SECTION B
UCE MATHEMATICS PAPER ONE 2022

11

a)

Item	Student A	Student B
Probability for passing test	$\frac{3}{5}$	$\frac{2}{3}$
Probability for not passing test		$1-\frac{2}{3}$ $\frac{1}{3}$

$P(\text{student A pass } \& \text{ student B fail})$

$= \frac{3}{5} \times \frac{1}{3}$

$= \frac{3}{15}$

$= \frac{1}{5}$

b)

i)

Die B \ Die A	7	8	9	10	11	12
1	6^1	7	8^7	9	10^{13}	11
2	5	6^4	7	8^{10}	9	10^{16}
3	4^2	5	6^8	7	8^{14}	9
4	3	4^5	5	6^{11}	7	8^{17}
5	2^3	3	4^9	5	6^{15}	7
6	1	2^6	3	4^{12}	5	6^{18}

ii) $n(S) = 36$

~~E~~ E = Multiple of 2

~~E =~~

$n(E) = 18$

$P(\text{multiple of 2}) = \frac{n(E)}{n(S)}$

$= \frac{18}{36}$

$= \frac{1}{2}$

iii) $n(S) = 36$

ε = Score of 3 or more

$n(\varepsilon) = 33$

$P(\text{score of 3 or more}) = \frac{n(E)}{n(S)}$

$= \frac{11}{\cancel{36}\ 12}$

$= \frac{11}{12}$

12 a)

$$81^{x-3} \times 27^{2-x} = \frac{1}{243^{x}}$$

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

$$3^{4(x-3)} \times 3^{3(2-x)} = 3^{-5x}$$

$$3^{4x-12} \times 3^{6-3x} = 3^{-5x}$$

$$3^{4x-12+6-3x} = 3^{-5x}$$

$$3^{x-6} = 3^{-5x}$$

By equating the powers

$x - 6 = -5x$

$x + 5x = 6$

$\frac{6x}{6} = \frac{6}{6}$

$x = 1$

b) $(134)_n = (54)_{eight}$

$1 \times n^2 + 3 \times n^1 + 4 \times n^0 = 5 \times 8^1 + 4 \times 8^0$

$n^2 + 3n + 4 \times 1 = 5 \times 8 + 4 \times 1$

$n^2 + 3n + 4 = 40 + 4$

$n^2 + 3n + 4 = 44$

$n^2 + 3n - 40 = 0$

By completing the squares

SW $\left(\frac{3}{2}\right)^2$

$n^2 + 3n = 40$

$n^2 + 3n + \left(\frac{3}{2}\right)^2 = 40 + \left(\frac{3}{2}\right)^2$

$\left(n + \frac{3}{2}\right)^2 = \frac{40}{1} + \frac{9}{4}$

$\left(n + \frac{3}{2}\right)^2 = \frac{160 + 9}{4}$

$\sqrt{\left(n + \frac{3}{2}\right)^2} = \sqrt{\frac{169}{4}}$

$\left(n + \frac{3}{2}\right) = \pm \frac{13}{2}$

Either

$n + \frac{3}{2} = \frac{13}{2}$

$n = \frac{13}{2} - \frac{3}{2}$

$= \frac{10}{2}$

$n = 5$

or

$n + \frac{3}{2} = -\frac{13}{2}$

$n = -\frac{13}{2} - \frac{3}{2}$

$= -\frac{16}{2}$

$= -8$

$n = 5$ (since the base can't be a negative

13

a) i) Commodities

Item	Posho	Potatoes	Sorghum	Rice
Akello	1	5	2	2
Baine	5	3	0	4
Cherop	4	0	0	8
Damba	2	3	4	3

$$\begin{pmatrix} 1 & 5 & 2 & 2 \\ 5 & 3 & 0 & 4 \\ 4 & 0 & 0 & 8 \\ 2 & 3 & 4 & 3 \end{pmatrix}$$

ii) Cost

Item	Cost
Posho	100,000
Potatoes	75000
Sorghum	60,000
Rice	200,000

$$\begin{pmatrix} 100{,}000 \\ 75{,}000 \\ 60{,}000 \\ 200{,}000 \end{pmatrix}$$

b)

