EQUITY
LEARNING PLACE

Elementary Math Topical (Matrices)

Question 1:

A rice distributor supplies rice to 3 different supermarkets in Singapore. The number of bags of rice supplied per delivery to each supermarket, the sizes and cost price are shown in the table below.

	Number of bags of rice per delivery			Number of deliveries in one month
Size of each bag	2.5 kg	5 kg	10 kg	
Supermarket A	40	25	10	6
Supermarket B	80	60	30	8
Supermarket C	30	20	25	11
Price per bag	$4	$7	$12	

a) If $\mathbf{P} = (40 \quad 25 \quad 10)$, evaluate 6**P**.

b) Describe what is represented by the elements of 6**P**.

c) If $\mathbf{Q} = \begin{pmatrix} 40 & 25 & 10 \\ 80 & 60 & 30 \\ 30 & 20 & 25 \end{pmatrix}$ and $\mathbf{R} = \begin{pmatrix} 4 \\ 7 \\ 12 \end{pmatrix}$, evaluate the matrix **T = QR**.

d) Describe what is represented by the elements of **T**.

The elements in matrix **V**, where **V = CT**, represents the total amount of money the distributor received from all the three supermarkets in one month.

e) Write down the matrix **C.**

f) Evaluate the matrix **V = CT.**

a)

$$6\mathbf{P} = 6\,(40 \quad 25 \quad 10) = (240 \quad 150 \quad 60)$$

b) The elements represent the number of bags for size 2.5kg, 5kg and 10kg delivered in one month respectively for Supermarket A.

c)

$$\mathbf{T} = \mathbf{QR} = \begin{pmatrix} 40 & 25 & 10 \\ 80 & 60 & 30 \\ 30 & 20 & 25 \end{pmatrix} \begin{pmatrix} 4 \\ 7 \\ 12 \end{pmatrix} = \begin{pmatrix} 455 \\ 1100 \\ 560 \end{pmatrix}$$

d) The elements represent the amount each Supermarket must pay for each delivery

e)

$$\mathbf{C} = (6 \quad 8 \quad 11)$$

f)

$$\mathbf{V} = (6 \quad 8 \quad 11) \begin{pmatrix} 455 \\ 1100 \\ 560 \end{pmatrix} = (17690)$$

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Question 2:

The matrix **N** shows the number of chocolate ice creams, almond ice creams and lime ice creams sold at a provision shop on Friday and Saturday.

	Chocolate	Almond	Lime	
N =	85	62	47	Friday
	165	90	78	Saturday

a) The selling price of one chocolate ice cream is $2.20, one almond ice cream is $1.80 and one lime ice cream is $1.20. Represent the selling prices in a 3 × 1 matrix **S**.

b) Evaluate the matrix **T** = **NS**

c) Explain what each element in matrix **T** represents.

d) The elements of the matrix **K** = **PN** represent the total number of chocolate ice creams, almond ice creams and lime ice creams sold respectively. Write down the matrix **P**.

a)

$$\mathbf{S} = \begin{pmatrix} 2.2 \\ 1.8 \\ 1.2 \end{pmatrix}$$

b)

$$\mathbf{T} = \begin{pmatrix} 85 & 62 & 47 \\ 165 & 90 & 78 \end{pmatrix} \begin{pmatrix} 2.2 \\ 1.8 \\ 1.2 \end{pmatrix} = \begin{pmatrix} 355 \\ 618.6 \end{pmatrix}$$

c) The elements represent the sales on Friday and Saturday respectively.

d)

$$\mathbf{P} = (1 \quad 1)$$

Question 3:

