CHRISTIAN SOCIAL SERVICES COMMISSION (CSSC)

NORTHERN ZONE JOINT EXAMINATIONS SYNDICATE (NZ-JES)

FORM FOUR PRE NATIONAL EXAMINATION AUG 2025

041 BASIC MATHEMATICS

MARKING SCHEME

SECTION A

1. a)

2	432	648	540
2	216	324	270
2	108	162	135
2	54	81	135
3	27	81	135
3	9	27	45
3	3	9	15
3	1	3	5
5	1	1	5
	1	1	1

GCF = 2 X 2 X3 X 3 X 3 = 108

They will step together after 108 times (03 marks)

(b) Given: reduced percent = 10% + 30% =40%

Remaining percent = 100% - 40% = 60%

The remaining length = remained percent x total lengh

$= \frac{60}{100} x 80cm$

= 48cm

Therefor remained length is 48cm (03 marks)

2. (a) $(\frac{1}{16})^{x+3}(\frac{1}{32})^{-x} = 1$

$$(\frac{1}{2})^{4(x+3)}(\frac{1}{2})^{5(-x)} = (\frac{1}{2})^{0}$$

$$(\frac{1}{2})^{4x+12}(\frac{1}{2})^{-5x} = (\frac{1}{2})^{0}$$

$$(\frac{1}{2})^{4x+12-5x} = (\frac{1}{2})^{0}$$

$$(\frac{1}{2})^{-x+12} = (\frac{1}{2})^{0}$$

-x+12 = 0

X = 12 (03 marks)

(b) given

$\log_{10} 40{,}500$

$\log_{10} 40{,}500 = \log_{10}(40{,}5\ x\ 100)$

$= \log_{10} 405 + \log_{10} 100$

$= \log_{10} 81x5 + \log_{10} 100$

$= \log_{10} 81 + \log_{10} 5 + \log_{10} 100$

$= \log_{10} 3^4 + \log_{10} 5^1 + \log_{10} 10^2$

$= \mathbf{4} \log_{10} 3 + \log_{10} 5 + 2 \log_{10} 10$

But $\log_{10} 3 = 0.4771\ and\ \log_{10} 5 = 0.6990$

=4(0.4471) + 0.6990 + 2

= 1.9084 + 0.6990 + 2

= 4.6074

Therefore $\log_{10} 40{,}500 = 4.6074$ (03 marks)

3. (a) let Adela be A , Amina be B and Charles be C

A = $\{1,2,3,4,5,6,,7,8,9,10,11,12,,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28 \text{ and } 29\}$

B= $\{2,4,6,8,10,12,14,16,18,20,22,242,26 \text{ and } 28\}$

C= $\{3,6,9,12,15,18,21,24 \text{ and } 27\}$

(i) A∩C = $\{6,12,18 \text{ and } 24\}$

Therefore numbers that were mentioned by Amina and Charles are $\{6,12,18 \text{ and } 24\}$ (02 marks)

(ii) A∪ $c = \{2,3,4,6,8,9,10,12,14,15,16,18,20,21,22,24,26,27 \text{ and } 28\}$

Therefore numbers were mentioned by either Amina or Charles is 19 (02 marks)

(b) n(A) = 9 and n(C) = 9

$P(C) = \frac{n(C)}{n(A)}$

$P(C) = \frac{9}{9}$

Therefore the probability that a selected number was a multiple of 3 is 0.31 (02 marks)

4. (a) Given that $\boldsymbol{a} = 4i + 3j \text{ and } \boldsymbol{b} = 6i - 3j$

Required to find values of h and k

If $h\boldsymbol{a} + k\boldsymbol{b} = 10i + j,$

h$(4i + 3j) + k(6i - 3j)$

$4hi + 3hj + 6ki - 3kj = 10i + j$

$4hi + 6ki + 3hj - 3kj = 10i + j$

$(4h + 6k)i + (3h - 3k)j = 10i + j$

by comparison

$4h + 6k = 10 \quad \ldots\ldots\ldots\ldots\ldots\ldots..(1)$

$3h - 3k = 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.(2)$

Solve by simultaneous eqn

$\boldsymbol{h} = \frac{6}{5}$ $\quad$ $\boldsymbol{and\ k} = \frac{13}{15}$ (03 marks)

