Worksheet 1 – Matrices

1. Answer

(a) $\boldsymbol{P}+\boldsymbol{R}=\begin{pmatrix}1 & 2\\ 3 & 4\end{pmatrix}+\begin{pmatrix}2 & 4\\ 6 & 8\end{pmatrix}=\begin{pmatrix}3 & 6\\ 9 & 12\end{pmatrix}$

(b) $\boldsymbol{R}-\boldsymbol{Q}=\begin{pmatrix}2 & 4\\ 6 & 8\end{pmatrix}-\begin{pmatrix}2 & 2\\ 6 & 4\end{pmatrix}=\begin{pmatrix}0 & 2\\ 0 & 4\end{pmatrix}$

(c) $2\boldsymbol{R}-\boldsymbol{Q}=2\begin{pmatrix}2 & 4\\ 6 & 8\end{pmatrix}-\begin{pmatrix}1 & 2\\ 3 & 4\end{pmatrix}=\begin{pmatrix}4 & 8\\ 12 & 16\end{pmatrix}-\begin{pmatrix}1 & 2\\ 3 & 4\end{pmatrix}=\begin{pmatrix}3 & 6\\ 6 & 12\end{pmatrix}$

2. Answer

$\boldsymbol{P}-\boldsymbol{Q}=\boldsymbol{R}$

$\begin{pmatrix}10 & 5\\ 3 & -2\end{pmatrix}-\begin{pmatrix}x & 1\\ 0 & -1\end{pmatrix}=\begin{pmatrix}15 & y\\ 3 & -1\end{pmatrix}$

$\begin{pmatrix}10-x & 4\\ 3 & -1\end{pmatrix}=\begin{pmatrix}15 & y\\ 3 & -1\end{pmatrix}$

$10-x=15$

$-x=5$

$x=-5$

$y=4$

3. Answer

$$\mathbf{P}+2\mathbf{Q}=\begin{pmatrix}1 & x\\ 5 & 0\end{pmatrix}+2\begin{pmatrix}0 & 5\\ y & 1\end{pmatrix}$$

$$=\begin{pmatrix}1+0 & x+10\\ 5+2y & 2\end{pmatrix}$$

$$\therefore \begin{pmatrix}1 & x+10\\ 5+2y & 2\end{pmatrix}=\begin{pmatrix}2k & 2k\\ 6k & 4k\end{pmatrix}$$

Equaling the corresponding elements, we have

$1=2k$

$k=\frac{1}{2}$

$x+10=2k$

$x=-9$

$5+2y=6\text{k}$

$y=-1$

$\therefore x=-9, y=-1, k=\frac{1}{2}$

4. Answer

(a) $\mathbf{AB} = \begin{pmatrix} -3 & -1 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} -1 \\ 2 \end{pmatrix}$

$$= \begin{pmatrix} 3-2 \\ -1+0 \end{pmatrix}$$

$$= \begin{pmatrix} 1 \\ -1 \end{pmatrix}$$

(b) $\mathbf{BC} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}\begin{pmatrix} 5 & -1 \end{pmatrix}$

$$= \begin{pmatrix} -5 & 1 \\ 10 & -2 \end{pmatrix}$$

(c) $\mathbf{A}^2 = \begin{pmatrix} 3 & -1 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} 3 & -1 \\ 1 & 0 \end{pmatrix}$

$$= \begin{pmatrix} 9-1 & -3+0 \\ 3+0 & -1+0 \end{pmatrix}$$

$$= \begin{pmatrix} 8 & -3 \\ 3 & -1 \end{pmatrix}$$

5. Answer

$$\begin{pmatrix} 3 & -2 & 0 \\ 1 & 0 & 2 \end{pmatrix}\begin{pmatrix} a \\ 9 \\ b \end{pmatrix} = \begin{pmatrix} 6 \\ -7 \end{pmatrix}$$

$$\begin{pmatrix} 3a-18 \\ a+2b \end{pmatrix} = \begin{pmatrix} 6 \\ -7 \end{pmatrix}$$

