**Holiday Homework Required:** First day Term one

**Recommended Work:** Chapter 26

**Resources Required for Subject:**
- Text book
- Graphic Calculator

**Key Links:** NA

**Additional Resources:** Nil
<table>
<thead>
<tr>
<th>Week starting</th>
<th>Class Work</th>
<th>Homework</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holiday Homework</td>
<td>Ex 26A Q1,2,3</td>
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<tr>
<td>Holiday Homework</td>
<td>Ex 26B Q1 to 6</td>
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<tr>
<td>Holiday Homework</td>
<td>Ex 26 C Q1 to 5</td>
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<tr>
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<td>Ex 26 D Q 1 to 7</td>
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1: 02/2
- Ex 27A Q1,2,3
- Ex 27B Q1,2,3,4,5,6
- Ex 27C Q1,2,3

2: 9/2
- Ex 27D Q1,2
- Ex 27E Q1,2,3
- Ex 27F Q1,2,3,4,5,6,7,8,9,10

3: 16/2
- Cp 27 Review Questions
- SAC 1: 20 points

CORE

4: 23/2
- Ex 1A Q1,2,3,4

4
- 1B Q1,3,5,7
- 1C Q1,3,5,7,9
- 1D Q1,3,
- 1E Q1,3,5,7

5: 02/3
- Chapter Review all questions

5
- Ex 2A Q1,3,5,7
- Ex 2B Q1,3,5
- Ex 2C Q1,3
- Ex 2D Q1,3

6: 09/3
- Chapter Review all questions

6
- Ex 3A Q1,3,5,7
- Ex 3B Q1,3,5,7
- Ex 3C Q1,3,5
- Ex 3D Q1,2

7: 16/3
- Ex 4A Q1,3

8: 23/3
- Ex 4B Q2
- Ex 4C Q1,3
- Ex 4D Q1,3
- Ex 4E Q1,2,3

8
- Ex 4F Q1,2,3

9: 13/4
- Ex 4G Q1,2,3

9
- Ex 4H Q1,2,3,4
- Ex 4I Q1

9
- Chapter Review all questions

Finish Cp Review

Finish Cp Review
<table>
<thead>
<tr>
<th>Time</th>
<th>Exercise Details</th>
<th>Notes</th>
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<tbody>
<tr>
<td>10:27</td>
<td>Ex 5B Q1,3,5,7</td>
<td>Q2,4,6,8</td>
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<tr>
<td>10</td>
<td>Ex 5C Q1,3,5,7,9,11,13</td>
<td>Q2,4,6,8,10,12</td>
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<td>Ex 5E Q1,2</td>
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<td>11:04</td>
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<tr>
<td>11</td>
<td>Ex 6A Q1,3,5</td>
<td>Q2,4</td>
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<td>Q2</td>
</tr>
<tr>
<td>11</td>
<td>Ex 6C Q1,3</td>
<td>Q2</td>
</tr>
<tr>
<td>11</td>
<td>Ex 6D Q1,2</td>
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<tr>
<td>11</td>
<td>Ex 6E Q1,2</td>
<td></td>
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<tr>
<td>11</td>
<td>Ex 6F Q1,3,5,7,9</td>
<td>Q2,4,6,8,10</td>
</tr>
<tr>
<td>11</td>
<td>Ex 6G Q1,3,5</td>
<td>Q2,4</td>
</tr>
<tr>
<td>12:11</td>
<td>Chapter Review all questions &amp; SAC Revision</td>
<td>Finish Cp Review</td>
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<tr>
<td>12</td>
<td>Ex7A Q1,3,5,7,9</td>
<td>Q2,4,6,8</td>
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<tr>
<td>12</td>
<td>Ex 7B Q1,3,5</td>
<td>Q2,4,6</td>
</tr>
<tr>
<td>12</td>
<td>Ex 7C Q1,3,5</td>
<td>Q2,4,6</td>
</tr>
<tr>
<td>12</td>
<td>Ex 7D Q1,3,5,7,9</td>
<td>Q2,4,6,8</td>
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<td>13:18</td>
<td>Ex7E Q1,3,5,7,9</td>
<td>Q2,4,6,8</td>
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<td>Chapter Review all questions &amp; SAC Revision</td>
<td>Finish Cp Review</td>
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<tr>
<td>25/5</td>
<td>Application Task 1 SAC: 40 points</td>
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<tr>
<td>29/5</td>
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</tbody>
</table>
Matrices: Revision Holiday Homework

Student name: ________________________________

Marks are given for clear explanations, working and correct answers.