(b) Given the point A (k,4) and B(3,3k) is to be parallel to the line $y - 3x - 4 = 0$

Required the value of k

From $y - 3x - 4 = 0$

Rearrange the eqn $y = 3x + 4$

$m_1 = 3$

For the parallel lines $m_1 = m_2$

$then$

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

$cross\ multiplication$

$3(3 - k) = 3k - 4$

$9 - 3k = 3k - 4$

$9 + 4 = 3k + 3k$

$6k = 13$

$k = 2\frac{1}{6}$ (03 marks)

5. (a) Given that $A_1 = 5M^2$, $A_2 = 0.8M^2$ and $S_2 = 180CM\ (1.8M)$

$S_1\ is\ required$

$$\frac{A_1}{A_2} = (\frac{S_1}{S_2})^2$$

$$\frac{5M^2}{0.8M^2} = (\frac{S_1}{1.8M})^2$$

$$6.25 = \frac{{S_1}^2}{3.24}$$

${S_1}^2 = 6.25x3.24$

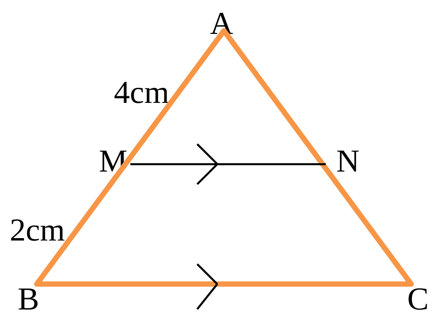
${S_1}^2 = 20.25$

$S_1 = \sqrt{20.25}$

$S_1 = 4.5m$

Therefore the large height is $4.5m$ (02 marks)

(b) consider the triangle bellow



5(b) (i) proof: consider $\Delta ABC\ and\ \Delta AMN$

$M\hat{A}N = B\hat{A}C\ (common\ angle)$

$A\widehat{M}N = A\hat{B}C\ (angle\ formed\ by\ parallel\ lines)$

$M\widehat{N}A = B\hat{C}A\ (third\ angle\ of\ triangle)$

Hence $\Delta ABC \sim \Delta AMN\ (AA\ similarity\ theorem)$ (02 marks)

(ii) $\frac{\overline{AB}}{\overline{AM}} = \frac{\overline{BC}}{\overline{MN}}$

$$\frac{6cm}{4cm} = \frac{4.5cm}{\overline{MN}}$$

By crossing multiplication

$$\overline{MN} = \frac{4.5cmx4cm}{6cm}$$

Then

$\overline{MN} = 3cm$ (02 marks)

6(a) given A car travels 23km in 15minutes

Required how fast (i) In kilometer per hours?

Convert 15 minutes into hours

$= \frac{15}{60}$

$= 0.25\ hours$

Then $speed = \frac{23km}{0.25hours}$

$speed = \frac{92km}{h}$

$therefore$ its going by 92km/h (02 marks)

(ii) in meter per second

Convert 23km into meter

$23km = 23000m$

Convert 15 minutes to second

$15minutes = 900second$

$speed = \frac{distance}{time}$

$speed = \frac{23000m}{900seond}$

$speed = 25.56m/s$

$therefore$ its going by 25.56m/s (02 marks)

6(b) given

600 students for 20 days

$(600 - 120)stdents\ take\ how\ many\ days?$

Since $number\ of\ students \propto \frac{1}{number\ of\ days}$

Let number of student be s and number of days be d

$$s \propto \frac{1}{d}$$

$$s = \frac{k}{d}$$

Where k is proportionality constant

Then
$$k = sxd$$

$$k = 600x20$$

$$k = 12000$$

Give
$$s = 480\ requred\ number\ of\ days\ taken$$

But

$$k = sxd$$

$$12000 = 480xd$$

$$d = \frac{12000}{480}$$

$$d = 25\ days$$

$therefore\ the\ number\ of\ days\ taken\ for\ 480\ students\ is\ 25$ (02 marks)