Equating the corresponding elements, we have

$3a - 18 = 6$

$a = 8$

$a + 2b = -7$

$b = -\frac{15}{2}$

$= -7\frac{1}{2}$

$\therefore a = 8, b = -7\frac{1}{2}$

6. Answer

$$h\begin{pmatrix} 2 \\ 8 \end{pmatrix} + k\begin{pmatrix} 3 \\ 4 \end{pmatrix} = \begin{pmatrix} 16 \\ 48 \end{pmatrix}$$

$$\begin{pmatrix} 2h + 3k \\ 8h + 4k \end{pmatrix} = \begin{pmatrix} 16 \\ 48 \end{pmatrix}$$

Equating the corresponding elements, we have

$2h + 3k = 16$ —— (1)

$8h + 4k = 48$

$2h + k = 12$ —— (2)

(1) – (2): $2k = 4$

$k = 2$

Substitute $k = 2$ into (2): $2h = 12 - 2$

$h = 5$

$\therefore h = 5, k = 2$

7. Answer

(a) $\mathbf{AB} = 2\mathbf{D}$

$$\mathbf{D} = \frac{1}{2}\mathbf{AB}$$

$$= \frac{1}{2}\begin{pmatrix} 1 & 0 & 1 \end{pmatrix}\begin{pmatrix} 1 \\ -28 \\ 2 \end{pmatrix}$$

$$= \frac{1}{2}(3)$$

$$= \left(1\frac{1}{2}\right)$$

(b) $\mathbf{C}^2 = \begin{pmatrix} 1 & -3 \\ 5 & 0 \end{pmatrix}\begin{pmatrix} 1 & -3 \\ 5 & 0 \end{pmatrix}$

$$= \begin{pmatrix} -14 & -3 \\ 5 & -15 \end{pmatrix}$$

8. Answer

$$\begin{pmatrix} 2 & z \\ 5 & x \end{pmatrix} = \begin{pmatrix} y & 4 \\ 5 & -2 \end{pmatrix}\begin{pmatrix} 1 & 3 \\ 0 & 2 \end{pmatrix}$$

$$\begin{pmatrix} 2 & z \\ 5 & x \end{pmatrix} = \begin{pmatrix} y & 3y+8 \\ 5 & 11 \end{pmatrix}$$

Equating the corresponding elements, we have

$y = 2$

$z = 3y + 8$

$= 6 + 8$

$= 14$

$x = 11$

$\therefore x = 11, y = 2, z = 14$

9. Answer

(a) **(i)** $\mathbf{MN} = \begin{pmatrix} 4 & 8 & 2 \\ 1 & 5 & 0 \end{pmatrix}\begin{pmatrix} 1.3 \\ 1.5 \\ 1.8 \end{pmatrix}$

$= \begin{pmatrix} 20.8 \\ 8.8 \end{pmatrix}$

(ii) It represents the total sales made for ice-lemon tea and barley are \$20.80 and \$8.80 respectively.

(b) **(i)** $\mathbf{PM} = \begin{pmatrix} 1 & 1 \end{pmatrix}\begin{pmatrix} 4 & 8 & 2 \\ 1 & 5 & 0 \end{pmatrix}$

$= \begin{pmatrix} 5 & 13 & 2 \end{pmatrix}$

(ii) It represents 5 small, 13 regular and 2 large cups of drinks sold over the 10-minute period.

10.

(a) $\mathbf{AB} = \begin{pmatrix} 29 \\ 35 \end{pmatrix}$

$$\begin{pmatrix} 2 & 3 & 2 \\ 3 & p & 1 \end{pmatrix}\begin{pmatrix} 8 \\ 1 \\ q \end{pmatrix} = \begin{pmatrix} 29 \\ 35 \end{pmatrix}$$

$$\begin{pmatrix} 16 + 3 + 2q \\ 24 + p + q \end{pmatrix} = \begin{pmatrix} 29 \\ 35 \end{pmatrix}$$

$$\begin{pmatrix} 19 + 2q \\ 24 + p + q \end{pmatrix} = \begin{pmatrix} 29 \\ 35 \end{pmatrix}$$

Equating the corresponding elements, we have

$19 + 2q = 29$

$q = 5$

$24 + p + q = 35$

$p = 35 - 24 - 5$

$= 6$

$\therefore p = 6,\ q = 5$

(b) $\begin{pmatrix} 200 & 150 \end{pmatrix}\begin{pmatrix} 29 \\ 35 \end{pmatrix} = (11\,050)$

(c) It represents the total cost of making 200 toy cars and 150 toy trains.