$$\begin{array}{c} \\ \text{Akello} \\ \text{Baine} \\ \text{cherop} \\ \text{Damba} \end{array} \begin{array}{c} \begin{matrix} \text{Posho} & \text{Potatoes} & \text{sorghum} & \text{Rice} \end{matrix} \\ \begin{pmatrix} 1 & 5 & 2 & 2 \\ 5 & 3 & 0 & 4 \\ 4 & 0 & 0 & 8 \\ 2 & 3 & 4 & 3 \end{pmatrix} \\ 4\times 4 \end{array} \quad \begin{array}{c} \\ \begin{pmatrix} 100{,}000 \\ 75{,}000 \\ 60{,}000 \\ 200{,}000 \end{pmatrix} \\ 4\times 1 \end{array}$$

$$\begin{pmatrix} 1\times 100{,}000 + 5\times 75{,}000 + 2\times 60{,}000 + 2\times 200{,}000 \\ 5\times 100{,}000 + 3\times 75{,}000 + 0\times 60{,}000 + 4\times 200{,}000 \\ 4\times 100{,}000 + 0\times 75{,}000 + 0\times 60{,}000 + 8\times 200{,}000 \\ 2\times 100{,}000 + 3\times 75000 + 4\times 60{,}000 + 3\times 200{,}000 \end{pmatrix}$$

$$\begin{pmatrix} 100{,}000 + 375{,}000 + 120{,}000 + 400{,}000 \\ 500{,}000 + 225{,}000 + 0 + 800{,}000 \\ 400{,}000 + 0 + 0 + 160{,}000 \\ 200{,}000 + 225{,}000 + 240{,}000 + 600{,}000 \end{pmatrix}$$

$$\begin{array}{l} \text{Akello} \\ \text{Baine} \\ \text{Cherop} \\ \text{Damba} \end{array} \begin{pmatrix} 995{,}000 \\ 1{,}525{,}000 \\ 2{,}000{,}000 \\ 1{,}265{,}000 \end{pmatrix}$$

c) Profit

$$\begin{array}{l} \\ \text{Akello} \\ \text{Baine} \\ \text{Cherop} \\ \text{Damba} \end{array} \begin{array}{c} \text{S.P} \\ \begin{pmatrix} 1{,}145{,}000 \\ 1{,}725{,}000 \\ 2{,}300{,}000 \\ 1{,}445{,}000 \end{pmatrix} \end{array} - \begin{array}{c} \text{C.P} \\ \begin{pmatrix} 995{,}000 \\ 1{,}525{,}000 \\ 2{,}000{,}000 \\ 1{,}265{,}000 \end{pmatrix} \end{array}$$

Akello = 150,000 /=

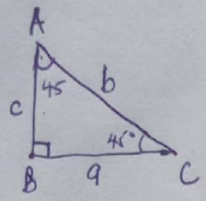
Baine = 200,000 /=

Cherop = 300,000 /=

Damba = 180,000 /=

(14)

a)



Value of b

$$A = \frac{1}{4}\pi r^2$$

$$10 = \frac{1}{4} \times \frac{22}{7} \times b^2$$

$$28 \times 10 = \frac{22b^2}{28_1} \times \cancel{28}^{1}$$

$$\frac{280}{22} = \frac{22b^2}{22}$$

$$b^2 = \frac{\cancel{280}^{140}}{\cancel{22}_{11}}$$

$$b = \sqrt{\frac{140}{11}}$$

Value of c

$$A = \frac{1}{4}\pi r^2$$

$$8 = \frac{1}{4} \times \frac{22}{7} \times c^2$$

$$28 \times 8 = \frac{22c^2}{\cancel{28}_1} \times \cancel{28}^{1}$$

$$\frac{224}{22} = \frac{\cancel{22}c^2}{\cancel{22}_{1}}$$

$$c^2 = \frac{\cancel{224}^{112}}{\cancel{22}_{1}}$$

$$\sqrt{c^2} = \sqrt{\frac{112}{11}}$$

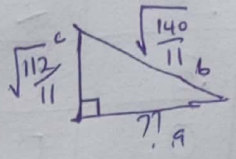
$$c = \sqrt{\frac{112}{11}}$$

b)

i)

Area of triangle ABC.