7(a) given, ratio of sacks of maize , millet and cassava in certain store is 6:7:3

there 42 sacks of millet. Required total sacks

from

$$sacks\ of\ millet = \frac{ratio\ of\ millet}{total\ ratio} xtotal\ sacks$$

$$42 = \frac{7}{16} xtotal\ sacks$$

$$total\ sacks = \frac{16}{7} x42$$

$$total\ sacks = 96$$

$therefore\ total\ sacks\ is\ 96$ (02 marks)

7(b) CASH ACCOUNT (1)

Dr Cr

Date	Particular	Folio	Amount	Date	Particular	Folio	Amount
1/1/2021	Capital	2	600,000	3	Purchases	3	400,000
4	Sales	4	300,000	5	purchase	3	100,000
8	sales	4	250,000	8	Salary	5	150,000
					Travel expen	6	120,000
					c/d		380,000
			1,150,000				1,150,000
1 february	balance	b/d	380,000				

(02 marks)

TRIAL BALANCE AS ENDED AT 31st January 2021

S/N	Account name	Dr	Cr
	Capital		600,000
	Cash	380,000	
	Purchases	500,000	
	Sales		550,000
	Salary	150,000	
	Traveling expenses	120,000	
		1,150,000	1,150,000

(02 marks)

8(a) The 20th term of an arithmetic progression is 60 and the 16th is 20. Find the sum of the first 40 terms

Given

$A_{20} = 60$

$A_{16} = 20$

$n = 40$

$requred\ sum\ of\ 40\ terms$

$$S_n = \frac{n}{2}(2A_1 + (n-1)d)$$

Also

$$A_n = A_1 + (n-1)d$$

$A_{20} = A_1 + (19)d$

$A_{16} = A_1 + (15)d$

Then

$60 = A_1 + (19)d \ldots\ldots\ldots\ldots\ldots\ldots..(eqn1)$

$20 = A_1 + (15)d \ldots\ldots\ldots\ldots\ldots\ldots..(eqn2)$

$solving\ by\ any\ simulteneous\ method\ A_1 = -130\ and\ d\ 10$

$$S_{40} = \frac{40}{2}(2(-130) + (40-1)10)$$

$S_{40} = 2600$

$therefore\ sum\ of\ 40\ terms\ is\ 2600$ (03 marks)

b) Peter saved Tsh. 6,000,000/= in a saving bank whose interest rate was 10% compounded annually. Find the amount of money in account after 5 years.

Given

$P = 6{,}000{,}000$

$R = 10\%$

$n = 5$

$t = 1$

From

$$A_n = P\left(1 + \frac{Rt}{100}\right)^n$$

$$A_5 = 6{,}000{,}000\left(1 + \frac{10x1}{100}\right)^5$$

$A_5 = 9{,}663{,}060$

Therefore the amount of money in account after 5 years is $9{,}663{,}060$ (03 marks)

9(a) without using mathematical tables simplify $\frac{sin120^0 + cos\,150^0}{2tan240^o}$

$sin120^0 = sin(180^0 - 120^0)$

$sin120^0 = sin60^0$

$cos150^0 = -\cos(180^0 - 150^0)$

$cos150^0 = -\cos 30^0$

$tan240^0 = tan(240^0 - 180^0)$

$tan240^0 = tan60^0$

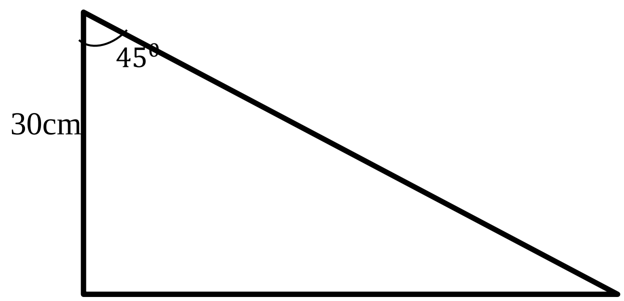
Then

$$\frac{sin120^0 + \cos 150^0}{2tan240^o} = \frac{sin60^0 - \cos 30^0}{2tan60^o}$$

$$= \frac{\frac{\sqrt{3}}{2} - \frac{\sqrt{3}}{2}}{2x\sqrt{3}}$$

$\frac{sin120^0 + \cos 150^0}{2tan240^o} = 0$ (03 marks)