1. The matrix shows the number of hours that Bob and Estie have been studying each subject during the past week.

\[
\begin{bmatrix}
\text{English} & \text{Maths} & \text{History} \\
\text{Bob} & 2 & 5 & 2 \\
\text{Estie} & 3 & 4 & 1
\end{bmatrix}
\]

a. How many hours did Bob spend studying Maths? (1 mark)
b. On which subject did Estie spend the least time? (1 mark)
c. What was the total number of hours that each person spent studying? (2 marks)
d. What was the total time spent studying Maths? (1 mark)

2. a. Give the order of the matrix \( A \).

\[
A = \begin{bmatrix}
3 & -2 \\
0 & 7 \\
-6 & 4
\end{bmatrix}
\]

(1 mark)
b. State the value of the elements:

i. \( a_{2,1} \)

ii. \( a_{1,2} \)

iii. \( a_{2,2} \) (3 marks)
3 Write a matrix to represent the connections between A, B and C in the network shown.

\[
A \rightarrow B \rightarrow C
\]

(3 marks)

4 Using the matrices B and C:

\[
B = \begin{bmatrix} 3 & -2 \\ 1 & 6 \end{bmatrix} \quad C = \begin{bmatrix} -4 & -5 \\ 7 & 8 \end{bmatrix}
\]

Find:

a. \( B + C \)

b. \( B - C \)

c. \( 5B \)

d. \( 3B - 2C \)

e. \( BC \)

f. \( B^{-1} \)

(2 + 2 + 2 + 4 + 4 + 4 = 18 marks)

5 Dodgy Dave’s Car Yard, “Where Bargains are Hard to Drive”, recorded the sales of cars and vans by Dave and Dudley in the matrix \( S \).

Each car sold for $10 000 and came with 12 months supply of free petrol. Each van sold for $9000 and came with 6 months supply of free petrol. This is recorded in matrix \( P \).

\[
S = \begin{bmatrix} \text{Dave} & 8 & 7 \\ \text{Dudley} & 5 & 9 \end{bmatrix} \quad P = \begin{bmatrix} \text{car} & 10000 & 12 \\ \text{van} & 9000 & 6 \end{bmatrix}
\]

Use matrix multiplication to find a matrix showing the total value of the sales and the total number of months of free petrol given by each salesman. (6 marks)

6 Use matrix methods on your graphics calculator to solve the simultaneous equations:

\[
7x - 2y = 31 \\
9x - 4y = 47
\]

(6 marks)
**Chapter 11 Review assignment answers**

1. a. 5 hr  
   b. History  
   c. Bob 9 hr, Estie 8 hr  
   d. 9 hr

2. a. $3 \times 2$  
   b. (i) 0  
      (ii) −2  
      (iii) 7

3. 

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>C</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

4. a. $\begin{bmatrix} -1 & -7 \\ 8 & 14 \end{bmatrix}$  
   b. $\begin{bmatrix} 7 & 3 \\ -6 & -2 \end{bmatrix}$  
   c. $\begin{bmatrix} 15 & -10 \\ 5 & 30 \end{bmatrix}$  
   d. $\begin{bmatrix} 17 & 4 \\ -11 & 2 \end{bmatrix}$  
   e. $\begin{bmatrix} -26 & -31 \\ 38 & 43 \end{bmatrix}$  
   f. $\begin{bmatrix} 0.3 & 0.1 \\ -0.05 & 0.15 \end{bmatrix}$
Matrices: Revision Holiday Homework

\[
\begin{array}{c|c|c}
\$ & Petrol \\
\hline
5 & Dave & 143000 & 138 \\
    & Dudley & 131000 & 114 \\
\end{array}
\]

6) $x = 3$, $y = -5$
Applications of matrices

Application 1: Simultaneous equations

As we saw in questions 11 and 12 from exercise 1C, matrices may be used to solve linear simultaneous equations. The pair of equations may be written in the form $AX = B$

where $A$ is the matrix of the coefficients of $x$ and $y$ in the equations, $X = \begin{bmatrix} x \\ y \end{bmatrix}$ and $B$ is the matrix of the numbers on the right-hand side of the simultaneous equations.

$A$ is called the coefficient matrix.

For example, the simultaneous equations:

$\begin{align*}
ax + by &= e \\
(cx + dy) &= f
\end{align*}$

can be expressed as the matrix equation:

$\begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} e \\ f \end{bmatrix}$

which is of the form $AX = B$.

As we have seen, this equation can be solved by using:

$A^{-1}AX = A^{-1}B$

$X = A^{-1}B$

**WORKED Example 10**

Solve $3x - y = 16$ and $2x + 5y = 5$ by matrix methods.

