MARKING SCHEME 2005 PAPER 2

SOLUTION	MARKS	ALT. METHOD
1. $\dfrac{243 \times 3^{2y}}{729 \times 3^{y} \div 3^{(2y-1)}}$ $= 81$		
$= \dfrac{3^5 \times 3^{2y}}{3^6 \times 3^{y} \div 3^{2y-1}}$ $= 3^5$	M1	
$= \dfrac{3^{5+2y}}{3^{6+y-(2y-1)}}$ $= 3^5$		
$= \dfrac{3^{5+2y}}{3^{7-y}}$ $= 3^5$		
$= 3^{-2+3y} = 3^5$	M1	
Hence $3y - 2 = 5$		
$3y = 7$		
$y = {}^7/_3 = 2\,{}^1/_3$	A1	
2. $\dfrac{\sqrt{63}+\sqrt{72}}{\sqrt{32}+\sqrt{28}} \times \dfrac{(\sqrt{32}-\sqrt{28})}{(\sqrt{32}-\sqrt{28})}$		
Deno $\Rightarrow$ $32 - \sqrt{32}\sqrt{28} + \sqrt{28}\sqrt{32} - 28$	M1½	
$\Rightarrow$ 4		
Num $\Rightarrow$ $\sqrt{63}\sqrt{32} - \sqrt{63}\sqrt{28} + \sqrt{(72 \times 32)} - \sqrt{72 \times 28}$		
$\Rightarrow \sqrt{9 \times 7 \times 16 \times 2} - \sqrt{9 \times 7 \times 7 \times 4} + \sqrt{9 \times 4 \times 2 \times 16 \times 2} - \sqrt{9 \times 4 \times 2 \times 7 \times 4}$		
$\Rightarrow$ $12\sqrt{14} - 42 + 48 - 12\sqrt{14} = 6$		
${}^6/_4 = 1\,{}^1/_2$	A1½	
3. Men: ${}^7/_9 \times 45 = 35$		Alternatively:
Wom: ${}^2/_9 \times 45 = 10$	M1	${}^4/_9(45 + x) = (10 + x)$
Let the No. be x		$4(45 + x) = 9(10 + x)$
Men: ${}^5/_9 (45 + x) = 35$	M1	$180 + 4x = 90 + 9x$
$225 + 5x = 315$		$5x = 90$
$x = 18$	A1	$x = 18$

14. $D = {}^{km}/_{m^2}$

$2 = \frac{500k}{5^3}$

$2 = 4k$

$k = ½$

$d = \frac{m}{2r^3}$

$20 = \frac{540}{2r^3}$

$r^3 = 27$

$r = 3$

M1

A1

$d = \frac{km}{m^2}$; k = constant

$2 = \frac{500k}{5^3}$

$k = ½$

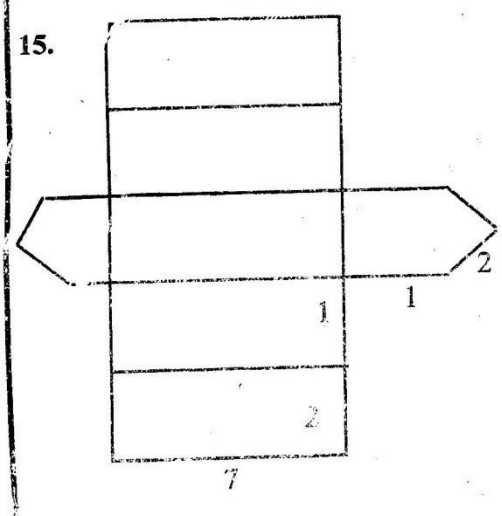
$d = \frac{m}{2r^3}$

$r^3 = \frac{m}{2d}$

sub $r^3 = \frac{540}{20}$

$3 = r$

15.