(b) An observer on top of a cliff 30cm above the sea level, view the ship on the sea level at an angle of depression of 45°. Find how far is the ship from the foot of the clif



$tan45^0 = \frac{opposite}{adjacent}$

$tan45^0 = \frac{x}{30cm}$

$x = 30cm\ xtan45^0$

$x = 30cm$

Therefore the ship is 30cm from the foot of the clip (03 marks)

10. (a) let the numbers be $x\ and\ y$

Then $\frac{x+y}{2} = 7\ \ and\ 3(x - y) = 18$

$x + y = 14 \quad and \quad x - y = 6$

Then solve by any simultaneous eqn

$x = 10 \; and \; y = 4$ (03 marks)

(b) given $x^2 - 8x + 7 = 0$

By spiliting the middle term $x = 7 \; or \; x = 1$ (03 marks)

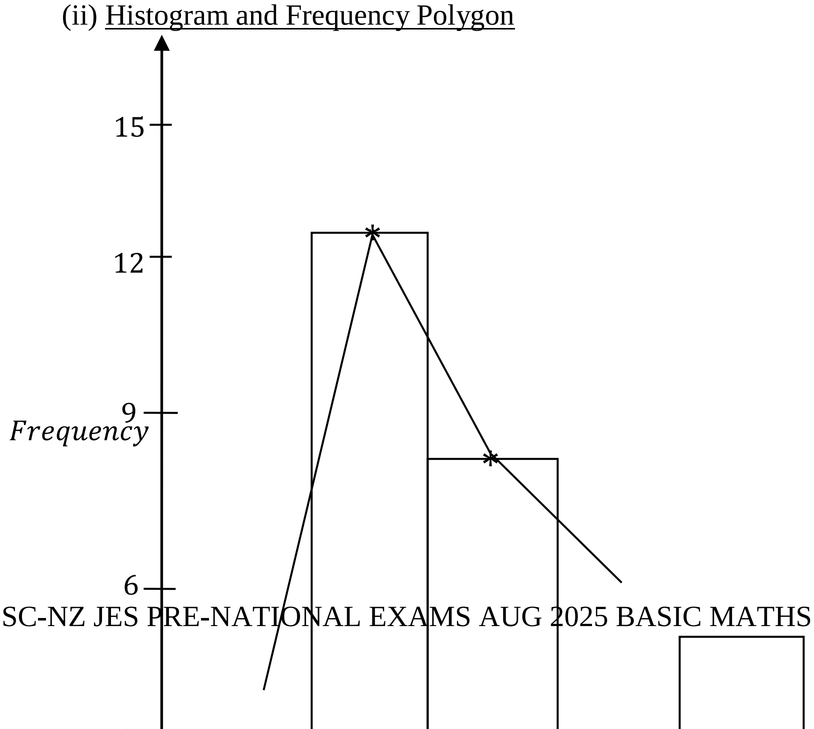
SECTION B

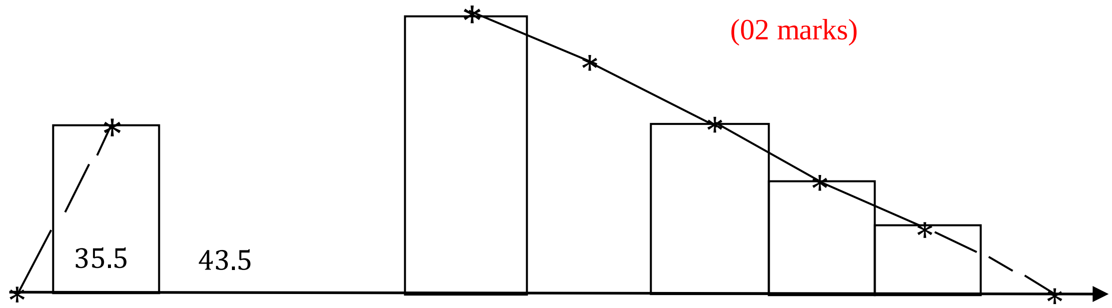
11(a) (i) To prepare frequency distribution table.