If X = $\begin{pmatrix} 1 & -3 \\ 0 & 1 \end{pmatrix}$ and Y = $\begin{pmatrix} 7 & -5 & 3 \\ 4 & 1 & 0 \end{pmatrix}$, evaluate

a) XY

b) $X^2 + I$

a)

$$\mathbf{XY} = \begin{pmatrix} 1 & -3 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 7 & -5 & 3 \\ 4 & 1 & 0 \end{pmatrix} = \begin{pmatrix} -5 & -8 & 3 \\ 4 & 1 & 0 \end{pmatrix}$$

b)

$$\mathbf{X^2 + I} = \begin{pmatrix} 1 & -3 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 1 & -3 \\ 0 & 1 \end{pmatrix} + \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

$$= \begin{pmatrix} 1 & -6 \\ 0 & 1 \end{pmatrix} + \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} 2 & -6 \\ 0 & 2 \end{pmatrix}$$

Question 4:

The price of tickets for Semifinals and Final football matches are different. The prices are further classified according to Category 1 (Cat 1), Category 2 (Cat 2) and Category 3 (Cat 3). The matrix **X** shows the prices, in dollars, of the football matches,

$$\mathbf{X} = \begin{matrix} \text{Cat 1} & \text{Cat 2} & \text{Cat 3} \\ \begin{pmatrix} 770 & 620 & 470 \\ 1500 & 920 & 590 \end{pmatrix} & \begin{matrix} \text{Semifinals} \\ \text{Final} \end{matrix} \end{matrix}$$

a) Cat 1 has 4000 seats, Cat 2 has 6000 seats and Cat 3 has 10 000 seats. Represent the number of seats in a 3×1 matrix **Y**.

b) Evaluate the matrix **A** = **XY**.

c) Explain what the elements in matrix **A** represent.

d) Given that there is a discount of 20% for Semi-final matches and 10% for Final match, find, by matrix multiplication the total amount of money collected from the sales of tickets for Semifinal and Final matches.

a)

$$\mathbf{Y} = \begin{pmatrix} 4000 \\ 6000 \\ 10000 \end{pmatrix}$$

b)

$$\mathbf{AY} = \begin{pmatrix} 770 & 620 & 470 \\ 1500 & 920 & 590 \end{pmatrix} \begin{pmatrix} 4000 \\ 6000 \\ 10000 \end{pmatrix} = \begin{pmatrix} 11500000 \\ 17420000 \end{pmatrix}$$

c) The elements represent the sales of all the tickets for Semi-finals and Final respectively.

d)

$$\begin{pmatrix} 0.8 & 0.9 \end{pmatrix} \begin{pmatrix} 11500000 \\ 17420000 \end{pmatrix} = (24878000)$$

The total sales amount collected is $24878000.

Question 5:

It is given that $A = \begin{pmatrix} 3 & 2 \\ 1 & -1 \end{pmatrix}$ and $B = \begin{pmatrix} x \\ y \end{pmatrix}$. Find B such that $AB = \begin{pmatrix} 8 \\ 6 \end{pmatrix}$.

$$\begin{pmatrix} 3 & 2 \\ 1 & -1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 8 \\ 6 \end{pmatrix}$$

$$3x + 2y = 8$$

$$x - y = 6$$

$$2x - 2y = 12$$

$$5x = 20$$

$$x = 4$$

$$y = -2$$

Elementary Math Topical (Matrices)

Question 6:

The table below records the number of hampers three companies ordered for Christmas. The costs of the three different kinds of Christmas hampers are $50 for 'Gift' hampers, $65 for 'Classic' hampers and $80 for 'Deluxe' hampers.

Company	Gift ($50)	Classic ($65)	Deluxe ($80)
Axe	14	2	5
Whye	10	6	3
Zee	13	8	2

a) **C** is a 3-by-1 matrix denoting the unit price of 'Gift' hampers, 'Classic' hampers and 'Deluxe' hampers respectively. Write down the matrix **C**.

b) Denoting the above table by matrix **P** = $\begin{pmatrix} 14 & 2 & 5 \\ 10 & 6 & 3 \\ 13 & 8 & 2 \end{pmatrix}$, evaluate **PC**.

c) Explain what the numbers in your answer to part **(b)** represent.

d) If matrix **X** is such that the numbers in **PX** represent the number of hampers that each company ordered, write down the matrix **X**.

