBA (SAS) (01/2 mark) 0½

Then

$\frac{CD}{CB} = \frac{CE}{CA} = \frac{DE}{AB}$ but $\frac{CD}{CA} = \frac{9}{6} = 1.5$, and $\frac{CE}{8} = 1.5$.....0½

The ratio of DE to AB must be also 1.5

Thus, DE = 1.5 x AB = 1.5 x 7 .....0½

=10.5cm

∴ Length of DE = 10.5cm.....01

Qn 6

(a) Given $y^2 \times \frac{(x-1)}{(x+d)}$ 0½

$y^2 = \frac{k(x-1)}{(x+d)}$.....0½

$k = y^2 \frac{(x+d)}{(x-1)}$, but y = 1, x=2, d=4

$k = 1^2 \frac{(2+4)}{2-1}$

$k = {}^{6}/_{1}$

$k = 6$.....01

To find x, y=2 and d = 1

From $y^2 = k\ (\underline{x-1})$ **.....0½**
$(x+d)$

$2^2 = 6\ (\underline{x-1})$
$(x+1)$

$4 = 6\ \underline{(x-1)}$
$x+1$

$4x + 4 = 6x - 6$**.....0½**

$\frac{10}{2} = \frac{2x}{2}$

$x = 5$ **.....0½**

6 (b)

$37½m \div 1½ = \frac{75}{2} - {}^{3}/_{2}$ **.....0½**

$= \frac{75}{2} \times {}^{2}/_{3}$**.....0½**

$= 25$

∴ There are 25 pieces cut **.....01**

Qn 7

(a) Given Capital P = 6,000,000/=

Rate R = 10% compound interest

time n =3 years

An =?

Amount A3 = $P(1+\frac{R}{100})^n$ **.....0½**

$= 6{,}000{,}000\ (1 + \frac{10}{100})^3$

$= 6{,}000{,}000\ (1.1)^3$ **.....0½**

= 6,000,000 x 1.331

7,986,000/=

∴ Amount after 3 years will be
7,986,000**.....01**

(b) TRADE ACCOUNT

Opening stock 8000 Add: purchase 25000**.....0½** Cost of goods for sale 33000**.....0½** Less: Closing stock 500 Cost of goods sold 32500**.....0½** Gross profit b/d 5500**.....0½**	Sales 3800 0**.....0½**
38000	38000 **.....01**

Qn 8

(a) From sequence $^1/_2$, $^2/_3$, $^3/_4$

Each term above and below differ by 1, so the

n^{th}term is given by $\frac{n}{n+1}$ **.....0½**

Then;

20^{th}term $= \frac{20}{20+1}$**.....0½**

$= \frac{20}{21}$ **.....01**

8 (b)