B1

M1

A1

16. $ds/dt = 0$ at maximum

$= 29.4 - 9.8t$

$9.8t = 29.4$

$t = 3$

hence $S = 29.4 \times 3 - 4.9 \times 3^2$

$= 44.1$

B1

M1

A1

17. $dy/dx = x^2 + 2x - 3$

at turning points; $dy/dx = 0$

$x^2 + 2x - 3 = 0$

$x^2 - x + 3x - 3 = 0$

$x(x-1) + 3(x-1) = 0$

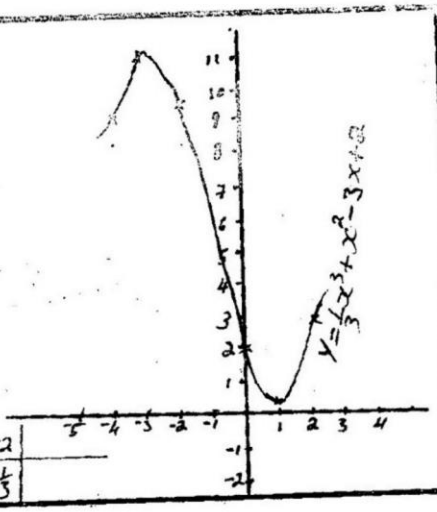
$(x-1)(x+3) = 0$

$x = 1$ or -3

Subst $y = 1/3$ or 11

The turning points are $(1, 1/3)$ and $(-3, 11)$

x	1	$\frac{1}{3}$	0	2	4	-2
y	$\frac{1}{3}$	11	2	$-\frac{2}{3}$	$-8\frac{2}{3}$	$9\frac{1}{3}$



18. $\begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} 2 & 2 & 4 \\ 0 & 4 & 4 \end{pmatrix} = \begin{pmatrix} 2a & 2a+4b & 4a+4d \\ 2c & 2c+4d & 4c+4d \end{pmatrix}$ B1

$\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}\begin{pmatrix} 2a & 2a+4b & 4a+4d \\ 2c & 2c+4d & 4c+4d \end{pmatrix} = \begin{pmatrix} -2c & -2c-4d & -4c-4d \\ -2a & -2a-4b & -4a-4d \end{pmatrix}$ M1

$\begin{pmatrix} 0 & -4 & -4 \\ -2 & -10 & -12 \end{pmatrix} = \begin{pmatrix} -2c & -2c-4d & -4c-4d \\ -2a & -2a-4d & -4a-4d \end{pmatrix}$ M1

