

## What is a determinant?

What is a determinant?  
 A numerical value given to a square array of numbers. It can help find inverses.

What is the formula for finding the determinant of a 2x2 matrix?

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

Example 1

$$\begin{vmatrix} 5 & -2 \\ 3 & 1 \end{vmatrix} = 5(1) - 3(-2) \\ = 5 + 6 \\ = \boxed{11}$$

Example 2

$$\begin{vmatrix} 3 & -5 \\ 7 & 9 \end{vmatrix} = 27 - (-35) \\ = \boxed{62}$$

Notation for Determinant:  $\det A$  or  $\begin{vmatrix} a & b \\ c & d \end{vmatrix}$

$$\det[A]$$

## Determinants of 3x3 Matrices Using Diagonals in 4 Steps

Step 1: Re-write the first two columns of your matrix to the right of your determinant.

$$\begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix} \begin{matrix} a & b \\ d & e \\ g & h \end{matrix}$$

$$\begin{vmatrix} 3 & -2 & 1 \\ 2 & 0 & 1 \\ 1 & 2 & -2 \end{vmatrix} \begin{matrix} 3 & -2 \\ 2 & 0 \\ 1 & 2 \end{matrix}$$

Step 2: Draw three diagonals downward to the right starting with the first row first column. You will have three diagonals. Multiply the three elements from each set of diagonals and write the product at the end of the diagonal.

$$\begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix} \begin{matrix} a & b \\ d & e \\ g & h \end{matrix}$$

$$3(-1)(-3) + (-2)(0)(1) + 1(2)(2) \\ 9 + 0 + (-4)$$

Step 3: Draw three diagonals upward to the right starting with the third row first column. You will have three diagonals. Multiply the three elements from each set of diagonals and write the products at the end of each diagonal.

$$\begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix} \begin{matrix} a & b \\ d & e \\ g & h \end{matrix}$$

$$1(-1)(-1) - 2(0)(3) - 3(2)(-2) \\ 1 - 0 - 12$$

Step 4: Add the bottom products and subtract the top products.

$$\underline{9} + \underline{0} + \underline{-4} - \underline{1} - \underline{0} - \underline{12}$$

$$-8$$

p. 384: 35-44