e) Evaluate $\begin{pmatrix} 1 & 1 & 1 \end{pmatrix}$ **P**.

f) What do the numbers in your answer in part **(e)** represent?

g) Write down and evaluate a product of two matrices which gives a single number for the total payment by the three companies **altogether**.

a)

$$\mathrm{C} = \begin{pmatrix} 50 \\ 65 \\ 80 \end{pmatrix}$$

b)

$$\mathbf{PC} = \begin{pmatrix} 14 & 2 & 5 \\ 10 & 6 & 3 \\ 13 & 8 & 2 \end{pmatrix}\begin{pmatrix} 50 \\ 65 \\ 80 \end{pmatrix} = \begin{pmatrix} 1230 \\ 1130 \\ 1330 \end{pmatrix}$$

c) The elements represent the total costs for all the hampers each company has to pay respectively.

d)

$$\mathbf{X} = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$$

e)

$$(1 \quad 1 \quad 1)\begin{pmatrix}14 & 2 & 5\\ 10 & 6 & 3\\ 13 & 8 & 2\end{pmatrix} = (37 \quad 16 \quad 10)$$

f) The elements represent the total number for each type of hampers the companies purchased respectively.

g)

$$(37 \quad 16 \quad 10)\begin{pmatrix}50\\ 65\\ 80\end{pmatrix} = (3690)$$

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Question 7:

A bubble tea shop sells 3 flavours of bubble tea. The table below shows the number of cups sold on two days and the price of each flavour.

	Earl Grey Tea	Honey Green Tea	Passion Fruit Tea
Day 1	45	36	55
Day 2	55	46	50
Price of each cup	$2.20	$1.75	$1.50

It is given that $\mathbf{X} = \begin{pmatrix} 45 & 36 & 55 \\ 55 & 46 & 50 \end{pmatrix}$ and $\mathbf{Y} = \begin{pmatrix} 2.20 \\ 1.75 \\ 1.50 \end{pmatrix}$.

a) Evaluate $\mathbf{S} = \mathbf{XY}$ and state what the elements of $\mathbf{S}$ represent.

b) Evaluate $\mathbf{R} = \begin{pmatrix} 1 & 1 \end{pmatrix}\mathbf{S}$ and state what the elements of $\mathbf{R}$ represent.

In celebration of its 8th anniversary, on 1st July, the shop decided to give a discount of 25% on the Earl Grey Tea, a 20% discount on the Honey Green Tea and a 10% discount on the Passion Fruit Tea.

If $\mathbf{D} = \mathbf{TY}$ and $\mathbf{D}$ is the matrix that represents the promotional prices, in dollars, of the 3 flavours of bubble tea,

c) find the value of k such that $\mathbf{T} = \begin{pmatrix} 0.75 & 0 & 0 \\ 0 & 0.8 & 0 \\ 0 & 0 & k \end{pmatrix}$.

d) evaluate $\mathbf{D}$,

e) by using matrix multiplication, find the total sales of bubble tea on 1st July given that the number of cups of Earl Grey Tea, Honey Green Tea and Passion Fruit Tea sold on that day were 85, 66 and 60 respectively.

a)

$$\mathbf{S} = \begin{pmatrix} 45 & 36 & 55 \\ 55 & 46 & 50 \end{pmatrix} \begin{pmatrix} 2.20 \\ 1.75 \\ 1.50 \end{pmatrix} = \begin{pmatrix} 244.5 \\ 276.5 \end{pmatrix}$$

The elements represent the sales for Day 1 and Day 2 respectively.

b)

$$\mathbf{R} = \begin{pmatrix} 1 & 1 \end{pmatrix} \begin{pmatrix} 244.5 \\ 276.5 \end{pmatrix} = (521)$$

The element represents the total sales for both days.

c) $k = 0.9$

d)

$$\mathbf{D} = \begin{pmatrix} 0.75 & 0 & 0 \\ 0 & 0.8 & 0 \\ 0 & 0 & 0.9 \end{pmatrix} \begin{pmatrix} 2.20 \\ 1.75 \\ 1.50 \end{pmatrix} = \begin{pmatrix} 1.65 \\ 1.4 \\ 1.35 \end{pmatrix}$$

e)

$$\begin{pmatrix} 85 & 66 & 60 \end{pmatrix} \begin{pmatrix} 1.65 \\ 1.4 \\ 1.35 \end{pmatrix} = (313.65)$$

Elementary Math Topical (Matrices)

Question 8:

The table below shows the number of ice-cream cones sold and the selling price for each flavour on a particular weekend in the Zoo.