$-2c = 0 \Rightarrow c = 0$ $\quad -4d = -4$ $\quad -2a - 4b = -10$

$-2a = 2 \Rightarrow a = 1$ $\quad d = 1$ $\quad -2 - 4b = 10$

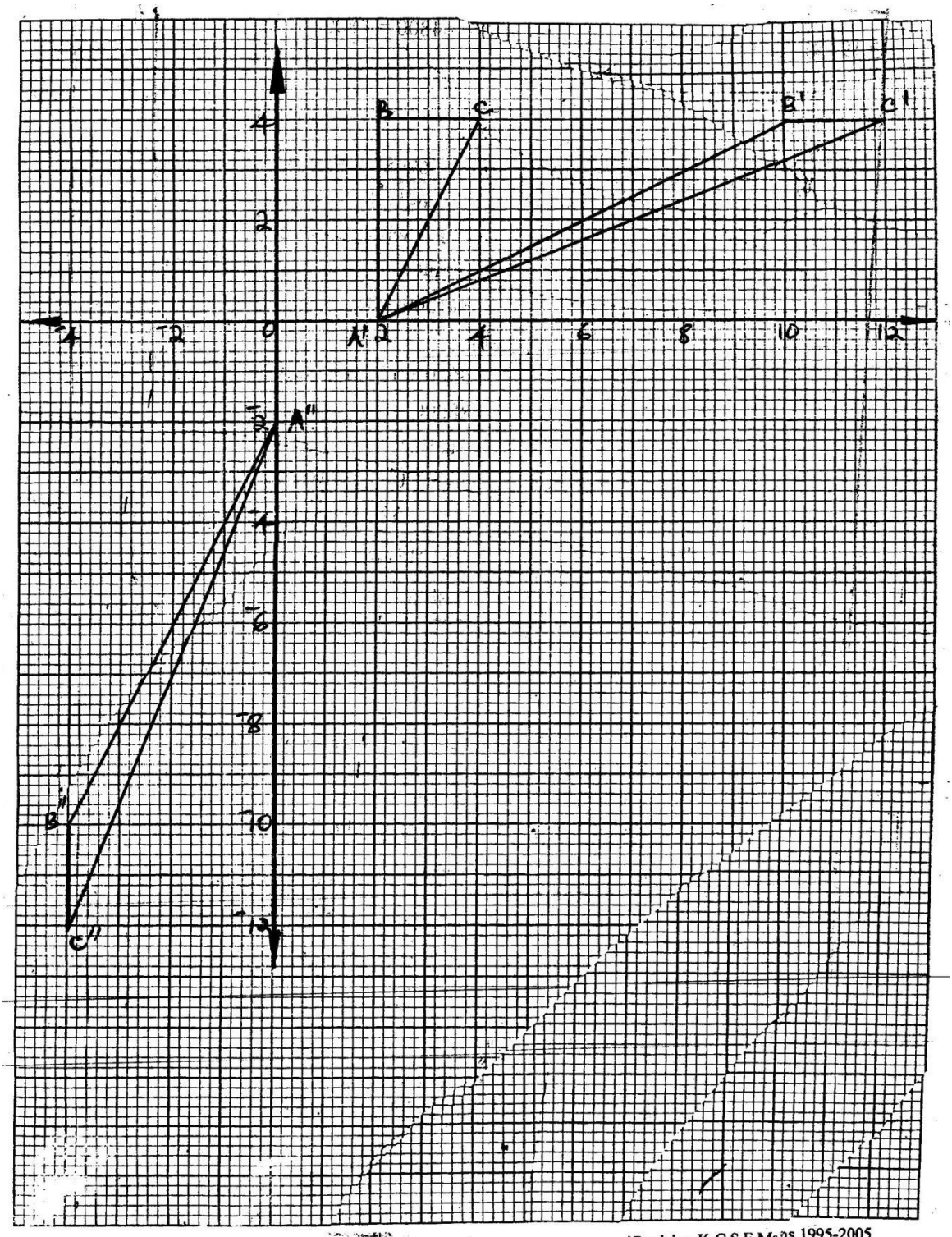
$b = 2$ M1

Hence $R = \begin{pmatrix} a & b \\ C & d \end{pmatrix} = \begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$

b) $\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 2 & 2 & 4 \\ 0 & 4 & 4 \end{pmatrix} = \begin{pmatrix} 2+0 & 2+8 & 4+8 \\ 0+0 & 0+4 & 0+4 \end{pmatrix} = \begin{matrix} A^1 & B^1 & C^1 \end{matrix}\begin{pmatrix} 2 & 10 & 12 \\ 0 & 4 & 4 \end{pmatrix}$

c) Shear x-axis invariant and $B(2,4) \longrightarrow B^1(10,4)$ or M1

$C(4,4) \longrightarrow C^1(12,4)$ A1


B
C
B'
C'
A'
A''
B''
C''

Q 19 a) c.d = 64800 – 60000 = 69601 – 64800 = 4800 — M1

a = 60000

n^{th} term = a + (- 1)d — B1

= 60000 + (n – 1) 4800

b) Common ratio = $\frac{64800}{60000} = \frac{69984}{64800} = 1.08$ — M1

nth term = ar^{n-1} where a = 60000 — A1

r = 108

= 60000$(1.08)^{n-1}$

7^{th} term:

