

4.5 Determinants

- 1) Evaluate the determinant for a 2 x 2 matrix,
- 2) Evaluate the determinant for a 3 x 3 matrix.

A determinant is a square array of numbers or letters enclosed between two parallel lines.

The determinant of the matrix $\begin{bmatrix} 2 & -2 \\ 4 & 8 \end{bmatrix}$ is written as $\begin{vmatrix} 2 & -2 \\ 4 & 8 \end{vmatrix}$

Second-Order Determinants

The determinant for a 2 x 2 matrix is called a second-order determinant. It is found by calculating the difference of the products of the two diagonals...

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

$$\begin{vmatrix} -2 & 5 \\ 6 & 8 \end{vmatrix} =$$

Third-Order Determinants

The determinant for a 3×3 matrix is called a third-order determinant. You will learn two methods for solving third-order determinants.

- 1) Minors
- 2) Diagonals

Minors

The minor of an element is the determinant formed when the row and column containing that element are deleted.

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

The minor for a is: $\begin{vmatrix} e & f \\ h & i \end{vmatrix}$

third-order determinant

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

Remember: $a - b + c$

Evaluate: $\begin{vmatrix} 2 & 7 & -3 \\ -1 & 5 & -4 \\ 6 & 9 & 0 \end{vmatrix}$

Diagonals

Step 1: Begin by rewriting the first two columns on the right side of the determinant.

Step 2: Starting at the top left, draw diagonals from each element in the top row. Find the product of each diagonal.

Step 3: Starting at the top right, draw diagonals from each element in the top row. Find the product of each diagonal.

Step 4: $[aei + bfg + cdh] - [gec + hfa + idb]$ or
[Step 2] - [Step 3]

Evaluate using diagonals:

$$\begin{vmatrix} -1 & 3 & -3 \\ 4 & -2 & -1 \\ 0 & -5 & 2 \end{vmatrix}$$

Area of a triangle

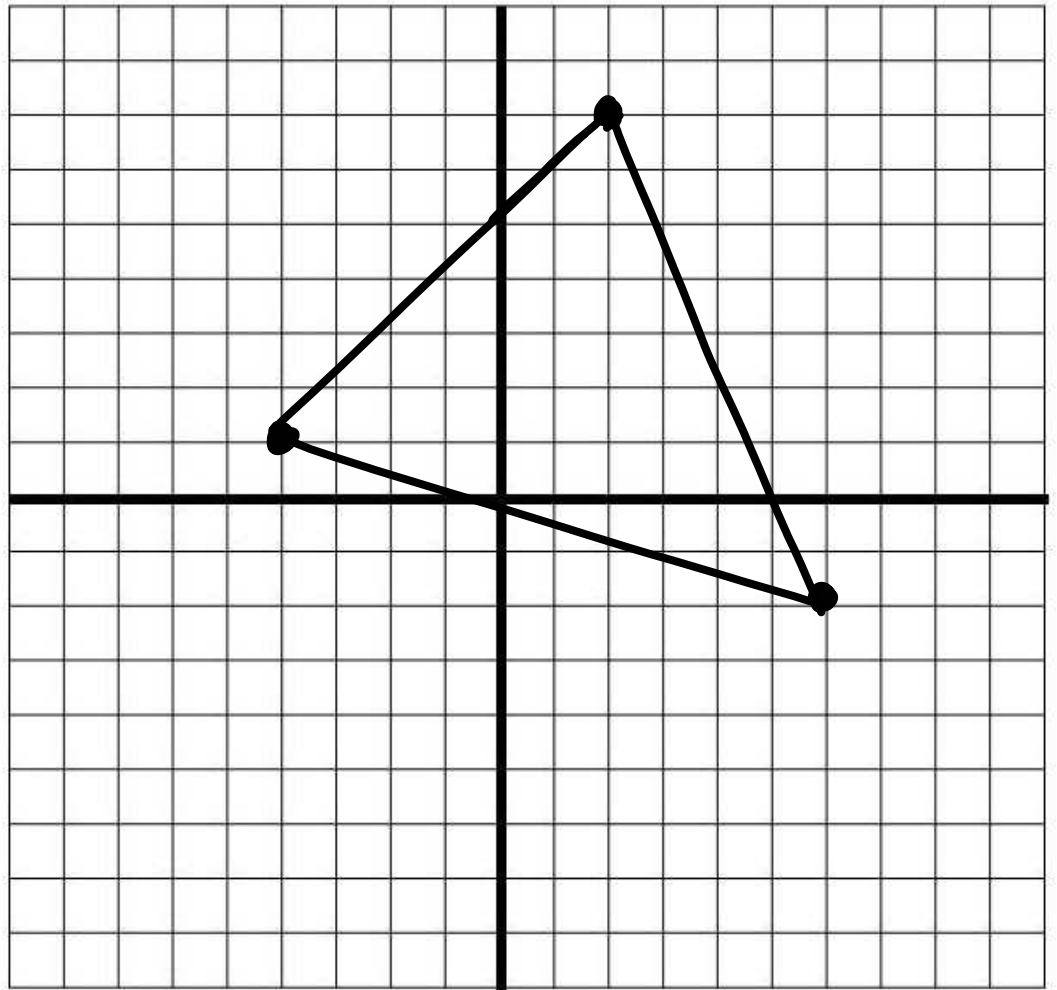
You can use determinants to find the area of triangles if you know the coordinates of the vertices.

The area of a triangle having vertices at (a,b) , (c,d) and (e,f) is:

$$A = \frac{1}{2} \begin{vmatrix} a & b & 1 \\ c & d & 1 \\ e & f & 1 \end{vmatrix}$$

For this formula, write the coordinates horizontally!!!

Find the area of the triangle:



Homework

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