Class interval (C.I)	Class marks (X)	Frequency (F)
32 – 39	35.5	4
40 – 47	43.5	13
48 – 55	51.5	8
56 – 63	59.5	6
64 – 71	67.5	5
72 – 79	75.5	3
80 – 87	83.5	2
88 – 95	91.5	1
		N = 42

(03 marks)

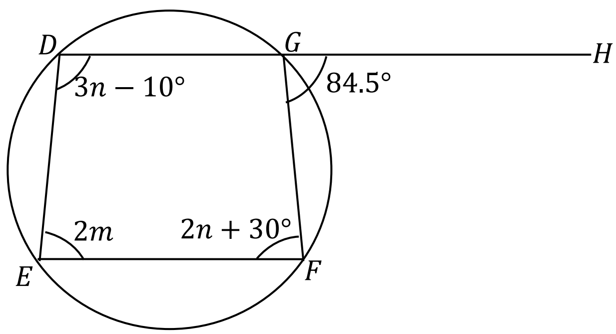
(ii) Histogram and Frequency Polygon





(02 marks)

11(b) Given;



$F\hat{G}D = 180° - F\hat{G}H$, But $F\hat{G}H = 84.5°$ ... ... (01 mark)

$F\hat{G}D = 180° - 84.5°$

$F\hat{G}D = 95.5°$

Then; $F\hat{G}H = F\hat{E}D$ .... Exterior angle of a cyclic quadrilateral is equal to the inside opposite angle. ... ... (01 mark)

$F\hat{G}H = F\hat{E}D$, but $F\hat{G}H = 84.5°$ and $F\hat{E}D = 2m$

Then, $84.5° = 2m$

$\frac{2m}{2} = \frac{84.5°}{2}$,

$m = 42.25°$ ... ... (01 mark)

Also, $F\hat{G}D = G\hat{D}E = F\hat{E}D = E\hat{F}G = 360°$, ... Complete circle has 360°.

$95.5° + 3n - 10° + 2m + 2n + 30° = 360°$

$5n + 200 = 360°$

$5n = 160°$ ... (01 mark)

$\frac{5}{5}n = \frac{160}{5}°, n = 32°$

∴ The value of $m = 42.25°$ and $n = 32°$ ... (01 mark)

12 (a) Solution;

$A(0°, 20°W), B(10°N, 20°W)$, speed $= 16knots$, time starting; $8:00am$ Tuesday

From; $\theta = 10° - 0°$

$\theta = 10°$ ..... $\left(0\frac{1}{2}\text{ mark}\right)$

Distance in nautical miles

Distance (d) $= \theta \times 60$

Distance (d) $= 10° \times 60$

Distance (d) $= 600nm$ ….. $\left(0\frac{1}{2}\text{ mark}\right)$

From; $speed = \frac{distance}{time}$

Time $= {distance}/{speed}$ ….. (01 mark)

Time $= {600nm}/{16nm/h}$

Time $= 37.5hrs$ ….. (01 mark)

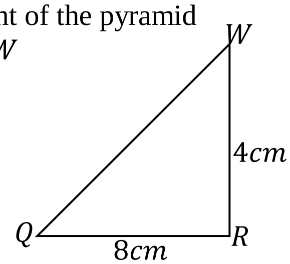
Time $= 37$hours and 30 minutes

Then; $8:00am$ on Tuesday $+37$hours and 30 minutes$= 9:30pm$ on Wednesday or 2130hours on Wednesday….. (01 mark)

$\therefore$ It will reach B at $9:30pm$ on Wednesday or 2130 hours on Wednesday ….. (01 mark)

12(b) (i) Height of the pyramid

Take ΔQRW



…(01 mark)

From; $a^2 + b^2 = c^2$

$\left(\overline{QW}\right)^2 = \left(\overline{QR}\right)^2 + \left(\overline{RW}\right)^2$