Abdi = 60000 + (7 – 1) 4800 — M1

= 88800

Amoit = ar^{n-1}

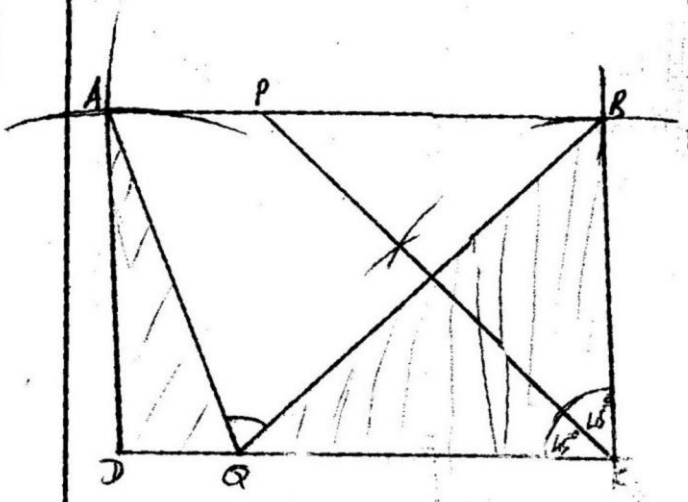
= 60000 $(1.08)^6$ — M1

= 95213 — B1

Difference = 95213 - 88800

= sh 641

20.



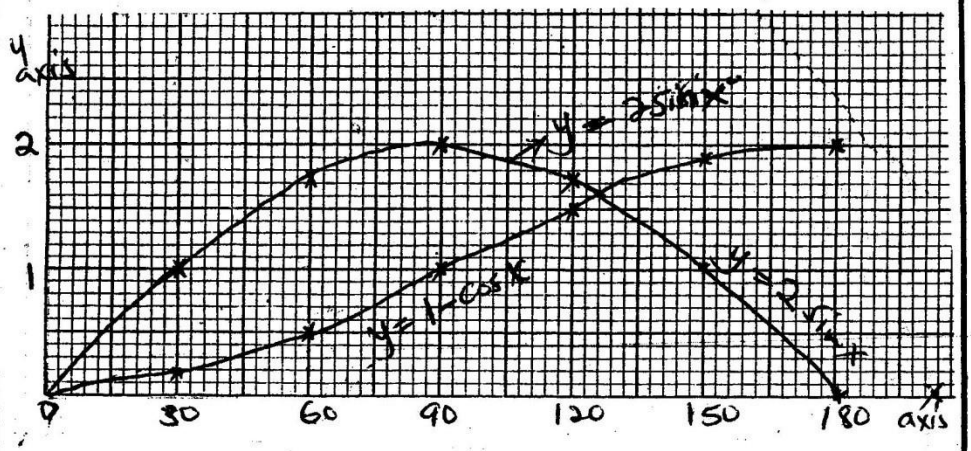
' lies on any point long cp — Rect 3 mks

$QB \leq 60^0 \leq 90^0$ — A1

b Q lies on the unshaded region — drawing M2 A1

21.

x^0	0	30	60	90	120	150	180
$2 \sin x^0$	0	1	1.732	2	1.732	1	0
$1 - \cos x^0$	0	0.134	0.5	1	1.5	1.866	2



c i) 129^0

ii) $0 \leqslant x \leqslant 129^0$

22.

