



# Determinants

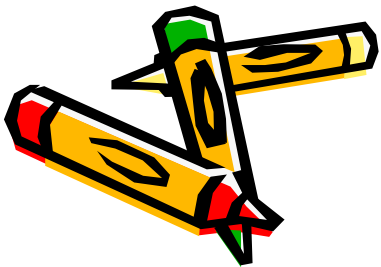
Associated with every square matrix is a whole number called the determinant

The Determinant of a Matrix  $A$  is denoted by  $\det A$  or  $|A|$



Determinant of a 2x2

$$\det \begin{bmatrix} \mathbf{a} & \mathbf{b} \\ \mathbf{c} & \mathbf{d} \end{bmatrix} = \begin{vmatrix} \mathbf{a} & \mathbf{b} \\ \mathbf{c} & \mathbf{d} \end{vmatrix} = ad - cb$$

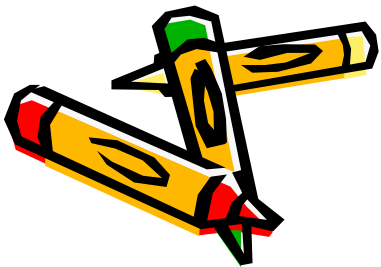
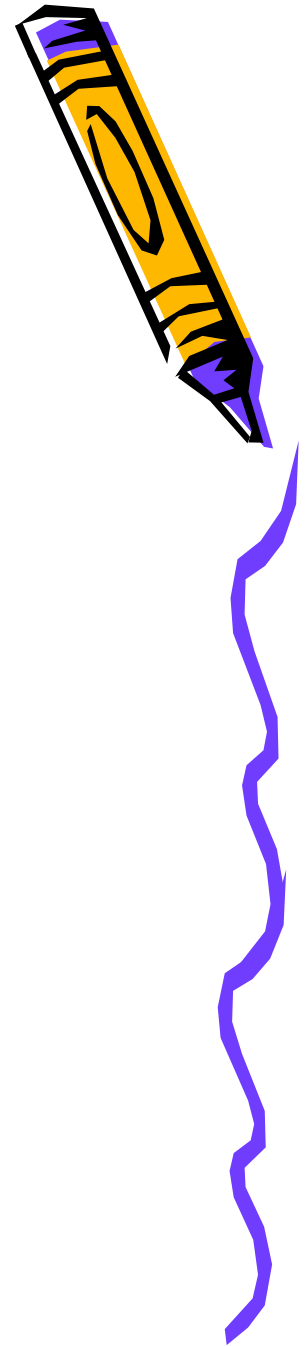


Ex 8 Evaluate the determinant  $\begin{bmatrix} 1 & 4 \\ 2 & 7 \end{bmatrix}$

$$\begin{vmatrix} 1 & 4 \\ 2 & 7 \end{vmatrix} = 1(7) - 2(4)$$

$$= 7 - 8$$

$$= -1$$

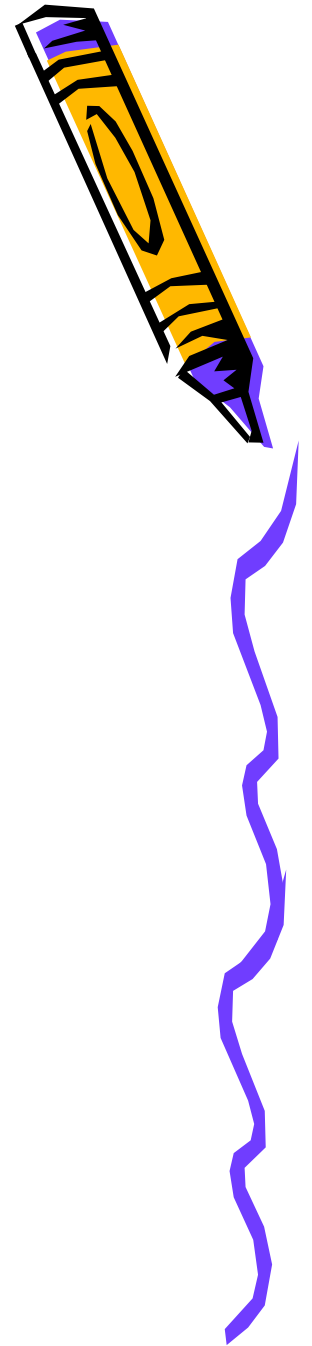


Ex 9

Evaluate the determinant

$$\begin{bmatrix} 7 & 2 \\ 2 & 3 \end{bmatrix}$$

$$\begin{vmatrix} 7 & 2 \\ 2 & 3 \end{vmatrix} = 7(3) - 2(2) \\ = 21 - 4 \\ = 17$$



# Ex 10 Evaluate



$$\begin{vmatrix} 2 & -3 & 4 & 2 & -3 \\ -2 & 0 & 3 & -2 & 0 \\ 1 & 2 & 6 & 1 & 2 \end{vmatrix}$$

Step 1: recopy the first two columns.