Worksheet 2 – Matrices

1. Answer

(a) John buys 8 litres of paint, 6 litres of detergent and 5 litres of alcohol.
Paul buys 7 litres of paint, 5 litres of detergent and 10 litres of alcohol.

Represent their purchases in a 2×3 matrix **P**.

Answer $\begin{bmatrix} 8 & 6 & 5 \\ 7 & 5 & 10 \end{bmatrix}$ [1]

(b) Evaluate the matrix $\mathbf{R} = \mathbf{PQ}$.

$$R = \begin{bmatrix} 8 & 6 & 5 \\ 7 & 5 & 10 \end{bmatrix} \begin{bmatrix} 23.2 & 19.7 \\ 4.5 & 5.5 \\ 9.8 & 9.2 \end{bmatrix} \quad \text{(M1)}$$

$$= \begin{bmatrix} 261.6 & 236.6 \\ 282.9 & 257.4 \end{bmatrix} \quad \text{(A1)}$$

Answer **R** =..... [2]

(c) How much money would Paul save by shopping in store B?

Saving = 282.9 – 257.4

Answer $ 25.50 [1]

(d) John shops in store A.
He has a shopping voucher that gives a discount of 20%.
How much does he pay in total for his items?

Answer $ 209.28 [1]

2. Answer

$$4\mathbf{A} = \begin{pmatrix} 2 & 6 \\ 8 & 4 \end{pmatrix}$$

$$\mathbf{A} = \begin{pmatrix} \frac{1}{2} & \frac{3}{2} \\ 2 & 1 \end{pmatrix}$$

3. Answer

$$2\begin{pmatrix} 3 & -4 \\ 0 & 2 \end{pmatrix} + \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} - 3\begin{pmatrix} -2 & -1 \\ 1 & 4 \end{pmatrix}$$

$$= \begin{pmatrix} 6 & -8 \\ 0 & 4 \end{pmatrix} + \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} - \begin{pmatrix} -6 & -3 \\ 3 & 12 \end{pmatrix}$$

$$= \begin{pmatrix} 13 & -5 \\ -3 & -7 \end{pmatrix}$$

4. Answer

(a) Answer

$$\mathbf{C} = \begin{pmatrix} 18 & 9 & 10 \\ 15 & 7 & 24 \end{pmatrix}$$

(b) Answer

$$\mathbf{S} = \begin{pmatrix} 18 & 9 & 10 \\ 15 & 7 & 24 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$$

$$= \begin{pmatrix} 37 \\ 46 \end{pmatrix}$$

(c) 37 and 46 represents the total cups of coffee sold at café A and B respectively.

(d) Answer

$$\mathbf{P} = \begin{pmatrix} 8 \\ 6 \\ 7 \end{pmatrix}$$

(e) Answer

$$\mathbf{T} = \begin{pmatrix} 18 & 9 & 10 \\ 15 & 7 & 24 \end{pmatrix} \begin{pmatrix} 8 \\ 6 \\ 7 \end{pmatrix}$$

$$= \begin{pmatrix} 268 \\ 330 \end{pmatrix}$$

5. Answer

(a) $\mathbf{P} = 7 \begin{pmatrix} 57 & 38 & 23 & 18 \\ 42 & 29 & 13 & 16 \end{pmatrix}$

$$= \begin{pmatrix} 399 & 266 & 161 & 126 \\ 294 & 203 & 91 & 112 \end{pmatrix}$$

(b) $\mathbf{N} = \begin{pmatrix} 0.50 \\ 0.75 \\ 1.20 \\ 1.20 \end{pmatrix}$

(c) $\mathbf{T} = \begin{pmatrix} 399 & 266 & 161 & 126 \\ 294 & 203 & 91 & 112 \end{pmatrix} \begin{pmatrix} 0.50 \\ 0.75 \\ 1.20 \\ 1.20 \end{pmatrix}$

$$= \begin{pmatrix} 743.40 \\ 542.85 \end{pmatrix}$$

(d) 743.40 represents the total cost of making regular pratas in 7 days and 542.85 represents the total cost of making upsized pratas in 7 days.