$(QW)^2 = 8^2 + 4^2$

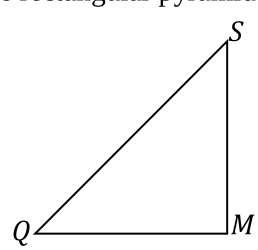
$\left(\overline{QW}\right)^2 = 64 + 16$

$\left(\overline{QW}\right)^2 = 80$

$\overline{QW} = \sqrt{80}$

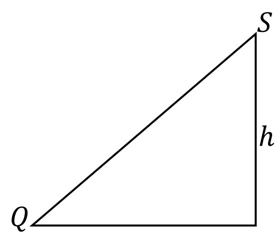
$\overline{QW} = 8.9442cm$ …$\left(0\frac{1}{2}\text{ mark}\right)$

Let centre of the rectangular pyramid be M



$\overline{QM} = \frac{\overline{QW}}{2}$, $\overline{QM} = \frac{8.9442}{2}$

$\overline{QM} = 4.4721cm.$ …$\left(0\frac{1}{2}\text{ mark}\right)$



M

From; $\left(\overline{QS}\right)^2 = \left(\overline{QM}\right)^2 + \left(\overline{MS}\right)^2$

$\left(\overline{16}\right)^2 = \left(\overline{4.4721}\right)^2 + \left(\overline{h}\right)^2$

$h^2 = 16^2 - \left(\overline{4.4721}\right)^2$

$h^2 = 16^2 - 20$

$h^2 = 256 - 20$

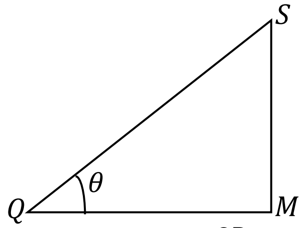
$h^2 = 236$

$h = \sqrt{236}$

$h = 15.36cm$…(01 mark)

∴ The height of the pyramid is $15.36cm$

(ii) Angle between SQ and the base $QRWV$



From; $\tan\theta = \frac{\text{OP}}{\text{adj}}$ or $\sin\theta = \frac{opp}{hyp}$ or $\cos\theta = \frac{Adj}{hyp}$

Then; $\cos\theta = \frac{Adj}{hyp} = \frac{4.4721}{16} = 0.2795$ …… (01 mark)

$\cos\theta = 0.2795$, but $\theta = \cos^{-1}(0.2795)$

$\theta = 73.76°$

∴ The Angle between SQ and the base $QRWV$ is $73.76°$. …….. (01 mark)

13(a) Solution

Image of the line $4x + 5y + 10 = 0$, reflection in the line $y - x = 0$ $i.e$ $y = x$

If $y = x$, then $\alpha = 45°$

From; $5y = -4x - 10$

$\frac{5y}{5} = -\frac{4x}{5} - \frac{10}{5}$

$y = -\frac{4x}{5} - 2$

For x – intercept $y = 0$

$0 = -\frac{4x}{5} - 2$

$-\frac{4x}{5} = 2$

$\frac{-4}{-4}x = \frac{10}{-4}$, $x = -\frac{5}{2}$

$\therefore x = (-\frac{5}{2}, 0)$ ….. $\left(0\frac{1}{2}\text{ mark}\right)$

For y – intercept, $x = 0$.

$y = -\frac{4x}{5} - 2$

$y = -0 - 2$

$y = -2$

$\therefore y = (0, -2)$ ….. $\left(0\frac{1}{2}\text{ mark}\right)$

Now, finding the image of each point, but if $y = x$ then $\alpha = 45°$

For point $(-\frac{5}{2}, 0)$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 2\times 45^\circ & \sin 2\times 45^\circ \\ \sin 2\times 45^\circ & -\cos 2\times 45^\circ \end{pmatrix}\begin{pmatrix} -\frac{5}{2} \\ 0 \end{pmatrix}$$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & \sin 90^\circ \\ \sin 90^\circ & -\cos 90^\circ \end{pmatrix}\begin{pmatrix} -\frac{5}{2} \\ 0 \end{pmatrix}$$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} -\frac{5}{2} \\ 0 \end{pmatrix}$$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 0\times -\frac{5}{2} + 1\times 0 \\ 1\times -\frac{5}{2} + 0\times 0 \end{pmatrix}$$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 0 \\ -\frac{5}{2} \end{pmatrix} \text{ .....}$$ (01 mark)