Step 2: multiply the down diagonals and add the products.

Step 3: multiply the up diagonals and add the products

NOTE: You **subtract** the up diagonal from the down diagonal

$$= (2*0*6 + -3*3*1 + 4*-2*2) - (1*0*4 + 2*3*2 + 6*-2*-3)$$

$$= (0 + -9 + -16) - (0 + 12 + 36)$$

$$= -25 - 48$$

$$= -73$$



Ex 11 Evaluate.

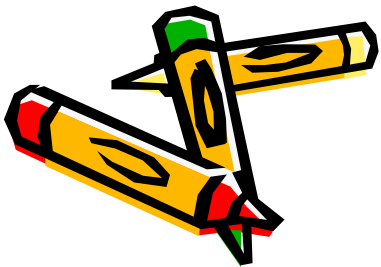
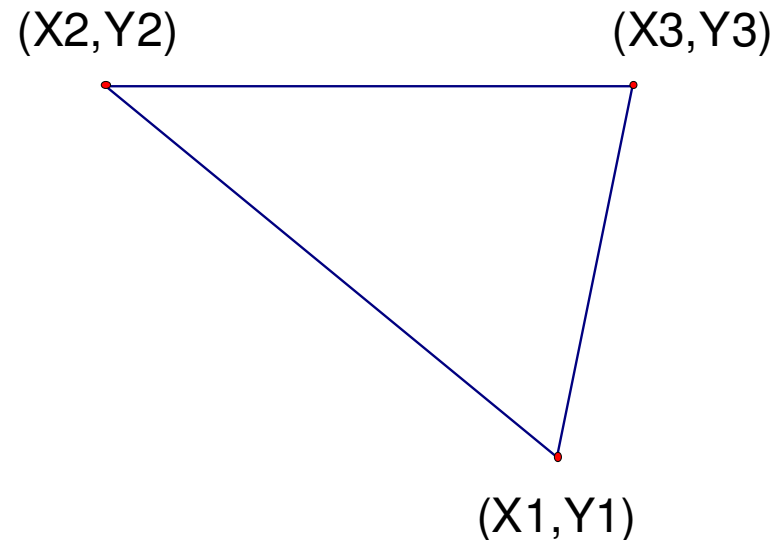
$$\det \begin{bmatrix} 4 & 3 & 1 \\ 5 & -7 & 0 \\ 1 & -2 & 2 \end{bmatrix} = -89$$



# Area of a Triangle!

- The area of a triangle with vertices  $(x_1, y_1)$ ,  $(x_2, y_2)$ , and  $(x_3, y_3)$

- Area =  $\pm \frac{1}{2} \begin{vmatrix} X1 & Y1 & 1 \\ X2 & Y2 & 1 \\ X3 & Y3 & 1 \end{vmatrix}$

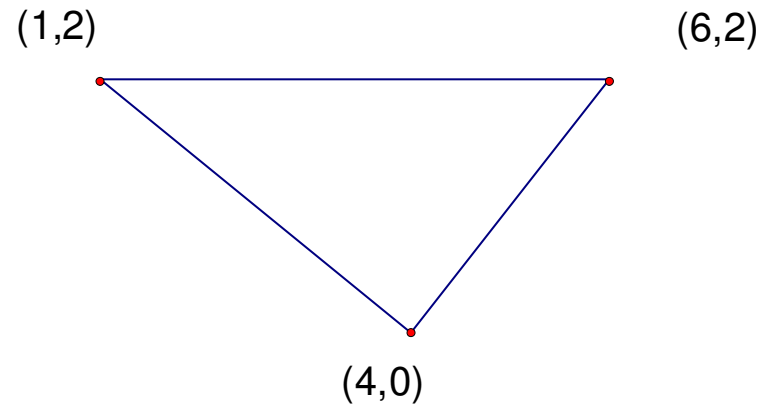


\*Where  $\pm$  is used to produce a positive area!!