Number of cones sold	Vanilla	Chocolate	Coffee
Saturday	40	59	22
Sunday	52	68	34
Price per cone	$0. 90	$1.20	$1.10

a) If matrix A = $\begin{pmatrix} 40 & 59 & 22 \\ 52 & 68 & 34 \end{pmatrix}$ and matrix B = $\begin{pmatrix} 0.9 \\ 1.2 \\ 1.1 \end{pmatrix}$, find $4AB$

b) Explain what matrix $4AB$ represents.

a)

$$4\mathbf{AB} = \mathbf{4}\begin{pmatrix} 40 & 59 & 22 \\ 52 & 68 & 34 \end{pmatrix}\begin{pmatrix} 0.9 \\ 1.2 \\ 1.1 \end{pmatrix} = \begin{pmatrix} 524 \\ 663.2 \end{pmatrix}$$

b) The sales for 4 Saturdays and Sundays respectively.

Elementary Math Topical (Matrices)

Question 9:

Ismart tour agency is well known for their Japan and Korea packages.

The matrix, ***L***, shows the average number of people buying tour packages to Japan and Korea per week in the month of May and June.

$$L = \begin{array}{c} \begin{matrix} \text{Japan} & \text{Korea} \end{matrix} \\ \begin{pmatrix} 25 & 32 \\ 30 & 40 \end{pmatrix} \end{array} \begin{matrix} \text{May} \\ \text{June} \end{matrix}$$

a) Assuming that there are 4 weeks in each month, evaluate matrix $M = 4L$.

The price of the Japan and Korea package is $1688 and $1458 respectively.

b) Represent the price of the tour package by a 2×1 column matrix N.

c) Evaluate the matrix $R = MN$.

d) State what the elements of R represent.

e) Evaluate $\frac{1}{2}(1 \quad 1)R$ and explain what the answer represents.

a)

$$\mathbf{M} = 4\begin{pmatrix} 25 & 32 \\ 30 & 40 \end{pmatrix} = \begin{pmatrix} 100 & 128 \\ 120 & 160 \end{pmatrix}$$

b)

$$\mathbf{N} = \begin{pmatrix} 1688 \\ 1458 \end{pmatrix}$$

c)

$$\mathbf{R} = \begin{pmatrix} 100 & 128 \\ 120 & 160 \end{pmatrix}\begin{pmatrix} 1688 \\ 1458 \end{pmatrix} = \begin{pmatrix} 355424 \\ 435840 \end{pmatrix}$$

d) The elements represent the total sales for Japan and Korea in a month

e)

$$\frac{1}{2}(1 \quad 1)\begin{pmatrix} 355424 \\ 435840 \end{pmatrix} = (395632)$$

The element represents the average sales for the month.

Elementary Math Topical (Matrices)

Question 10:

A garment factory makes dresses and shirts.

The following table represents the various components used in making one dress and one shirt.

	Cloth (unit)	Labour (unit)	Others (unit)
Per Dress	6	8	3
Per Shirt	4	5	3

a) Represent the data in the above table by a 2×3 matrix **M**.

b) The cost of cloth is \$12/unit, the cost of labour is \$8/unit and the cost of others is \$1.20/unit. Write down a matrix **C**, such that **MC** gives the total cost of producing one dress and one shirt.

c) Evaluate **MC**.