Value of a.



$$a^2 = b^2 - c^2$$

$$= \left(\sqrt{\frac{140}{11}}\right)^2 - \left(\sqrt{\frac{112}{11}}\right)^2$$

$$a^2 = \frac{140}{11} - \frac{112}{11}$$

$$\sqrt{a^2} = \sqrt{\frac{28}{11}}$$

$$a = \sqrt{\frac{28}{11}}$$

$$A = \frac{1}{2}bh$$

$$= \frac{1}{2} \times \sqrt{\frac{28}{11}} \times \sqrt{\frac{112}{11}}$$

$$= \frac{1}{2} \times \frac{56}{11}$$

$$= \frac{28}{11}$$

$$= 2.5454 \text{ cm}^2$$

ii)

Area of Quadrant BCF

$$A = \frac{1}{4}\pi r^2$$

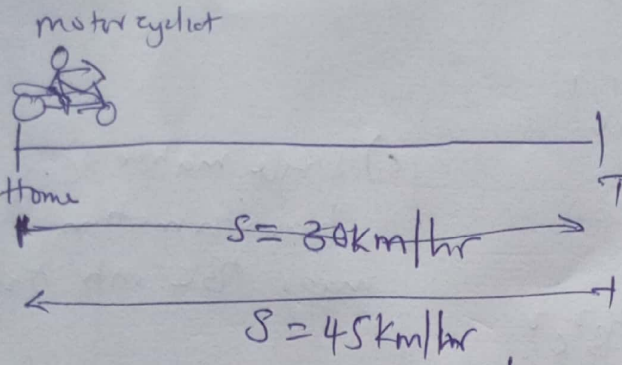
$$= \frac{1}{4} \times \frac{22}{7} \times \left(\sqrt{\frac{28}{11}}\right)^2$$

$$= \frac{1}{\cancel{4}_1} \times \frac{\cancel{22}^{2}}{\cancel{7}_1} \times \frac{\cancel{28}^{\cancel{4}1}}{\cancel{11}_1}$$

$$A = 2 \text{cm}^2$$

15

a)



i)

T.T = 50min

$= \frac{50}{60}$

$= \frac{5}{6}$ hrs.

Home to Trading centre

$T_1 = \frac{D}{S}$

$T_1 = \frac{D}{30}$

Trading Centre to Home

$T_2 = \frac{D}{S}$

$T_2 = \frac{D}{45}$

$T_1 + T_2 = T.T$

$\frac{D}{30} + \frac{D}{45} = \frac{5}{6}$

$\frac{45D + 30D}{1350} = \frac{5}{6}$

$\frac{75D}{1350} = \frac{5}{6}$

$450D = 6750$

$D = 15$ km

ii) time spent to travel from the trading centre back home

$T_2 = \frac{D}{45}$

$= \frac{15}{45_3}$

$= \frac{1}{3}$ hrs

(b)

Let the cost for loaves of bread be x and the cost of salt be y.

$3x + 2y = 6200$ ——(1)

By mistake

$2x + 3y = (6200 - 400)$

$2x + 3y = 5800$ ——(ii)

$2 \mid 3x + 2y = 6200$

$3 \mid 2x + 3y = 5800$

$6x + 4y = 12400$

$6x + 9y = 17400$

$-5y = -5000$

$y = 1000$

Using eqn (1)

$3x + 2y = 6200$

$3x + 2(1000) = 6200$

$3x + 2000 = 6200$

$3x = 4200$

$x = 1400$

i) a loaf of bread = shs. 1400

ii) a kilogram of salt = shs. 1000

16

$ABC \xrightarrow{T_1} A'B'C'$

$T_1 = \begin{pmatrix} 2 & 1 \\ 1 & -2 \end{pmatrix}$

$A'B'C' \xrightarrow{T_2} A^2B^2C^2$

$T_2 = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$

a) Coordinates of A_1, B_1 and C_1

$I = T_1 \times O_1$

$= \begin{pmatrix} 2 & 1 \\ 1 & -2 \end{pmatrix} \begin{pmatrix} A & B & C \\ 4 & 4 & 2 \\ 1 & 4 & 1 \end{pmatrix}$

