

4.2 Systems of linear equations

Ex: Admission fee at the state fair is \$1.50 for children and \$4 for adults. On a certain day 2200 people entered and \$5050 was collected. How many children and adults attended.

$$\begin{aligned}a + c &= 2200 \\ 4a + 1.5c &= 5050\end{aligned}$$

$$a = 2200 - c$$

$$\begin{aligned}4(2200 - c) + 1.5c &= 5050 \\ 8800 - 4c + 1.5c &= 5050 \\ -4c + 1.5c &= -3750 \\ -2.5c &= -3750 \\ c &= 1500\end{aligned}$$

$$\begin{aligned}a + 1500 &= 2200 \\ a &= 700\end{aligned}$$

adults - 700
children - 1500

Methods: Elimination, substitution, graphing, setting equal

Matrix multiplication - comes from dot product

Dimensions: Row x Column
Individual numbers - Element

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

2×3 3×2

$\begin{matrix} \textcircled{2} & \textcircled{3} & \textcircled{3} & \textcircled{2} \\ \uparrow & & & \uparrow \\ \text{defined} & & & 2 \times 2 \\ & & & \text{resulting matrix} \end{matrix}$

inside number of matrix must be the same
outside numbers give new matrix dimensions

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$$\begin{bmatrix} 6 & 3 & -1 \\ 4 & 2 & 7 \end{bmatrix} \cdot \begin{bmatrix} 0 & -5 \\ 3 & -2 \\ -1 & 4 \end{bmatrix} = \begin{bmatrix} 6(0) + 3(3) + (-1)(-1) & -30 + (-6) + (-4) \\ 0 + 6 - 7 & -20 - 4 + 28 \end{bmatrix} \rightarrow \begin{bmatrix} 10 & -40 \\ -1 & 4 \end{bmatrix}$$

$$\begin{bmatrix} a & b & c \\ d & e & f \end{bmatrix} \cdot \begin{bmatrix} g & h \\ i & j \\ k & l \end{bmatrix} = \begin{bmatrix} ag+bh+ci & aj+bk+cl \\ dg+eh+fi & dj+ek+fl \end{bmatrix}$$

Inverse matrix

inverse of 3 $\rightarrow 3^{-1}$ or $1/3$ $3 \cdot 1/3 = 1$

$$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \quad \text{determinate} \quad A^{-1} \rightarrow \frac{1}{ad-bc} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$$

inverse matrix = determinate \cdot adjunct

$$\text{adjunct} \begin{bmatrix} a & b \\ c & d \end{bmatrix} \rightarrow \begin{bmatrix} d & b \\ c & a \end{bmatrix} \rightarrow \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$$

$$\text{Ex: } \begin{bmatrix} -1 & 4 \\ 6 & 2 \end{bmatrix}$$

$$1 / [(-1 \cdot 2) - (4 \cdot 6)] \rightarrow (2 - 24) \rightarrow -1/22$$

$$-\frac{1}{22} \begin{bmatrix} +2 & -4 \\ -6 & -1 \end{bmatrix} = \begin{bmatrix} -2/22 & 4/22 \\ 6/22 & 1/22 \end{bmatrix}$$

\leftarrow inverse matrix

Solving with matrices

write as matrix equation then solve

$$\begin{array}{l} 6x + y = 16 \\ -8x - 3y = -8 \end{array} \rightarrow \begin{bmatrix} 6 & 1 \\ -8 & -3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 16 \\ -8 \end{bmatrix}$$

$A \qquad B$

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● Identity matrix $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ same as 1 in $3 \cdot \frac{1}{3} = 1$

multiply identity matrix by B to find solutions

calculator TI-89 - inverse matrix

apps

data/matrix

3: New

2: Matrix

Enter dimensions