TEACHING TRANSPARENCY

4-4 Determinants and Cramer's Rule

Determinant of a 2 × 2 Matrix

WORDS	NUMBERS	ALGEBRA
The **determinant** of a 2 by 2 matrix is the difference of the products of the diagonals	$\det\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix} = \begin{vmatrix}1 & 2\\ 3 & 4\end{vmatrix} = (1)(4) - (3)(2) = -2$	$\det\begin{bmatrix}a & b\\ c & d\end{bmatrix} = \begin{vmatrix}a & b\\ c & d\end{vmatrix} = ad - cb$

Cramer's Rule for Two Equations

$$\begin{cases} a_1x + b_1y = c_1 \\ a_2x + b_2y = c_2 \end{cases}$$ has solutions $x = \dfrac{\begin{vmatrix}c_1 & b_1\\ c_2 & b_2\end{vmatrix}}{D}$, $y = \dfrac{\begin{vmatrix}a_1 & c_1\\ a_2 & c_2\end{vmatrix}}{D}$,

where $D = \begin{vmatrix}a_1 & b_1\\ a_2 & b_2\end{vmatrix}$.

TEACHING TRANSPARENCY

4-4 Determinants and Cramer's Rule (continued)

Cramer's Rule for Three Equations

The system $\begin{cases} a_1x + b_1y + c_1z = d_1 \\ a_2x + b_2y + c_2z = d_2 \\ a_3x + b_3y + c_3z = d_3 \end{cases}$ has solutions given by

$$x = \frac{\begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix}}{D},\ y = \frac{\begin{vmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{vmatrix}}{D},\ z = \frac{\begin{vmatrix} a_1 & b_1 & d_1 \\ a_2 & b_2 & d_2 \\ a_3 & b_3 & d_3 \end{vmatrix}}{D}$$

where $D = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$ and $D \neq 0$.