6. Answer

(a) On average, the restaurant sells 5 Set A, 3 Set B and 6 Set C per day.

Represent this as a 3 × 1 column matrix **R**.

$$\begin{pmatrix} 5 \\ 3 \\ 6 \end{pmatrix}$$

Answer ..... [1]

(b) Evaluate the matrix **N = 7R**.

$$7\begin{pmatrix} 5 \\ 3 \\ 6 \end{pmatrix} = \begin{pmatrix} 35 \\ 21 \\ 42 \end{pmatrix}$$

Answer ..... [1]

(c) Evaluate **M = TN**.

$$\begin{pmatrix} 2 & 4 & 7 \\ 1 & 2 & 3 \\ 1 & 1 & 2 \\ 2 & 3 & 4 \end{pmatrix}\begin{pmatrix} 35 \\ 21 \\ 42 \end{pmatrix} = \begin{pmatrix} 448 \\ 203 \\ 140 \\ 301 \end{pmatrix}$$

(d) State what each of the element(s) of **M** represent.

Answer ..Each element of M shows **the total number of packets** of each of **the 4 different types of food items that were sold in one week (or 7 days)** respectively.
.....[1]

(e) (i) If the restaurant sells Set A at \$24, Set B at \$43 and Set C at \$70, calculate the total sales from the dinner sets.

4 possible methods

Matrix Method	**Non-Matrix Method**
Weekly $\begin{pmatrix} 24 & 43 & 70 \end{pmatrix}\begin{pmatrix} 35 \\ 21 \\ 42 \end{pmatrix} = (4683)$ Ans: \$4683	**Weekly** Total for set $= 24(35) + 43(21) + 70(42)$ $= \$4683$
Daily $\begin{pmatrix} 24 & 43 & 70 \end{pmatrix}\begin{pmatrix} 5 \\ 3 \\ 6 \end{pmatrix} = (669)$ Ans: \$669	**Daily** Total for set $= 24(5) + 43(3) + 70(6)$ $= \$669$

(e)(ii)

6 possible methods

Matrix Method	**Non-Matrix Method**
Weekly $\begin{pmatrix}4 & 6.50 & 5 & 5\end{pmatrix}\begin{pmatrix}448\\203\\140\\301\end{pmatrix}=(5316.5)$ $\$5316.5\times0.9=\$4784.85$ $\frac{4784.85-4683}{4784.85}\times100\%=2.1285\%$ $=2.13\%$	**Weekly** Total sales for à la carte $=4(448)+6.5(203)+5(140)+5(301)$ $=\$5316.50$ $\$5316.5\times0.9=\$4784.85$ $\frac{4784.85-4683}{4784.85}\times100\%=2.1285\%$ $=2.13\%$
Daily $\begin{pmatrix}2 & 4 & 7\\1 & 2 & 3\\1 & 1 & 2\\2 & 3 & 4\end{pmatrix}\begin{pmatrix}5\\3\\6\end{pmatrix}=\begin{pmatrix}64\\29\\20\\43\end{pmatrix}$ $\begin{pmatrix}4 & 6.50 & 5 & 5\end{pmatrix}\begin{pmatrix}64\\29\\20\\43\end{pmatrix}=(759.5)$ $\$759.5\times0.9=\$683.55$ $\frac{683.55-669}{683.55}\times100\%$ $=2.1285$ $=2.13\%$	**Daily** No. of fried rice = 2(5) + 4(3) + 7(5) = 64 No. of stir fried veg.= 1(5) + 2(3) + 3(6) = 29 No. of sambal toufu = 1(5) + 1(3) + 2(6) = 20 No. of mango sticky rice = 2(5) + 3(3) + 4(6) = 43 Total sales for à la carte = 4(64) + 6.5(29) + 5(20) + 5 (43) = \$759.50 $\$759.5\times0.9=\$683.55$ $\frac{683.55-669}{683.55}\times100\%$ $=2.1285$ $=2.13\%$
Daily then weekly (LAST STEP) $\frac{7(683.55-669)}{7(683.55)}\times100\%$ $=\frac{4784.85-4683}{4784.85}\times100\%$ $=2.1285\%$ $=2.13\%$	**Daily then weekly (LAST STEP)** $\frac{7(683.55-669)}{7(683.55)}\times100\%$ $=\frac{4784.85-4683}{4784.85}\times100\%$ $=2.1285\%$ $=2.13\%$