$= \begin{pmatrix} 8+1 & 8+4 & 4+1 \\ 4+-2 & 4+-8 & 2+-2 \end{pmatrix}$

$= \begin{pmatrix} 9 & 12 & 5 \\ 2 & -4 & 0 \end{pmatrix}$

$A_1(9,2)$, $B_1(12,-4)$, $C_2(5,0)$

b) Coordinates of A_2, B_2 and C_2

$I = T_2 \times O_2$

$= \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 9 & 12 & 5 \\ 2 & -4 & 0 \end{pmatrix}$

$= \begin{pmatrix} 0+-2 & 0+4 & 0+0 \\ 9+0 & 12+0 & 5+0 \end{pmatrix}$

$= \begin{pmatrix} -2 & 4 & 0 \\ 9 & 12 & 5 \end{pmatrix}$

$A_2(-2,9)$, $B_2(4,12)$, $C_2(0,5)$

c) Single matrix of transformation that maps ABC into $A_2B_2C_2$

$ABC \longrightarrow A_2B_2C_2$

T_1 followed by T_2

$T_2 \times T_1$

$\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 2 & 1 \\ 1 & -2 \end{pmatrix}$

$\begin{pmatrix} 0+-1 & 0+2 \\ 2+0 & 1+0 \end{pmatrix}$

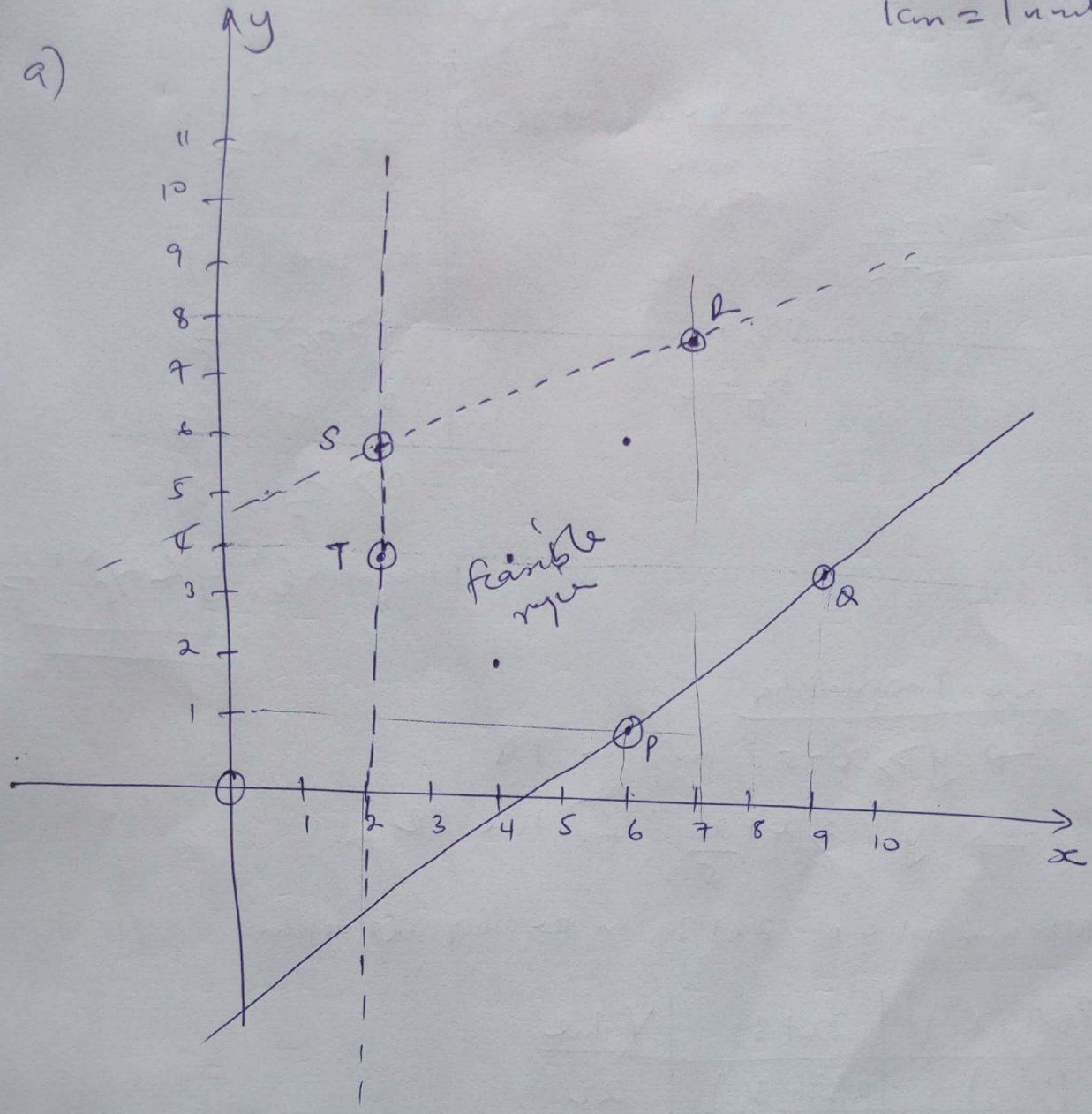
$\begin{pmatrix} -1 & 2 \\ 2 & 1 \end{pmatrix}$