Find the area of the triangle.



$$\text{Area} = \pm \frac{1}{2} \begin{vmatrix} 1 & 2 & 1 \\ 4 & 0 & 1 \\ 6 & 2 & 1 \end{vmatrix}$$



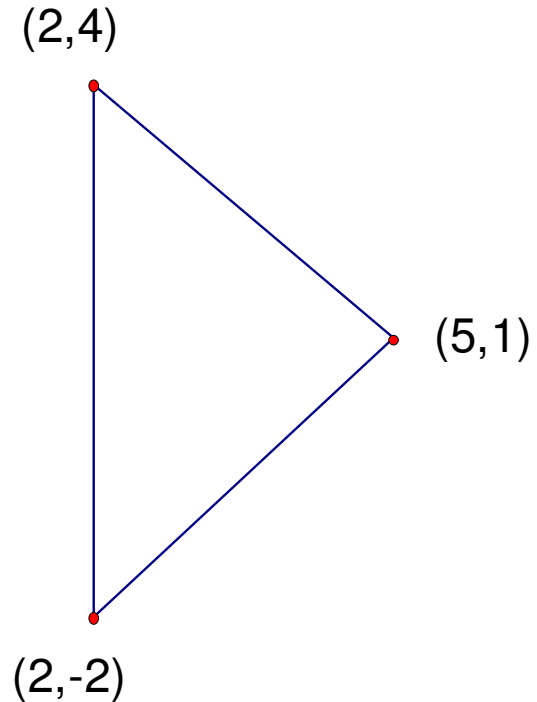
$$= \pm \frac{1}{2} [(0 + 12 + 8) - (0 + 2 + 8)] = 5 \text{ Square units}$$



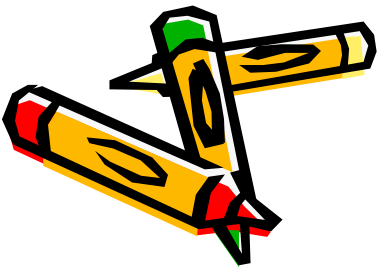
Find the area of the triangle.



$$\text{Area} = \pm \frac{1}{2} \begin{vmatrix} 2 & 4 & 1 \\ 2 & -2 & 1 \\ 5 & 1 & 1 \end{vmatrix}$$



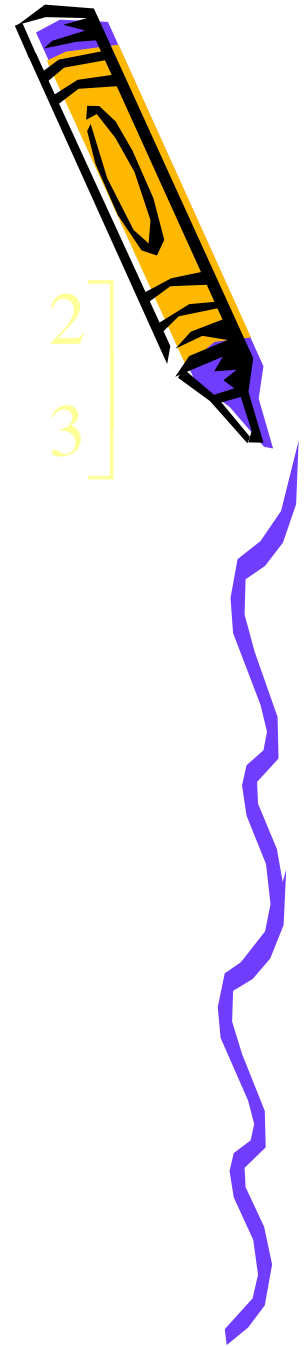
$$= 9 \text{ Square units}$$



# Using the TI-83

- Go to the Matrix menu
- Go to Edit
- Enter the dimensions
- Enter the values into the matrix

$$\begin{bmatrix} 7 & 2 \\ 2 & 3 \end{bmatrix}$$



# Determinant of a 3x3

From the calculator!!

- Enter the given matrix into matrix A.
- Go to the home screen
- Go to the Matrix menu
- Go to Math
- Choose 1: det
- Select matrix A.
- Press Enter

$$\begin{bmatrix} 1 & -3 & 0 \\ 2 & 0 & 1 \\ 5 & 12 & 9 \end{bmatrix}$$