Given G3 = 3, G8 = -96**.....0½**

From $G_n = G_1 r^{n-1}$

$G3 = G_1 r^3 = 3$

$G8 = G_1 r^7 = -96$**.....0½**

Then

$r \rightarrow \frac{G_1 r7}{G_1 r2} = \frac{-96}{3}$ **.....0½**

$\rightarrow r^5 = -32$ **.....0½**

$\rightarrow r^5 = (-2)^5$

By comparison

$r = -2$

$\therefore$ Common ratio r =-2**.....01**

Then from $G_1 r^2 = 3$ **.....0½**

$G1 (-2)^2 = 3$

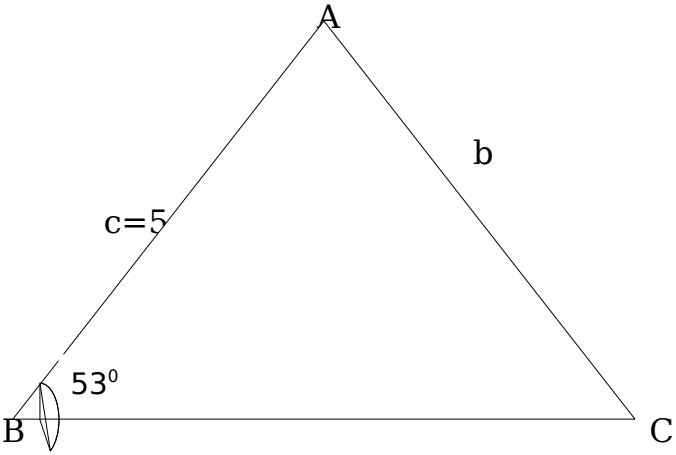
$4G_1 = 3$

$G_1 = {}^3/_4$

$\therefore$ First term is ${}^3/_4$ **.....0½**

Qn 9

(a) Consider DABC



a = 9cm

Applying cosine rule

$b^2 = a^2 + c^2 - 2ac\ coSB$ **.....0½**

$= 9^2 + 5^2 - 2x9x5 \cos 53^0$

$= 81+25 - 90x0.6018$

$=106 - 54.162$ **.....0½**

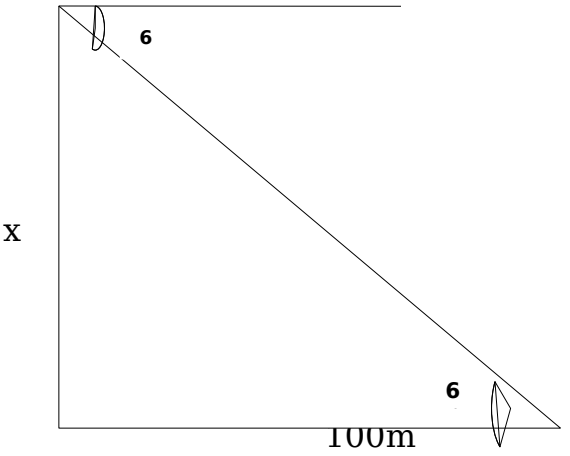
$= 51.838$

$b = +\sqrt{51.838}$

= + 7.19 cm **.....0½**

∴ Value of b= 7.20cm**.....01**

(b) Top of tower



Ground**.....01**

From the figure

Tan 60^0 = opposite**.....0½**
adjacent

Tan 60^0 = x
100m

x = 100m tan 60^0

=100m x 1.732 **.....0½**

=173.2m

∴ Height of tower is 173.2m **.....01**

Qn10

(a) Let the two numbers be x and y

Then x +y = 8
$x^2 + y^2 = 40$ **.....0½**
From eqn
X =8-y
Substute eqn (3) into eqn (2)
Then $(8-y)^2 + y^2 = 40$ **.....0½**
$64 - 16y + y^2 + y^2 = 40$
$64 - 16y + 2y^2 = 40$
$2y^2 - 16y + 24 = 0$
y2 - 8y + 12 =0
y2 - 6y - 2y + 12 =0
y(y-6) - 2 (y-6) = 0**.....0½**
(y-6) (y-2) = 0
y = 6 or y = 2
Then from x = 8-y
x = 8-6, $x^2 = 8-2$
x = 2, $x^2 = 6$**.....0½**

Thu; The two number are 2 and 6**.....01**
10 (b)
Given $2x^2 + x = 10$, = $2x^2 + x - 10 = 0$
From GQf

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$ but a =

2,

b = 1

c = 10

Then;

$$x = -1 + \sqrt{(1) - ¿¿}$$

2x2

……0½

$$= -1 + \sqrt{1 - -80}$$

4

$$= \frac{-1 + \sqrt{81}}{4}$$ **……0½**

$$\frac{-1 + 9}{4}$$ **……0½**

Either $x = \frac{-1 + 9}{4}$ or $x = \frac{-1 - 9}{4}$

Either $x = {}^{8}/_{4}$ or $x = \frac{-10}{4}$ **……0½** _____

Either x = 2 or $x = {}^{-5}/_{2}$

∴ x = 2 or x = -5/12 **……01**

SECTION B

Qn 11

(a) From the data

Assumed mean $A = \frac{31 + 40}{2} = \frac{71}{2}$

A = 35.5 **……0½**

Score	Class mark	Freg (f)	D = xi - A	Fi. di

01 -10	5.5	5	-30	-150
11 -20	15.5	7	-20	-140
21 - 30	25.5	15	10	150
31 - 40	35.5	25	0	0
41 - 50	45.5	8	10	80

$\sum fi = 60$ **.....01** $\sum fidi$ -60 **.....01**

11 (a)

From mean $(x) = A + \frac{\sum fidi}{\sum fi}$

$= 35.5 + \frac{-60}{60}$

$= 35.5 + {}^{-}1$

$= 34.5$

∴ Mean score is 34.5 ----------01

(ii) Median $(x) = L + \left(\frac{N}{2} - \sum fb\right) \frac{C}{fm}$

But N = 60

$\sum fb = 27$ thus; $x = 30.5 + \frac{(60/2 - 27)10}{25}$

$fm = 25$

$C = 10$ $= 30.5 + (3/25)10$

.....0½

$L = 30.5$ $= 30.5 + 1.2$

$= 31.7$

∴ The median is 31.7 (01 mark)