**THINK**

1. Write the simultaneous equations as a matrix equation.

$\begin{bmatrix} 3 & -1 \\ 2 & 5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 16 \\ 5 \end{bmatrix}$

2. Calculate the inverse of the coefficient matrix.

$\det \begin{bmatrix} 3 & -1 \\ 2 & 5 \end{bmatrix} = 15 + 2 = 17$

The inverse is $\frac{1}{17} \begin{bmatrix} 5 & 1 \\ -2 & 3 \end{bmatrix}$

3. Multiply both sides of the equation by this inverse matrix.

$\frac{1}{17} \begin{bmatrix} 5 & 1 \\ -2 & 3 \end{bmatrix} \begin{bmatrix} 3 & -1 \\ 2 & 5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{17} \begin{bmatrix} 5 & 1 \\ -2 & 3 \end{bmatrix} \begin{bmatrix} 16 \\ 5 \end{bmatrix}$

4. Remember $A^{-1}A = I$ and $IX = X$.

$\frac{1}{17} \begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{17} \begin{bmatrix} 85 \\ -17 \end{bmatrix}$

5. Simplify this matrix.

$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 5 \\ -1 \end{bmatrix}$

6. Write the answers in the form $x = \ldots$ and $y = \ldots$

$x = 5$ and $y = -1$ is the solution of the simultaneous equations.

*Note: The solution can be checked by substituting $x = 5$ and $y = -1$ into the original equations.*
WORKED Example 11

In a large country town, there are three major supermarkets. Customers switch from one to another due to advertising, better service, prices and for other reasons. A survey of 1000 customers has revealed the following information for the past month.

Best Buys started with 40% of the market; 90% of its customers remained loyal to Best Buys but 5% changed to Great Groceries and 5% to Super Store.

Great Groceries started with a 36% market share; 85% remained loyal, 10% transferred to Best Buys and 5% to Super Store.

Super Store started with 24% of the customers; it lost 15% to Best Buys and 5% to Great Groceries, but 80% remained.

Summarise the information in matrix form and calculate the new market shares.

THINK

1. The information may be summarised in a $3 \times 3$ matrix with the rows representing retention rates and gains and the columns representing retention rates and losses. This may be called a transition matrix.

Row 1 shows that Best Buys retains 90% of its customers, gains 10% of Great Groceries’ customers and gains 15% of Super Store’s customers.

Column 1 indicates that Best Buys retains 90% of its customers, loses 5% to Great Groceries and loses 5% to Super Store.

2. Write the current market shares as a $3 \times 1$ matrix.

The market share matrix is

\[
\begin{bmatrix}
0.40 \\
0.36 \\
0.24
\end{bmatrix}
\]

3. The new market share will be the transition matrix, converted to decimal numbers, multiplied by the market share matrix.

The new market shares are Best Buys 43.2%, Great Groceries 33.8% and Super Store 23.0%.

4. Express the new market shares as percentages.

WRITE

<table>
<thead>
<tr>
<th></th>
<th>Best Buys</th>
<th>Great Groceries</th>
<th>Super Store</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retention rates and losses %</td>
<td>90</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Retention rates and gains %</td>
<td>5</td>
<td>85</td>
<td>5</td>
</tr>
<tr>
<td>Super Store</td>
<td>5</td>
<td>5</td>
<td>80</td>
</tr>
</tbody>
</table>

\[
\begin{bmatrix}
0.90 & 0.10 & 0.15 \\
0.05 & 0.85 & 0.05 \\
0.05 & 0.05 & 0.80
\end{bmatrix}
\begin{bmatrix}
0.40 \\
0.36 \\
0.24
\end{bmatrix} =
\begin{bmatrix}
0.432 \\
0.338 \\
0.230
\end{bmatrix}
\]

remember

1. Matrices may be used to solve simultaneous equations. The pair of equations may be written in the form $AX = B$, where $A$ is the matrix of the coefficients of $x$ and $y$ in the equations, $X = \begin{bmatrix} x \\ y \end{bmatrix}$ and $B$ is the column matrix for the numbers on the right-hand side of the simultaneous equations.

2. Matrices can also be used to summarise information which is in table form and solve related problems but care must be taken in setting up the matrices.
EXERCISE 1D

Applications of matrices

In the following exercise solve all problems manually then use a graphics calculator wherever appropriate to check your solutions.

