

1. What are the dimensions (rows  $\times$  columns) for each matrix? What is the transpose and dimensions for each matrix?

$$\underline{\underline{\mathbf{A}}} = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

$$\underline{\underline{\mathbf{B}}} = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$$

$$\underline{\underline{\mathbf{C}}} = \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix}$$

2. Perform the matrix multiplication, if the inner dimensions match.

row vector  $\underline{\underline{\mathbf{v}}} = [0, -1]$

$$\underline{\underline{\mathbf{v}}} \underline{\underline{\mathbf{A}}} =$$

$$\underline{\underline{\mathbf{v}}}^T \underline{\underline{\mathbf{A}}} =$$

$$\underline{\underline{\mathbf{A}}} \underline{\underline{\mathbf{v}}} =$$

$$\underline{\underline{\mathbf{A}}} \underline{\underline{\mathbf{v}}}^T =$$

3. Perform the matrix multiplication to produce an identity matrix (I).

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \begin{bmatrix} -2 & 1 \\ \frac{3}{2} & -\frac{1}{2} \end{bmatrix} =$$

$$\begin{bmatrix} 1 & -2 \\ -3 & 4 \end{bmatrix} \begin{bmatrix} -2 & -1 \\ -\frac{3}{2} & -\frac{1}{2} \end{bmatrix} =$$

$$\begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix} \begin{bmatrix} \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & -\frac{1}{2} \end{bmatrix} =$$

4. Perform the matrix multiplication using an identity matrix (I).

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} =$$

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} =$$

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} =$$

5. Find the  $2 \times 2$  matrix inverse. What is  $\underline{\underline{A}}^{-1}\underline{\underline{A}}$ ?

$$\text{if } \underline{\underline{A}} = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \text{ then } \underline{\underline{A}}^{-1} = \frac{1}{ad-bc} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$$

$$\underline{\underline{A}} = \begin{bmatrix} 2 & 2 \\ 1 & -1 \end{bmatrix}$$

$$\underline{\underline{A}}^{-1} =$$

6. Find the length ( $x$ ) and width ( $y$ ) of a rectangular fence.

Fact 1: The perimeter is 24.

Fact 2: The length is 2 more than the width.

- a) Express the facts as 2 equations with 2 unknowns
- b) Solve the equations by hand using substitution
- c) Solve the equations by hand using matrices
- d) Solve the equations on the computer using matrices.

7. Find the length ( $x$ ) and width ( $y$ ) of the rectangular fences.

a) perimeter = 46, length is 3 more than the width.

b) perimeter = 40, length is 4 more than the width.

c) perimeter = 50, length is 5 more than the width.

d) perimeter = 36, length is 10 more than the width.

e) perimeter = 190, length is 15 more than the width.

f) perimeter = 1090, length is 25 more than the width.

8. Perform the matrix multiplication, if the inner dimensions match.

$$\underline{\underline{\mathbf{C}}} = \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix} \quad \text{row vector } \underline{\underline{\mathbf{v}}} = [0, -1]$$

$$\underline{\underline{\mathbf{v}}} \underline{\underline{\mathbf{C}}} =$$

$$\underline{\underline{\mathbf{v}}}^T \underline{\underline{\mathbf{C}}} =$$

$$\underline{\underline{\mathbf{C}}} \underline{\underline{\mathbf{v}}} =$$

$$\underline{\underline{\mathbf{C}}} \underline{\underline{\mathbf{v}}}^T =$$

9. Perform the matrix multiplication to produce an identity matrix (I).

$$\begin{bmatrix} 0 & 0 & 1 \\ 1 & 1 & 1 \\ 4 & 2 & 1 \end{bmatrix} \begin{bmatrix} \frac{1}{2} & -1 & \frac{1}{2} \\ -\frac{3}{2} & 2 & -\frac{1}{2} \\ 1 & 0 & 0 \end{bmatrix} =$$



10. Perform the matrix multiplication using an identity matrix (**I**).

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} =$$

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} =$$

11. Find the  $3 \times 3$  matrix inverse. What is  $\underline{\underline{A}}^{-1}\underline{\underline{A}}$ ?

$$\underline{\underline{A}} = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 1 & 1 \\ 4 & 2 & 1 \end{bmatrix}$$

$$\underline{\underline{A}}^{-1} =$$

12. Fit the parabola through 3 points by solving for a, b, and c.

$$y = ax^2 + bx + c$$

Parabola passes through: (0,8), (1,6), and (2,0)

- a) Express the facts as 3 equations with 3 unknowns
- b) Solve the equations by hand using substitution
- c) Solve the equations by hand using matrices
- d) Solve the equations on the computer using matrices.

13. Perform the following parabola modeling exercises on the computer.

a) A fish jumps through the points  $(0,0)$ ,  $(3,3)$ , and  $(4,2)$ .

b) A fish jumps through the points  $(0,0)$ ,  $(4,4)$ , and  $(5,2)$ .

c) A parabolic satellite dish has width 16 and depth 2

d) A parabolic satellite dish has width 6 and depth 4