(iii) Range = Highest marks - lowest marks

.....0½

45.5 -5.5

∴Range = 40 **.....0½**

11. (b) Given < ACB = ½ x < AOB (angle at centre) 0½

Then a = ½ x 40^0 .....0½

a = 20^0 .....0½

11.(b)

Thus

Since a+b = 180^0 (opposite angles of cycle quadrilateral) 0½

20^0 + b = 18^0 .....0½

b= 180^0 - 20^0

= $160^{0\backslash}$

∴ b = 160^0 .....0½

Qn 12

(a) (i) Given point x (43^0N, 71^0w)

Velocity = 500km lh

time = 3hours

From velocity (v) = distance (D) 0½

Time (t)

Then D = V.t

= 500 km/h x 3hrs

= 1500 km

∴ Distance is 1500km ------01

(ii) Since an aeroplene flies east means that, it flies in the same latitude but changing its longitude

Thus from $D = \frac{2\pi RCoS\alpha\ Q}{360^0}$ 0½

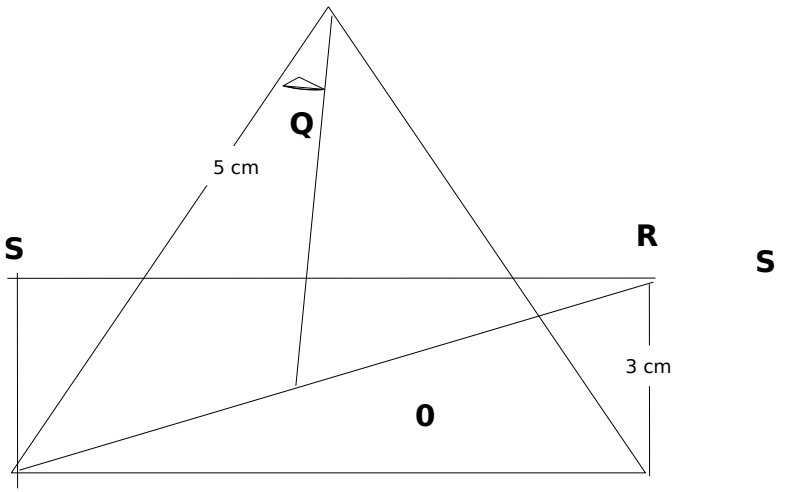
$$D = \frac{\pi RC\,oS\alpha\,Q}{180^0}$$

$$\alpha = \frac{180 \times D}{\pi RcosQ}$$

12 (a)
But D = 1500km
π = 3.14
R = 6370km
Q = 43^0
Then;
$\alpha = \frac{180 \times 1500km}{3.14 \times 6370km \times \cos 43^0}$
.....0½

$= \frac{270000}{20001.8 \times 0.5551}$ 0½
$= \frac{270000}{11102.19918}$
x = 24^0,-------01
Q = 71^0-24^0 = 57^0w (43^0N, 57^0w)
∴ The new latitude and longitude is ------01

12. (b)
Drop a perpendicular from V to PQRS at O



.....0½

Applying Pythagoras theorem in DPQR

$= \bar{P}Q^2 + \bar{Q}R^2 = 4^2 + 3^2$

$= 16 + 3^2$ 0½

$= 16+9$

$= \sqrt{25} = 5cm$ 0½

12 (b)

But $\bar{P}O = ½ \bar{P}R$

$= ½ x$ 0½

$= 2.5$ cm

$\bar{P}O = 2.5cm$ 0½

Then in cosQ = $\frac{\text{Adjacent}}{\text{Hypotenuse}}$ 0½

$= \frac{2.5cm}{5cm}$ 0½

cosQ = ½

$Q = COS^{-1}(½)$ 0½

$Q = 60^0$

∴ The angle between VP and PQRS is 60^0

.....0½

Qn 13

(a) Given $L\begin{pmatrix} = & o \\ x & o \end{pmatrix} 2x$ I LI = -8

The ILI = (oxo - x x 2x)