7. Answer

(a) $\mathbf{A} = \begin{pmatrix} 159 & 175 \\ 230 & 215 \\ 205 & 223 \end{pmatrix}$

(b) $\mathbf{P} = (8 \quad 25 \quad 12)$

(c) $\mathbf{C} = (8 \quad 25 \quad 12)\begin{pmatrix} 159 & 175 \\ 230 & 215 \\ 205 & 223 \end{pmatrix}$

$= (159 \times 8 + 230 \times 25 + 12 \times 205 \quad \ldots)$

$= (9482 \quad 9451)$

(d) The elements represent the total cost of all shoes to be purchased from Joe Sporting House and Mikasa Sports respectively.

(e) $\mathbf{Q} = \begin{pmatrix} 0.9 & 0 \\ 0 & 0.85 \end{pmatrix}$

(f) $\begin{pmatrix} 159 & 175 \\ 230 & 215 \\ 205 & 223 \end{pmatrix}\begin{pmatrix} 0.9 & 0 \\ 0 & 0.85 \end{pmatrix} = \begin{pmatrix} 143.1 & 148.75 \\ 207 & 182.75. \\ 184.5 & 189.55 \end{pmatrix}$

$(8 \quad 25 \quad 12)\begin{pmatrix} 143.1 & 148.75 \\ 207 & 182.75. \\ 184.5 & 189.55 \end{pmatrix} = (8533.8 \quad 8033.35)$

OR

$(9482 \quad 9451)\begin{pmatrix} 0.9 & 0 \\ 0 & 0.85 \end{pmatrix} = (8533.8 \quad 8033.35)$

Buy from Mikasa Sports as it is cheaper

Worksheet 3 – Matrices

1. Answer

(a) $\mathbf{P} = \begin{pmatrix} 20 & 10 & 10 \\ 25 & 15 & 0 \end{pmatrix}$

(b) $\mathbf{T} = \begin{pmatrix} 0.9 \\ 1.2 \\ x \end{pmatrix}$

(c) $\mathbf{Q} = \begin{pmatrix} 20 & 10 & 10 \\ 25 & 15 & 0 \end{pmatrix}\begin{pmatrix} 0.9 \\ 1.2 \\ x \end{pmatrix} = \begin{pmatrix} 30 + 10x \\ 40.5 \end{pmatrix}$

(d) Cost of set X and set Y respectively

(e) $30 + 10x = 40.5$

$x = 1.05$

2. Answer

(a) Evaluate the matrix $\mathbf{S} = 3\mathbf{P}$.

$$\textit{Answer } \mathbf{S} = \begin{pmatrix} 60 & 150 & 90 \\ 120 & 180 & 60 \\ 90 & 60 & 150 \end{pmatrix} \quad [1]$$

(b) The cost of 5 kg, 10 kg and 15 kg bags are \$9.50, \$12.60 and \$23 respectively. Represent the prices of the coffee beans in a 3 × 1 column matrix **Q**.

$$\textit{Answer } \mathbf{Q} = \begin{pmatrix} 9.5 \\ 12.6 \\ 23 \end{pmatrix} \quad [1]$$

(c) Evaluate the matrix $\mathbf{T} = \mathbf{SQ}$.

$$T = \begin{pmatrix} 60 & 150 & 90 \\ 120 & 180 & 60 \\ 90 & 60 & 150 \end{pmatrix}\begin{pmatrix} 9.5 \\ 12.6 \\ 23 \end{pmatrix}$$

$$T = \begin{pmatrix} 60(9.5) + 150(12.6) + 90(23) \\ 120(9.5) + 180(12.6) + 60(23) \\ 90(9.5) + 60(12.6) + 150(23) \end{pmatrix}$$

$$T = \begin{pmatrix} 4530 \\ 4788 \\ 5061 \end{pmatrix}$$

B2[Deduct B1 for each error]

$$\textit{Answer } T = \begin{pmatrix} 4530 \\ 4788 \\ 5061 \end{pmatrix} \quad [2]$$

(d) State what each of the elements of **T** represents.