a) $x^2 = y^2 + z^2 - 2xy \cos x$

$= 40000 + 40000 - 2 \times 40000 \cos 50$

$= 80000 - 51424$

$x^2 = 28576$

$x = 169.04$

$zy = x = 169.04$

sin rule $\frac{y}{\sin y} = \frac{x}{\sin x}$

$\frac{200}{\sin y} = \frac{169}{\sin 50}$

$\sin y = \frac{200 \sin 50}{169}$

M1

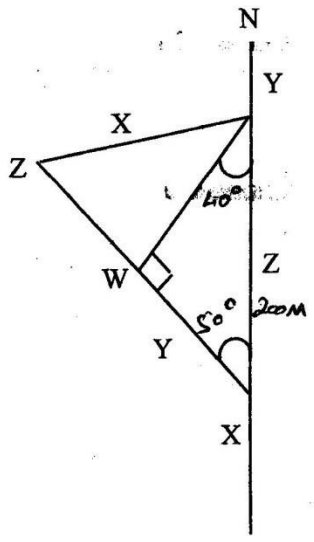
$\sin y = 0.90656$

$y = 65^0$

bearing z from y $= (180 + 65)^0$

$= 245^0$

A1



b) wy = 200 — M1

sin 50 sin 90

wy = sin 50 x 200 / sin 90

= 0.90656 x 200

wy = 181/m — A1

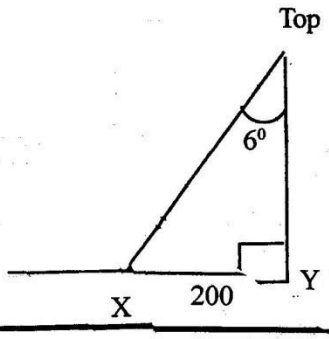
c) TYX = ⊾ (right angled triangle) — B1

XTY = 6⁰ (given) — M1

therefore XYT = (90 – 6)

= 84⁰ — A1

Angle of elevation of the top = 84⁰



23. $PH^2 = \sqrt{4.5^2 + 8^2}$

$= \sqrt{20.25 + 64}$ — A1

$= 9.2$

$fc = \sqrt{FH^2 + hc^2}$

$= \sqrt{9.2^2 + 6^2}$

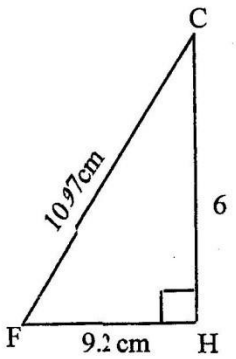
$= 10.97cm$ — A1

b) — A1

i) $\tan \theta = {}^{6}/_{9.2}$

$\tan \theta = 0.6522$

$\theta = 33^0$



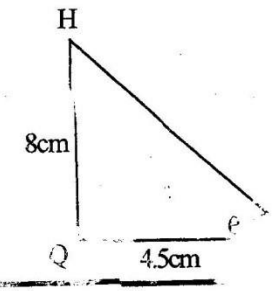
ii) — B

$\tan \theta = {}^{8}/_{4.5}$

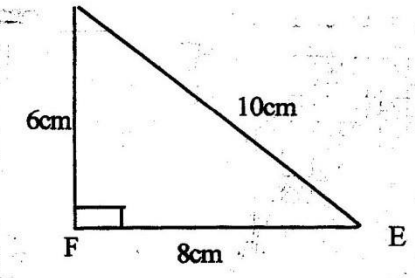
A1

$\tan \theta$ 1.7750

$\theta = 60.60^0$ — A1



c)