Shop *A* ordered 20 dresses and 35 shirts, Shop *B* ordered 42 dresses and 36 shirts and Shop *C* ordered 22 dresses and 69 shirts from the garment factory. This data can be represented by matrix **P**.

d) Find **PMC** and interpret what the results mean.

a)

$$\mathbf{M} = \begin{pmatrix} 6 & 8 & 3 \\ 4 & 5 & 3 \end{pmatrix}$$

b)

$$\mathbf{C} = \begin{pmatrix} 12 \\ 8 \\ 1.2 \end{pmatrix}$$

c)

$$\mathbf{MC} = \begin{pmatrix} 6 & 8 & 3 \\ 4 & 5 & 3 \end{pmatrix} \begin{pmatrix} 12 \\ 8 \\ 1.2 \end{pmatrix} = \begin{pmatrix} 139.6 \\ 91.6 \end{pmatrix}$$

d)

$$\mathbf{PMC} = \begin{pmatrix} 20 & 35 \\ 42 & 36 \\ 22 & 69 \end{pmatrix} \begin{pmatrix} 139.6 \\ 91.6 \end{pmatrix} = \begin{pmatrix} 5998 \\ 9160.8 \\ 9391.6 \end{pmatrix}$$

The elements represent the total cost of each shop respectively.

Elementary Math Topical (Matrices)

Question 11:

The table below shows the fares of 3 types of taxis in Singapore.

		Normal	Limousine	Chrysler
Flag-down Fare	Inclusive of first km or less	$3.20	$3.90	$5.00
Distance Rate Fare	Every 1 km thereafter up to 10 km	$0.50	$0.60	$0.80
	Every 1 km thereafter after 10 km	$0.40	$0.50	$0.70
Waiting Time Fare	Every 1 minute of waiting or less	$0.30	$0.50	$0.60

a) If Ahmad takes a normal taxi for a distance of 13 km with a waiting time of 3 minutes, show that he needs to pay $9.90.

b) Kelly travels a total distance of 15 km and waited in traffic for an estimated time of 8 minutes. Matrix A below represents the distanced travelled by Kelly and her waiting time in the taxi.

$$A = \begin{pmatrix} 1 & a & 4 & b \end{pmatrix}$$

Explain why a = 10 and b = 8.

c) The information about the fares in the table can be represented by matrix $B = \begin{pmatrix} 3.2 & 3.9 & 5 \\ 0.5 & 0.6 & 0.8 \\ 0.4 & 0.5 & 0.7 \\ 0.3 & 0.5 & 0.6 \end{pmatrix}$

Calculate, using a matrix operation involving *A* and *B*, the taxi fare Kelly would have to pay if she took the 3 different types of taxis.

d) During peak hour, the surcharge for normal, limousine and Chrysler are 25%, 20% and 30% of the total fare respectively.

By using matrix multiplication, find the amount of taxi fare Kelly has to pay if she took the 3 different types of taxis.

a)

$$\text{Total amount} = 3.2 + 10 \times 0.5 + 2 \times 0.4 + 3 \times 0.3 = \$9.90$$

b) a represent the number of km for the distance rate fare of \$0.4 per km and b represent the number of minutes of waiting time.

c)

$$(1 \quad 10 \quad 4 \quad 8)\begin{pmatrix} 3.2 & 3.9 & 5 \\ 0.5 & 0.6 & 0.8 \\ 0.4 & 0.5 & 0.7 \\ 0.3 & 0.5 & 0.6 \end{pmatrix} = (12.2 \quad 15.9 \quad 20.6)$$

Normal: \$12.20 Limousine: \$15.90 Chrysler: \$20.60

d)

$$(12.2 \quad 15.9 \quad 20.6)\begin{pmatrix} 1.25 & 0 & 0 \\ 0 & 1.2 & 0 \\ 0 & 0 & 1.3 \end{pmatrix} = (15.25 \quad 19.08 \quad 26.78)$$

Normal: \$15.25 Limousine: \$19.08 Chrysler: \$26.78

Question 12:

The table below shows the number of cups of yoghurt of two flavors, Peach and Mango,

sold at three dessert shops in August and September.