Total sales of coffee beans to Shop A($4530), Shop B($4788) and Shop C ($5061) in a year.

3. Answer

(a) Answer

$$\mathbf{W} = \begin{pmatrix} 6 & 8 \\ 4 & 2 \\ 3 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \end{pmatrix}$$

$$= \begin{pmatrix} 14 \\ 6 \\ 4 \end{pmatrix}$$

The elements in W represents the toral number of transactions for each type of property.

(b) Answer

$$\mathbf{R} = \begin{pmatrix} 3000 & 7000 & 11000 \\ 800 & 1800 & 2500 \end{pmatrix}$$

$$\mathbf{S} = \begin{pmatrix} 3000 & 7000 & 11000 \\ 800 & 1800 & 2500 \end{pmatrix} \begin{pmatrix} 14 \\ 6 \\ 4 \end{pmatrix}$$

$$= \begin{pmatrix} 128000 \\ 32000 \end{pmatrix}$$

The elements in S represents the total amount of commission earned and the total government tax paid for each type of transactions.

(c) Answer

$$\mathbf{T} = \begin{pmatrix} 1 & -1 \end{pmatrix}$$

$$\mathbf{TS} = \begin{pmatrix} 1 & -1 \end{pmatrix} \begin{pmatrix} 128000 \\ 32000 \end{pmatrix}$$

$$= (128000 - 32000)$$

$$= (96000)$$

Total amount earned = $96000

4. Answer

(a) $\mathbf{R} = \mathbf{PQ} = \begin{pmatrix} 7 & 3 & 5 \\ 6 & 4 & 2 \end{pmatrix} \begin{pmatrix} 2500 & 200 \\ 3500 & 300 \\ 2000 & 80 \end{pmatrix} = \begin{pmatrix} 38000 & 2700 \\ 33000 & 2560 \end{pmatrix}$

(b) The elements represent the total basic wages and total fringe benefits paid to the stadd in the shops at Glow@Clementi and Glow@Tampines respectively.

(c) $\begin{pmatrix} 38000 & 2700 \\ 33000 & 2560 \end{pmatrix} \begin{pmatrix} 1 \\ 1.1 \end{pmatrix} = \begin{pmatrix} 38000 + 2700(1.1) \\ 33000 + 2560(1.1) \end{pmatrix} = \begin{pmatrix} 40970 \\ 35816 \end{pmatrix}$

Glow@Clementi = $ 40970

Glow@Tampines = $ 35816

5. Answer

(a) $\mathbf{E} = \begin{pmatrix} 30 & 20 \\ 25 & 25 \end{pmatrix}$

(b) $\mathbf{S} = 5 \begin{pmatrix} 15 & 10 \\ 20 & 15 \end{pmatrix} + 2 \begin{pmatrix} 30 & 20 \\ 25 & 25 \end{pmatrix}$

$= \begin{pmatrix} 135 & 90 \\ 150 & 125 \end{pmatrix}$

(c) $\mathbf{P} = (10 \quad 15)$

(d) $\mathbf{T} = (10 \quad 15) \begin{pmatrix} 135 & 90 \\ 150 & 125 \end{pmatrix} = (1350 + 2250 \quad 900 + 1875) = (3600 \quad 2775)$

(e) The elements of T represent the total charges of Zumba classes for all male and female participants respectively, over a 1-week period.

6. Answer

(a) Answer

(i)

$$\mathbf{NC} = \begin{pmatrix} 35 & 46 \\ 43 & 70 \end{pmatrix} \begin{pmatrix} 15 \\ 10 \end{pmatrix}$$
$$= \begin{pmatrix} 985 \\ 1345 \end{pmatrix}$$

(ii) The elements represent the total costs of producing both titles at Hougang and Bishan outlets. OR The cost of producing both titles at Hougang and Bishan outlets are $985 and $1345 respectively.