Also, for point $(0, 2)$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 2\times 45^\circ & \sin 2\times 45^\circ \\ \sin 2\times 45^\circ & -\cos 2\times 45^\circ \end{pmatrix}\begin{pmatrix} 0 \\ -2 \end{pmatrix}$$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 90^\circ & \sin 90^\circ \\ \sin 90^\circ & -\cos 90^\circ \end{pmatrix}\begin{pmatrix} 0 \\ -2 \end{pmatrix}$$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} 0 \\ -2 \end{pmatrix}$$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 0\times 0 + 1\times -2 \\ 1\times 0 + 0\times -2 \end{pmatrix}$$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} -2 \\ 0 \end{pmatrix} \text{ .....}$$ (01 mark)

$\therefore$ The image will be $\left(0, -\frac{5}{2}\right)$ and $(-2, 0)$.

Then, finding the equation of the line from the two points;

From; $m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$

$$m = \frac{-2-0}{0-\left(\frac{-5}{2}\right)} = -\frac{\frac{2}{5}}{2}$$

$\therefore m = -\frac{4}{5}$ ..... (01 mark)

(Using first point to find the equation)

But from; $m = \frac{y_2 - y_1}{x_2 - x_1}$

$-\frac{4}{5} = \frac{y-0}{x+\frac{5}{2}}$, $\quad 5y = -4(x + \frac{5}{2})$

$5y = -4x - \frac{20}{2}$, $5y = -4x - 10$

$\rightarrow 5y + 4x + 10 = 0$

$\therefore$ The image will be $5y + 4x + 10 = 0$ ..... (01 mark)

13(b) Solution

$\begin{pmatrix} 4 & -3 \\ k & 6 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 8 \\ 14 \end{pmatrix}$ …….. (02 marks)

Since the matrix do not have a solution, then determinant is equal to zero.

$(4 \times 6) - (k \times -3) = 0$

$24 + 3k = 0$

$24 = -3k, \ \frac{24}{3} = -\frac{3k}{3}$

$k = -8$

∴ The value of $k = -8$ …….. (03 marks)

14(a) (i) The ordered pairs belong to the relation R are $\{(1,2), (-3,4), (-8,0), and\ (-8,-3)\}$ … (02 marks)

(ii) $R^{-1} = \{(2,1), (4,-3), (0,-8), (-3,-8)\}$ ……… (01 mark)

Domain of $R^{-1} = \{(2,4,0,-3\}$

Range of $R^{-1} = \{1,-3,-8\}$ …….. (01 mark)

14(b) Solution

Table of constraints

Let type A be x and type B be y.

	Hours	Materials	Profit
Type A	3	6	4000
Type B	6	7	6000
	60	90	

Constraints/inequalities

$3x + 6y \leq 60$ ………. (i) …… $\left(0\frac{1}{2} \text{ mark}\right)$

$6x + 7y \leq 90$ ………. (ii) …… $\left(0\frac{1}{2} \text{ mark}\right)$

$x \geq 0$ and $y \geq 0$

Objective function $f(x,y) = 4000x + 6000y$ …… (01 mark)