	Selling Price ($)	August		September	
		Peach	Mango	Peach	Mango
Shop *A*	3.50	210	320	305	110
Shop *B*	3.20	250	430	95	350
Shop *C*	4.00	160	220	240	180

The information for the number of cups of yoghurt sold in August can be represented by the matrix **Q**

$$= \begin{pmatrix} 210 & 320 \\ 250 & 430 \\ 160 & 220 \end{pmatrix}$$

a) Represent the selling price of the yoghurts in the three shops as a row matrix **P**.

b) Write down a 3×2 matrix **R** to represent the number of cups of yoghurt sold in September.

c) Given that **T** = **Q** + **R**, evaluate **T**.

d) Explain what the elements in **T** represent.

e) Given that **N** = **PT**, evaluate **N**.

f) Explain what the elements in **N** represent.

During a promotion, the amount of sales for Peach yoghurt increased by 20% and the amount of sales for Mango yoghurt increased by 30%.

g) The elements of the matrix **S**, where **S** = **NX**, represent the total amount of sales for each type of yoghurt during the promotion. Evaluate **S**.

h) Using matrix multiplication, find the total amount of sales for the three shops during the promotion.

a)

$$\mathbf{P} = (3.5 \quad 3.2 \quad 4)$$

b)

$$\mathbf{R} = \begin{pmatrix} 305 & 110 \\ 95 & 350 \\ 240 & 180 \end{pmatrix}$$

c)

$$\mathbf{T} = \mathbf{Q} + \mathbf{R} = \begin{pmatrix} 210 & 320 \\ 250 & 430 \\ 160 & 220 \end{pmatrix} + \begin{pmatrix} 305 & 110 \\ 95 & 350 \\ 240 & 180 \end{pmatrix} = \begin{pmatrix} 515 & 430 \\ 345 & 780 \\ 400 & 400 \end{pmatrix}$$

d) The elements represent the total number of yoghurt sold in August and September of each shop and each flavours respectively.

e)

$$\mathbf{N} = \mathbf{PT} = (3.5 \quad 3.2 \quad 4)\begin{pmatrix} 515 & 430 \\ 345 & 780 \\ 400 & 400 \end{pmatrix} = (4506.5 \quad 5601)$$

f) The elements represent the total sales for each flavour respectively.

g)

$$\mathbf{S} = (4506.5 \quad 5601)\begin{pmatrix} 1.2 & 0 \\ 0 & 1.3 \end{pmatrix} = (5407.8 \quad 7281.3)$$

h)

$$(5407.8 \quad 7281.3)\begin{pmatrix} 1 \\ 1 \end{pmatrix} = (12689.1)$$

The total sales during the promotion is $12689.10.

Elementary Math Topical (Matrices)

Question 13:

The table below shows the number of packets of chocolates of four brands:

A, *B*, *C* and *D,* sold at 3 grocery shops.

	Brand *A*	Brand *B*	Brand *C*	Brand *D*
Shop 1	5	3	1	1
Shop 2	11	6	8	5
Shop 3	8	5	4	3

A packet of chocolate costs \$15 for Brand *A*, \$10 for Brand *B*, \$8 for Brand *C* and \$5 for Brand *D*.

The information can be represented by the matrix $\boldsymbol{P} = \begin{pmatrix} 15 \\ 10 \\ 8 \\ 5 \end{pmatrix}$,

a) Write down a 3 × 4 matrix $\boldsymbol{Q}$ that represents the data in the table above,

b) Evaluate $\boldsymbol{QP}$,

c) Explain what the elements in $\boldsymbol{QP}$ represent.