(b) Answer

$$\mathbf{S} = \begin{pmatrix} p \\ q \end{pmatrix}, \ \mathbf{NS} = \begin{pmatrix} 35 & 46 \\ 43 & 70 \end{pmatrix}\begin{pmatrix} p \\ q \end{pmatrix} = \begin{pmatrix} 35p+46q \\ 43p+70q \end{pmatrix}$$

(c)

$$\mathbf{NS} - \mathbf{NC} = \begin{pmatrix} 1905 \\ 2745 \end{pmatrix}$$

$$\begin{pmatrix} 35p+46q \\ 43p+70q \end{pmatrix} - \begin{pmatrix} 985 \\ 1345 \end{pmatrix} = \begin{pmatrix} 1905 \\ 2745 \end{pmatrix}$$

$$35p+46q-985=1905$$
$$43p+70q-1345=2745$$

$$35p+46q=2890 \text{ ------(1)}$$
$$43p+70q=4090---(2)$$

(1) x 43 – (2)x 35 :

$$(1505p+1978q)-(1505p+2450q)=-18880$$
$$-472q=-18880$$
$$q=40,$$
$$p=\frac{2890-46(40)}{35}=30$$

7. Answer

(a) $\mathbf{N} = \begin{pmatrix} 4 & 10 & 2 \\ 5 & 5 & 3 \end{pmatrix}$

(b) $\mathbf{C} = \begin{pmatrix} 0.2 \\ 0.5 \\ 6 \end{pmatrix}$

(c) (i) $\mathbf{P} = \begin{pmatrix} 4 & 10 & 2 \\ 5 & 5 & 3 \end{pmatrix}\begin{pmatrix} 0.2 \\ 0.5 \\ 6 \end{pmatrix}$

$$= \begin{pmatrix} 18.20 \\ 22 \end{pmatrix}$$

(ii) The postage cost paid by Kim and Mary respectively

(d) (i) $\mathbf{R} = \begin{pmatrix} 1.20 & 0 & 0 \\ 0 & 1.10 & 0 \\ 0 & 0 & 1.05 \end{pmatrix}$

(ii) **New cost** $= \begin{pmatrix} 1.20 & 0 & 0 \\ 0 & 1.10 & 0 \\ 0 & 0 & 1.05 \end{pmatrix} \begin{pmatrix} 0.2 \\ 0.5 \\ 6 \end{pmatrix} = \begin{pmatrix} 0.36 \\ 0.55 \\ 6.30 \end{pmatrix}$

New total $= \begin{pmatrix} 4 & 10 & 2 \\ 5 & 5 & 3 \end{pmatrix} \begin{pmatrix} 0.36 \\ 0.55 \\ 6.30 \end{pmatrix}$

$= \begin{pmatrix} 19.54 \\ 23.45 \end{pmatrix}$

Total $= 19.54 + 23.45 = \$42.99$

8. Answer

(a) Answer

Flour ($/g)	Sugar ($/g)	Number of eggs ($/egg)
0.0015	0.0018	0.225

(b) $\mathbf{E} = \begin{pmatrix} 0.0015 \\ 0.0018 \\ 0.225 \end{pmatrix}$

(c) $\mathbf{DE} = \begin{pmatrix} 90 & 50 & 1.5 \\ 220 & 200 & 8 \\ 60 & 80 & 2 \end{pmatrix} \begin{pmatrix} 0.0015 \\ 0.0018 \\ 0.225 \end{pmatrix} = \begin{pmatrix} 0.5625 \\ 2.49 \\ 0.684 \end{pmatrix}$

(d) The elements in DE represents the cost price in $ needed for the making of one cookie, one cake and one pancake respectively.

(e) Total cost $= (70 \quad 30 \quad 120) \begin{pmatrix} 0.5625 \\ 2.49 \\ 0.684 \end{pmatrix} = (196.155)$

$196.16 (nearest cent)