M1

Cosine rule

$6^2 = 10^2 + 8^2 - 2 \times 8 \times 10 \cos \theta$

$36 = 100 + 64 - 160 \cos \theta$

$36 = 164 - 160 \cos \theta$

$\cos \theta = {}^{128}/_{16}$

$\theta = 0.8$

$= 36^0.9^1$

A1

$\tan \grave{e} = {}^{6}/_{8}$

$= 0.75$

$= 36^0.9^1$

24 a) i) $= 75x + 75y \geqslant 6$

$= 25x + 25y \geqslant 2$

M1

ii) $75x \leqslant 175$

$3x \leqslant 7$

iv) $y > o$

M1

iii) $75y \leqslant 180$

$5y \leqslant 12$

v) $x > 0$

M1

b) See diagram next page

4 mks

c) i) lowest cost $= 20x + 50y$

at (0.1, 0) $c = 20 \times 0.1 + 50 \times 0$

$c = 2/=$

A1

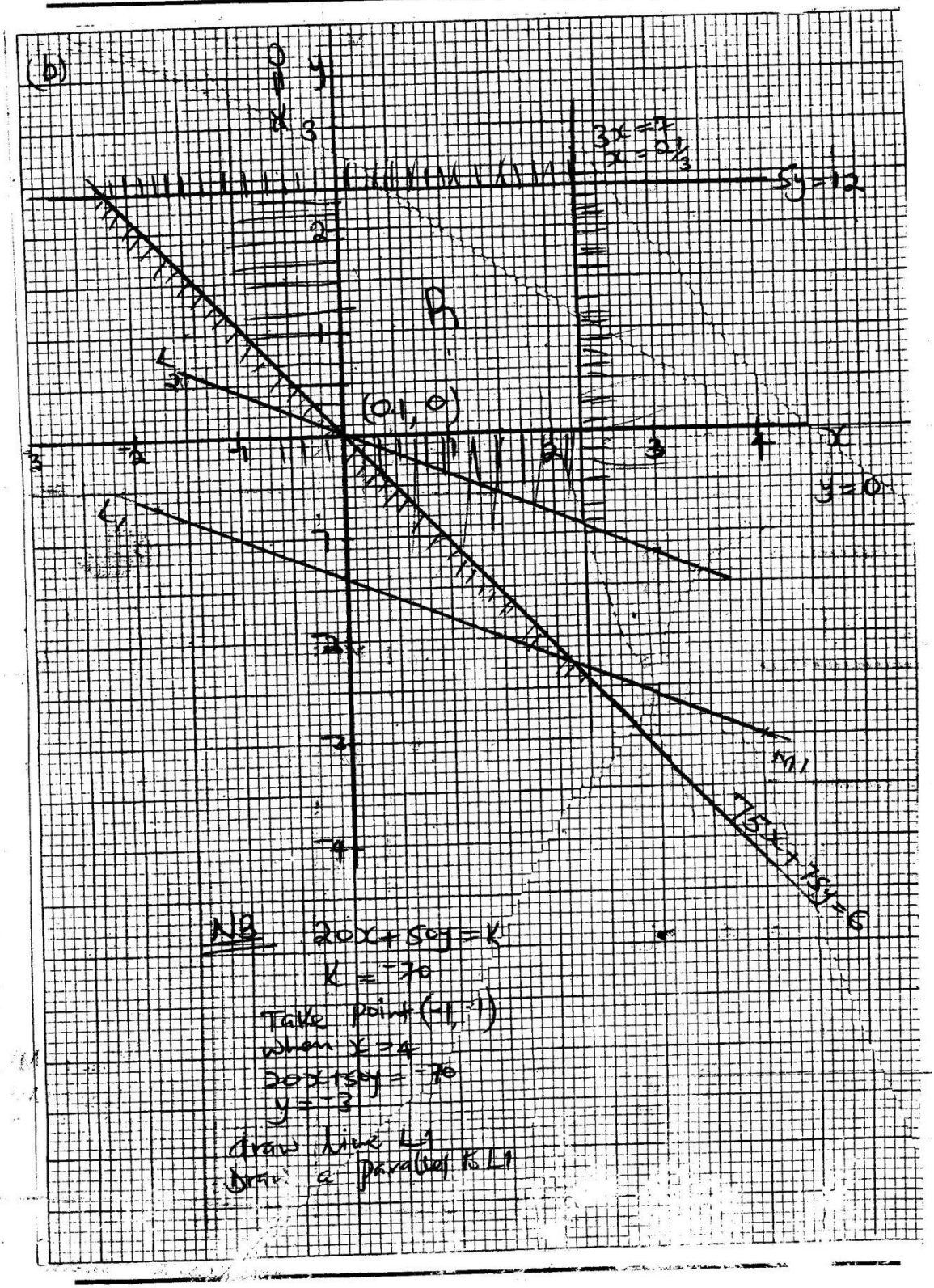
ii) Max cost $= 20 \times 2.3 \quad 50 \times 2.4$

$c = 46 + 120$

$c = 166/=$

Line 1 = M1

Line 1 = M1


(b)
y
x
3x = 7
x = 2 1/3
5y = 12
y = 0
(0, 0)
L1
L2
NB
20x + 50y = K
K = -70
Take point (-1, -1)
when x = -1
20x + 50y = -70
y = -3
draw line L1
Draw a parallel to L1