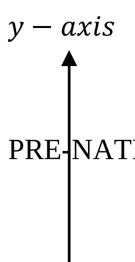
x and y intercept for each equation

Table value for $3x + 6y = 60$

x	0	20
y	10	0

For $6x + 7y = 90$

x	0	15
y	12.8	0



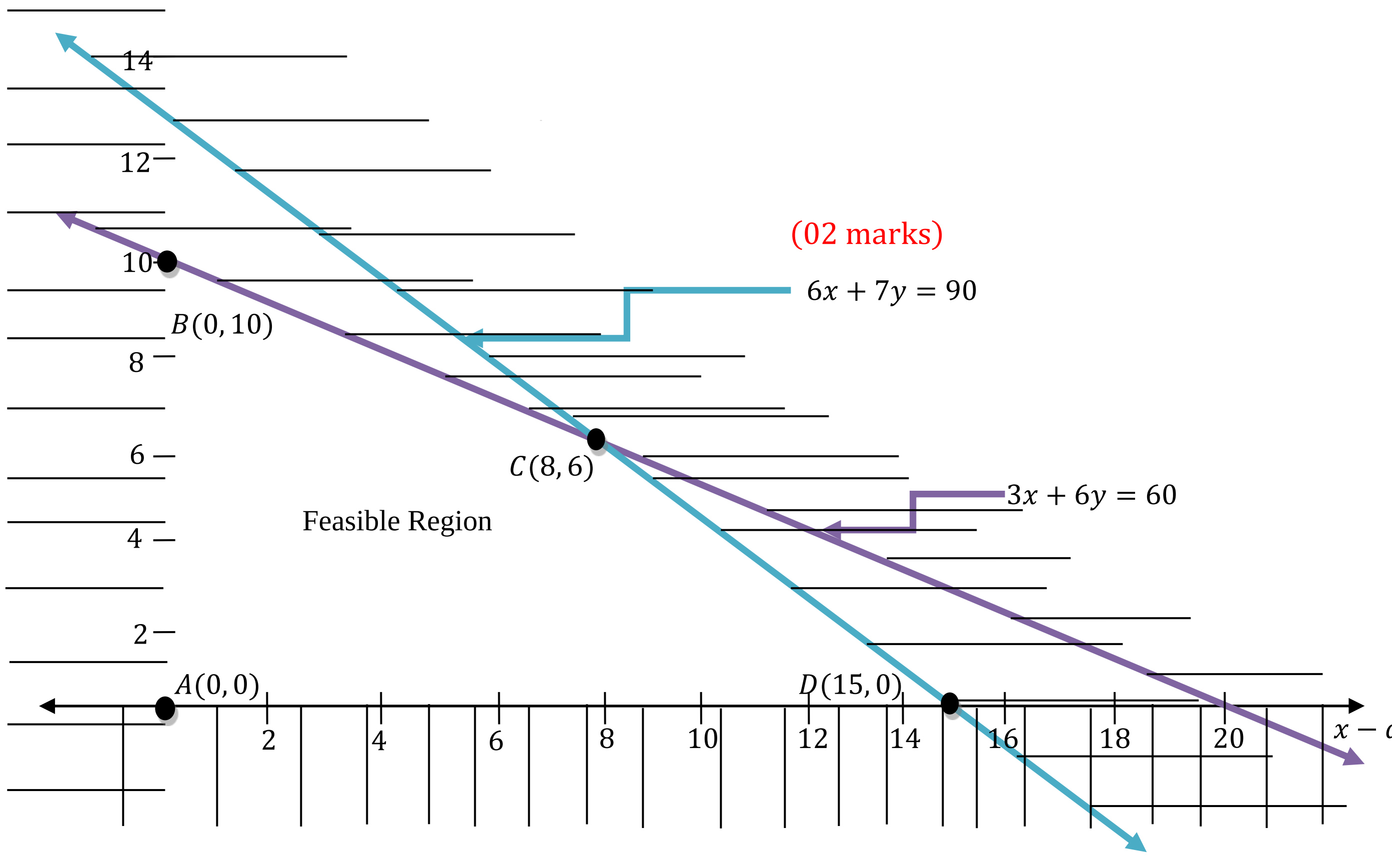


Table of results

(01 mark)

Corner points	Objective function $f(x, y) = 4000x + 6000y$	Total
$A(0, 0)$	$4000 \times 0 + 6000 \times 0 = 0$	0
$B(0, 10)$	$4000 \times 0 + 6000 \times 10 = 60\ 000$	60 000
$C(8, 6)$	$4000 \times 8 + 6000 \times 6 = 68{,}000$	68,000
$D(15, 0)$	$4000 \times 15 + 6000 \times 0 = 60\ 000$	60 000

∴ They should made 8 clothes of type A and 6 clothes of type B in order to make a profit of 68 000 shillings. (01 mark)