Brand *A* comes in packets of 18 g, Brand *B* in packets of 20 g, Brand *C* in packets of 15 g and Brand *D* in packets of 10 g.

d) Write down a 4 × 1 matrix $\boldsymbol{S}$ such that matrix $\boldsymbol{QS}$ represents the total number of grams of chocolates sold by each shop.

e) Evaluate $\boldsymbol{QS}$.

f) Hence find the average cost of chocolate per gram at Shop 2.

a)

$$\mathbf{Q} = \begin{pmatrix} 5 & 3 & 1 & 1 \\ 11 & 6 & 8 & 5 \\ 18 & 5 & 4 & 3 \end{pmatrix}$$

b)

$$\mathbf{QP} = \begin{pmatrix} 5 & 3 & 1 & 1 \\ 11 & 6 & 8 & 5 \\ 18 & 5 & 4 & 3 \end{pmatrix} \begin{pmatrix} 15 \\ 10 \\ 8 \\ 5 \end{pmatrix} = \begin{pmatrix} 118 \\ 314 \\ 367 \end{pmatrix}$$

c) The elements represent the sales for each shop respectively.

d)

$$\mathbf{S} = \begin{pmatrix} 18 \\ 20 \\ 15 \\ 10 \end{pmatrix}$$

e)

$$\mathbf{QS} = \begin{pmatrix} 5 & 3 & 1 & 1 \\ 11 & 6 & 8 & 5 \\ 18 & 5 & 4 & 3 \end{pmatrix} \begin{pmatrix} 18 \\ 20 \\ 15 \\ 10 \end{pmatrix} = \begin{pmatrix} 175 \\ 488 \\ 514 \end{pmatrix}$$

f)

$$\text{Average cost per gram} = \frac{314}{488} = \$0.64$$

Elementary Math Topical (Matrices)

Question 14:

The following table shows the number of pens, books and files bought by May and June at a stationery shop.

	Pens	Books	Files
May	5	3	10
June	8	7	4

The cost of a pen is $2.60, a book is $6.00 and a file is $4.50.

a) Represent the data in the above table by a 2 x 3 matrix **M**.

b) Represent the costs in a 3 x 1 column matrix **N**.

c) Evaluate the matrix **T** = **MN**.

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

e) During a sale, the stationery shop decided to give a discount. The cost of the stationery is reduced by 10% for a pen, 25% for a book and 20% for a file.

Find a 3 x 1 matrix **S** which will give the sale price of the stationeries.

f) Hence, using matrix multiplication, calculate the revised amount of money that May and June have to pay respectively during the sale.

a)

$$\mathbf{M} = \begin{pmatrix} 5 & 3 & 10 \\ 8 & 7 & 4 \end{pmatrix}$$

b)

$$\mathbf{N} = \begin{pmatrix} 2.6 \\ 6 \\ 4.5 \end{pmatrix}$$

c)

$$\mathbf{T} = \begin{pmatrix} 5 & 3 & 10 \\ 8 & 7 & 4 \end{pmatrix}\begin{pmatrix} 2.6 \\ 6 \\ 4.5 \end{pmatrix} = \begin{pmatrix} 76 \\ 80.8 \end{pmatrix}$$

d) The elements represent cost of each shop respectively.

e)

$$\mathbf{S} = \begin{pmatrix} 0.9 & 0 & 0 \\ 0 & 0.75 & 0 \\ 0 & 0 & 0.8 \end{pmatrix} \begin{pmatrix} 2.6 \\ 6 \\ 4.5 \end{pmatrix} = \begin{pmatrix} 2.34 \\ 4.5 \\ 3.6 \end{pmatrix}$$

f)

$$\begin{pmatrix} 5 & 3 & 10 \\ 8 & 7 & 4 \end{pmatrix} \begin{pmatrix} 2.34 \\ 4.5 \\ 3.6 \end{pmatrix} = \begin{pmatrix} 61.2 \\ 64..62 \end{pmatrix}$$

May: $61.20, June: $64.62

Elementary Math Topical (Matrices)

Question 15:

Sandy is a Yoga and Pilates instructor. She offers basic, intermediate and advanced sessions. Each student has a 4-week block of sessions with one session per week. The matrix, **P**, shows the number of students she teaches each week in one 4-week block.