1. Solve these simultaneous equations by matrix methods.
   a. \( 2x - 3y = 13 \) and \( x + 2y = 3 \)
   b. \( 3x + y = 9 \) and \( -2x + 5y = -6 \)
   c. \( -x + 4y = -2 \) and \( x - 5y = 0 \)
   d. \( 6x + 7y = 0 \) and \( 4x - 3y = 0 \)
   e. \( 4x + y = 20 \) and \( x - y = 0 \)
   f. \( 3x - 2y = 0 \) and \( x - y = 1 \)

2. Consider these two pairs of simultaneous equations:
   i. \( 3x - 2y = 4 \)
      \( 6x - 4y = 12 \)
   ii. \( 3x - 2y = 6 \)
      \( 6x - 4y = 12 \)
   a. Show by algebraic means that the simultaneous equations in i have no solution.
   b. Show that the simultaneous equations in ii have an infinite number of solutions.
   c. Write the equations in matrix form and explain how these facts are related to the determinant of the matrix of the coefficients.
   d. Draw, on two sets of axes, graphs of the two lines in each of i and ii.
   e. Explain how the graphs are related to parts a and b.

3. **Multiple choice**
   Consider the simultaneous equations:
   \( 3x - 2y = 5 \)
   \( y + 2x = 8 \)
   a. The coefficient matrix is:
      \[
      \begin{bmatrix}
      3 & -2 \\
      1 & 2 \\
      \end{bmatrix}
      \]
   b. The solution to the simultaneous equations is:
      A. \( x = 2, y = 3 \)
      B. \( x = 3, y = 2 \)
      C. \( x = \frac{13}{4}, y = \frac{19}{8} \)
      D. \( x = -2, y = 2 \)
      E. \( x = \frac{4}{3}, y = \frac{7}{3} \)

4. **Multiple choice**
   In an alternative Australian rules football game, a team gains \( x \) points for a goal and \( y \) points for a behind. In one game Geelong obtained 66 points by scoring 10 goals and 8 behinds and Essendon obtained 70 points from 12 goals and 5 behinds.
   a. This information is represented by which of the following matrix equations?
      \[
      \begin{bmatrix}
      10 & 8 \\
      12 & 5 \\
      \end{bmatrix}
      \begin{bmatrix}
      x \\
      y \\
      \end{bmatrix}
      =
      \begin{bmatrix}
      66 \\
      70 \\
      \end{bmatrix}
      \]
   b. The value of \( x - y \) is:
      A. 5
      B. 4
      C. 6
      D. 3
      E. 2

5. The sum of two numbers is 20 and their difference is 12. Find the numbers by setting up simultaneous equations and solving by matrix methods.
6. In a factory, two types of components are processed on two separate machines. The respective processing times on the first machine are 18 minutes and 21 minutes, while for the second machine the times are 4 minutes and 42 minutes. How many of each type of component should be processed in an 8-hour shift so that both machines are fully occupied?

7. In a swimming competition, 5 points are awarded for first place, 3 for second, 2 for third and 1 point for an unplaced result. The top competitors' results were:

<table>
<thead>
<tr>
<th>Name</th>
<th>No. of races competed in</th>
<th>First placings</th>
<th>Second placings</th>
<th>Third placings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rania</td>
<td>6</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Patricia</td>
<td>4</td>
<td>4</td>
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<td></td>
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<tr>
<td>Anh</td>
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<td>3</td>
<td>2</td>
<td></td>
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<td>Mayssa</td>
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<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Rachel</td>
<td>6</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Place the results and points in suitable matrices and use matrix multiplication to find the highest points scorer.

8. Cyril's circus arrived in town last week and during the week the number of adults, children and pensioners attending the circus was recorded for the first five shows (see table below).

<table>
<thead>
<tr>
<th></th>
<th>Adults</th>
<th>Children</th>
<th>Pensioners</th>
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</thead>
<tbody>
<tr>
<td>Monday</td>
<td>400</td>
<td>200</td>
<td>20</td>
</tr>
<tr>
<td>Tuesday</td>
<td>450</td>
<td>350</td>
<td>50</td>
</tr>
<tr>
<td>Wednesday</td>
<td>370</td>
<td>410</td>
<td>45</td>
</tr>
<tr>
<td>Thursday</td>
<td>290</td>
<td>380</td>
<td>70</td>
</tr>
<tr>
<td>Friday</td>
<td>420</td>
<td>530</td>
<td>65</td>
</tr>
</tbody>
</table>

The entry cost is $20 for adults, $6 for children and $5 for pensioners.