-8 = 0-2x2 .....0½

$\frac{-8}{-2} = \frac{-x^2}{-2}$

$x^2 = 4$ 0½

x = +2 01

(b) From the matrix to get determinant

of $\begin{pmatrix} 5 & 9 \\ -3 & 5 \end{pmatrix} \begin{pmatrix} \quad \end{pmatrix} = \begin{pmatrix} 5x5 & - & (-3 \times 9) \end{pmatrix}$

= (25 + 27) = 52 01

Qn 13 (b) cont

Pre -multiply the inverse of 2x2 matrix both sides

$^1/_{52} \begin{pmatrix} 5 & -9 \\ 3 & 5 \end{pmatrix} \begin{pmatrix} 5 \\ -3 \end{pmatrix} \begin{pmatrix} 9x \\ 5 \end{pmatrix} = {}^1/_{52} \begin{pmatrix} 5 \\ \end{pmatrix} - \begin{pmatrix} 9 & 8 \\ 3 & 5 \end{pmatrix} 12$

y

-------01

Since A ; A = A . A -1 = I

Then $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} \quad \\ \quad \end{pmatrix} x = {}^1/_{52} \begin{pmatrix} 40 & -108 \\ 24 & +60 \end{pmatrix}$ -------01

y

$\begin{pmatrix} X \\ Y \end{pmatrix} = \begin{pmatrix} -\frac{68}{52} \\ \frac{84}{52} \end{pmatrix}$

$\begin{pmatrix} X \\ Y \end{pmatrix} = \begin{pmatrix} {}^{-17}/_{13} \\ {}^{21}/_{13} \end{pmatrix}$ 0½

Hence x = $^{-17}/_{13}$ and y = $^{21}/_{13}$ 0½

13. (c)

Given $M \begin{pmatrix} \text{Cos } 2x & \sin 2x \\ \sin 2x & -\text{Cos} 2x \end{pmatrix}$ but $x = 135^0$

$u = (6.1)$

$t = 4$

Required M (tu)

$M = \begin{pmatrix} \text{Cos } 2x\ 135^0 & \sin 2x 135^0 \\ \sin 2x 135^0 & -\text{Cos} 2x 135^0 \end{pmatrix}$

.....0½

$M = \begin{pmatrix} \text{Cos } 270^0 & \text{Sin} 270^0 \\ \text{Sin} 270^0 & -\text{Cos } 270^0 \end{pmatrix}$

.....0½

$M = \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ 0½

Then M (t u) = t (MU)

13 (c) cont

Mt (U) = t (MU)

$= 4 \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 6 \\ 1 \end{pmatrix}$ 0½

$= 4 \begin{pmatrix} -1 \\ -6 \end{pmatrix}$ 0½

$= \begin{pmatrix} 4 & -4 \\ -24 & \end{pmatrix}$ 01

∴ M (t u) = (-4, -24)

Qn 14

(a) Given g(x) $\begin{cases} = & x \text{ for } x < -2 \\ & 2, \text{ for } -2 \leq x \leq 2 \\ & x+1 \text{ for } x < 2 \end{cases}$

Table of values for

Y = x y = x+1

X	-2	-3	-4	-5
Y	-2	-3	-4	-5
X				
Y	3	4	5	6

.....0½ 0½

14(a)

Graph

Then

g (-1) = 2 (from graph) --------01

g (3) = x + 1

= 3+1

∴g (3) = 4 01

14 (b)

From the information you are given

Let x = wheat

y = pyrethrum = y

Then

Wheat		Pyrethrum	Total
Labour	3x	3y	48
Cost	250	100 (.....0½)	2500

Constraints:-

$3x + 3y \leq 48$

$250x + 100y \leq 2500$

$x \geq 0$

$y \geq 0$

Objective function f(x, y) = x+ y = maximum
.....0½

Then from $3x + 3y \leq 48 \rightarrow x + y = 16$

X	0	16
y	6	0

Also $250x + 100y \leq 2500 \rightarrow 5x + 2y = 50$

X	0	10
y	25	0

.....0½

Graph

Scan graph

14 (b) cont

Corner Point	F (x,y) = x+y	Value
A (10, 0)	10 + 0	10
B (6,10)	6+10	16
C (0, 15)	0 + 15	15 .....0½)
D (0,0)	0 + 0	0

∴ The greatest possible number of hectares of land he can plant the crops is 16 hectares by using 6 hectares of wheat and 10 hestares of pyrethrum
--------01