$$\mathbf{P} = \begin{array}{c} \begin{matrix} \textit{Basic} & \textit{Intermediate} & \textit{Advanced} \end{matrix} \\ \begin{pmatrix} 2 & 1 & 3 \\ 3 & 2 & 0 \end{pmatrix} \end{array} \begin{matrix} \\ \textit{Yoga} \\ \textit{Pilates} \end{matrix}$$

a) Evaluate the matrix $\mathbf{N} = 4\mathbf{P}$

b) Sandy charges \$30 for each basic session, \$35 for each intermediate session and \$40 for each advanced session. Represent the session charges in a 3×1 column matrix **M**.

c) Evaluate the matrix $\mathbf{Q} = \mathbf{NM}$.

d) State what the elements of **Q** represent.Sandy wants to attract more students so she reduces her prices by 25%. The number of students enrolling for basic and intermediate sessions increased by twice the number but the number of students enrolling for advanced sessions remained unchanged.

e) Calculate the total amount of money she collects for this 4-week block after the reduction in price.

a)

$$\mathbf{N} = 4\begin{pmatrix} 2 & 1 & 3 \\ 3 & 2 & 0 \end{pmatrix} = \begin{pmatrix} 8 & 4 & 12 \\ 12 & 8 & 0 \end{pmatrix}$$

b)

$$\mathbf{M} = \begin{pmatrix} 30 \\ 35 \\ 40 \end{pmatrix}$$

c)

$$\mathbf{Q} = \begin{pmatrix} 8 & 4 & 12 \\ 12 & 8 & 0 \end{pmatrix}\begin{pmatrix} 30 \\ 35 \\ 40 \end{pmatrix} = \begin{pmatrix} 860 \\ 640 \end{pmatrix}$$

d) The elements represent the sales for Yoga and Pilates class for a 4 week bloc respectively.

e)

$$\begin{pmatrix} 1 & 1 \end{pmatrix}\begin{pmatrix} 4 & 2 & 3 \\ 6 & 4 & 0 \end{pmatrix}\begin{pmatrix} 22.5 \\ 26.25 \\ 30 \end{pmatrix} = (472.5)$$

The total amount of money collected in this 4 week bloc is \$472.50.

Elementary Math Topical (Matrices)

Question 16:

Two tour agents, Michelle and Lucy sell tour packages to Tokyo, Bangkok and Greece.

The table below shows the number of tour packages each of them sold in December.

Packages	**Michelle**	**Lucy**
Tokyo	25	20
Bangkok	38	35
Greece	46	50

a) Represent the information above in a 3×2 matrix, **D**.

b) The sales commission for the tour packages to Tokyo, Bangkok and Greece are \$200, \$150 and \$100 respectively. Using matrix multiplication, find the total sales commission earned by Michelle and Lucy each.

c) Given that $\mathbf{S} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$, evaluate **DS.**

d) Explain what each element in matrix **DS** represent.

e) The prices of the tour packages to Tokyo, Bangkok and Greece are \$2400, \$1900 and \$2600 respectively. Using matrix multiplication, calculate the total sales amount collected by Michelle and Lucy.

a)

$$\mathbf{D} = \begin{pmatrix} 25 & 20 \\ 38 & 35 \\ 46 & 50 \end{pmatrix}$$

b)

$$(200 \quad 150 \quad 100)\begin{pmatrix} 25 & 20 \\ 38 & 35 \\ 46 & 50 \end{pmatrix} = (15300 \quad 14250)$$

Michelle: \$15300, Lucy: \$14250

c)

$$\mathbf{DS} = \begin{pmatrix} 25 & 20 \\ 38 & 35 \\ 46 & 50 \end{pmatrix}\begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 45 \\ 73 \\ 96 \end{pmatrix}$$

d) The element represent the number of packages sold for each place respectively.

e)

$$(2400 \quad 1900 \quad 2600)\begin{pmatrix}45\\73\\96\end{pmatrix} = (496300)$$

The total sales is $496300.