Set up the information in suitable matrices to find the total takings for the first five shows.
Exercise 1C - Multiplicative inverse and solving matrix equations

1. \[ AB = \begin{bmatrix} 0 & 1 \\ 0 & 1 \end{bmatrix}, \quad A^{-1} = \frac{1}{6}B, \quad B^{-1} = \frac{1}{6}A \]

2. \[ MN = -2 \begin{bmatrix} 0 & 1 \\ 0 & 1 \end{bmatrix}, \quad M^{-1} = -\frac{1}{2}N, \quad N^{-1} = -\frac{1}{2}M \]

3. \( a \begin{bmatrix} 5 \\ 2 \end{bmatrix} b \begin{bmatrix} 12 \\ -8 \end{bmatrix} c \begin{bmatrix} 7 \\ 14 \end{bmatrix} d \begin{bmatrix} -2 \\ 6 \end{bmatrix} \)

4. \( a \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} b \begin{bmatrix} -2 & 3 \\ -4 & 5 \end{bmatrix} c \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \)

5. \( C \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} D \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \)

6. Answers will vary.

7. \( a \begin{bmatrix} 1 \\ 2 \\ 0 \\ -2 \end{bmatrix} b \begin{bmatrix} 0 \\ 1 \\ 2 \\ 0 \end{bmatrix} c \begin{bmatrix} 1 \\ 2 \\ 0 \\ -2 \end{bmatrix} \)

8. \( D \) - det = 0, \( E \) - det = 0

9. \( A \begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix} \)

10. \( a \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} b \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} c \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \)

11. \( a \begin{bmatrix} 1 \\ 2 \\ 5 \\ 12 \end{bmatrix} b \begin{bmatrix} 3 \\ 4 \\ 5 \\ 6 \end{bmatrix} \)

12. \( a x = -2, y = 1 \\ b x = 1, y = 2 \\ c x = -2, y = 3 \\ d x = 4, y = 4 \)

Exercise 1D - Applications of matrices

1. \( a (5, -1) b (3, 0) c (10, 2) d (0, 0) e (4, 4) f (-2, -3) \)

2. \( a \) and \( b \) Answers will vary.

3. \( a x = -2, y = 1 \\ b x = 1, y = 2 \\ c x = -2, y = 3 \\ d x = 4, y = 4 \)

4. In i there are parallel lines; in ii there is only one line.

5. \( 16, 4 \) \( 15, 10 \) \( 7, 4 \) S51 070

Exercise 1E - Matrices and transformations

1. \( a \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix} b \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} c \begin{bmatrix} 2 \\ 3 \\ -1 \end{bmatrix} d \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \)

2. \( a \begin{bmatrix} 7 \\ 0 \end{bmatrix} b \begin{bmatrix} 0 \\ 1 \end{bmatrix} c \begin{bmatrix} 2 \\ 4 \end{bmatrix} d \begin{bmatrix} 0 \\ 0 \end{bmatrix} \)

3. \( a i (3, -1) ii (4, 2) iii (3, 4) iv (1, 3) \)

4. \( (0, -1), (-1, 0), (0, 1) \)

5. \( a \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} b \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} c \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} d \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix} \)

6. \( a (0, 2) b (1, 1) c (2, 3) d (0, 0) e (1, 0) f (1, 0) g (0, 1) h (1, 0) i (0, 1) j (1, 0) \)

7. \( a \begin{bmatrix} 1 \\ 1 \\ 2 \\ 3 \end{bmatrix} b \begin{bmatrix} 1 \\ 1 \\ 2 \\ 3 \end{bmatrix} c \begin{bmatrix} 1 \\ 1 \\ 2 \\ 3 \end{bmatrix} \)

8. \( a \begin{bmatrix} 0 \\ 0 \\ 1 \\ 1 \end{bmatrix} b \begin{bmatrix} 1 \\ 1 \\ 2 \\ 3 \end{bmatrix} c \begin{bmatrix} 1 \\ 1 \\ 2 \\ 3 \end{bmatrix} \)

<table>
<thead>
<tr>
<th>Transformation</th>
<th>Matrix</th>
<th>Length</th>
<th>Gradient</th>
<th>Angle</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Translation</td>
<td>[ \begin{bmatrix} 2 \ 4 \end{bmatrix} ] No change No change No change No change</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reflection</td>
<td>[ \begin{bmatrix} -1 \ 0 \ 1 \end{bmatrix} ] No change No change No change No change</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotation</td>
<td>[ \begin{bmatrix} 0 \ -1 \ 1 \end{bmatrix} ] No change No change No change No change</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. \( a \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{bmatrix} \)

10. \( a \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{bmatrix} \)

11. \( a \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{bmatrix} \)

12. \( a \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{bmatrix} \)

13. \( a \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{bmatrix} \)

14. \( a \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{bmatrix} \)

15. \( a \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{bmatrix} \)