(17)

NB should be put on the graph for proper accuracy

Scale
1cm = 1 unit

a)



b) Inequalities that describe the feasible region using line PQ and SR.

Case for line PQ.

P(6,1) x_1, y_1 Q(9,4) x_2, y_2

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

$= \frac{4-1}{9-6}$

$= \frac{3}{3}$

$= 1$

value of c using P(6,1) (x y)

$y = mx + c$

$1 = 1 \times 6 + c$

$1 = 6 + c$

$-5 = c$

from

$y = mx + c$

$y = 1 \times x + -5$

$y = x - 5$

test point pt (0,0)

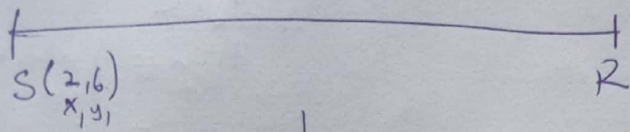
$y \geq x - 5$

$0 \geq 0 - 5$

$0 \geq -5$ true

Inequality (1), $y \geq x - 5$

Case for line SR



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

$= \frac{8-6}{7-2}$

$= \frac{2}{5}$

value of c using pt S(2,6) (x y)

$y = mx + c$

$6 = \frac{2}{5} \times 2 + c$

$6 = \frac{4}{5} + c$

$6 - \frac{4}{5} = c$

$\frac{26}{5} = c$

$y = mx + c$

$y = \frac{2}{5}x + \frac{26}{5}$

test point (0,0)

$y > \frac{2}{5}x + \frac{26}{5}$

$0 > \frac{2}{5}(0) + \frac{26}{5}$

$0 > \frac{26}{5}$ (false

Inequality ⑥: $y < \frac{2}{5}x + \frac{26}{5}$

Two Inequalities

→ $y \geq x - 5$ for line PQ

→ $y < \frac{2}{5}x + \frac{26}{5}$ for line SR

c) Maximum value of $2x + 3y$ in the feasible region

Point (x, y)	$2x + 3y$	Value
(2, 6)	2(2) + 3(6)	22
(6, 1)	2(6) + 3(1)	15
(9, 4)	2(9) + 3(4)	30
(7, 8)	2(7) + 3(8)	38 ✓
(2, 4)	2(2) + 3(4)	16

The maximum value of $2x + 3y$ in the feasible region is 38 for values of $x = 7$ and $y = 8$

END

Note: Any corrections are highly welcome.