

4.2 Exercises - Applications of Basic Operations

Complete each item on separate paper.

1. Sales and Commissions

Ms. Fong and Mr. Petris are salespeople for a new car agency that sells only two models. August was the last month for this year's models, and next year's models were introduced in September. Gross dollar sales for each month are given in the following matrices:

$$\begin{array}{c}
 \text{Fong} \\
 \text{Petris}
 \end{array}
 \begin{array}{c}
 \text{AUGUST SALES} \\
 \text{Compact} \quad \text{Luxury} \\
 \left[\begin{array}{cc}
 \$36,000 & \$72,000 \\
 \$72,000 & \$0
 \end{array} \right] = A
 \end{array}
 \quad
 \begin{array}{c}
 \text{SEPTEMBER SALES} \\
 \text{Compact} \quad \text{Luxury} \\
 \left[\begin{array}{cc}
 \$144,000 & \$288,000 \\
 \$180,000 & \$216,000
 \end{array} \right] = B
 \end{array}$$

For example, Ms. Fong had \$36,000 in compact sales in August and Mr. Petris had \$216,000 in luxury car sales in September.

- What were the combined dollar sales in August and September for each salesperson and each model?
- What was the increase in dollar sales from August to September?
- If both salespeople receive a 3% commission on gross dollar sales, compute the commission for each salesperson for each model sold in September.

2. **Cost Analysis.** A company with two different plants manufactures guitars and banjos. Its production costs for each instrument are given in the following matrices:

$$\begin{array}{c}
 \text{Materials} \\
 \text{Labor}
 \end{array}
 \begin{array}{c}
 \text{Plant X} \\
 \text{Guitar} \quad \text{Banjo} \\
 \left[\begin{array}{cc}
 \$30 & \$25 \\
 \$60 & \$80
 \end{array} \right] = A
 \end{array}
 \quad
 \begin{array}{c}
 \text{Plant Y} \\
 \text{Guitar} \quad \text{Banjo} \\
 \left[\begin{array}{cc}
 \$36 & \$27 \\
 \$54 & \$74
 \end{array} \right] = B
 \end{array}$$

Find $\frac{1}{2}(A + B)$, the average cost of production for the two plants.

3. If both labor and materials at plant X in item 2 are increased 20%, write the matrix operations (in terms of A and B) used to find the new average cost of production for the two plants.

4.

Fruit Farms

| | Peaches | Apricots | Plums | Apples |
|--------|---------|----------|-------|--------|
| Income | 26 | 18 | 32 | 19 |

| Location | Peaches | Apricots | Plums | Apples |
|----------|---------|----------|-------|--------|
| Farm 1 | 165 | 217 | 430 | 290 |
| Farm 2 | 243 | 190 | 235 | 175 |
| Farm 3 | 74 | 150 | 198 | 0 |

- Write matrix A so that it represents the location/production table.
- Write matrix B so that it represents the income by fruit table and so that it can be multiplied by matrix A .
- Calculate the total income for each farm.
- Find the total income of all three farms.

Use matrix multiplication to complete items 5 and 6. You must write the matrix multiplication to receive credit.

5. In a three team track meet, the following numbers of 1st, 2nd, and 3rd place finishes were recorded.

| School | First Place | Second Place | Third Place |
|---------|-------------|--------------|-------------|
| Lee | 4 | 10 | 6 |
| Central | 7 | 6 | 9 |
| Clarke | 8 | 3 | 4 |

If 5 points are awarded for 1st, 3 points for 2nd, and 1 point for 3rd, determine who won the track meet.

6. On two days, a store sold the following amounts of pencils, erasers, and binders.

| | Pencils | Erasers | Binders |
|---------|---------|---------|---------|
| Monday | 48 | 7 | 9 |
| Tuesday | 54 | 10 | 6 |

If the price for each pencil, eraser, and binder, respectively, is \$0.20, \$0.35, and \$2.85, how much was made each day?

7.

$$M = \begin{bmatrix} \text{Cereal A} & \text{Cereal B} \\ 4 \text{ g/oz} & 2 \text{ g/oz} \\ 20 \text{ g/oz} & 16 \text{ g/oz} \\ 3 \text{ g/oz} & 1 \text{ g/oz} \end{bmatrix} \begin{matrix} \text{Protein} \\ \text{Carbohydrate} \\ \text{Fat} \end{matrix}$$

$$N = \begin{bmatrix} \text{Mix X} & \text{Mix Y} & \text{Mix Z} \\ 15 \text{ oz} & 10 \text{ oz} & 5 \text{ oz} \\ 5 \text{ oz} & 10 \text{ oz} & 15 \text{ oz} \end{bmatrix} \begin{matrix} \text{Cereal A} \\ \text{Cereal B} \end{matrix}$$

- Find the amount of protein in mix X .
- Find the amount of fat in mix Z .
- Discuss possible interpretations of the elements in the matrix products MN and NM .
- If either of the products MN or NM has a meaningful interpretation, find the product and label its rows and columns.