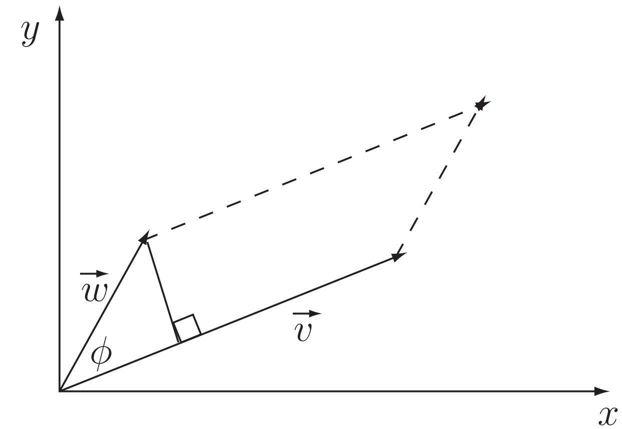
Area

For $\vec{v} = (v_1, v_2)$ and $\vec{w} = (w_1, w_2)$ there are a number of notable consequences of the relationship

$$||\vec{v} \times \vec{w}|| = \begin{vmatrix} v_1 & v_2 \\ w_1 & w_2 \end{vmatrix} = ||\vec{v}|| \, ||\vec{w}|| \sin \phi$$



$$A = bh$$
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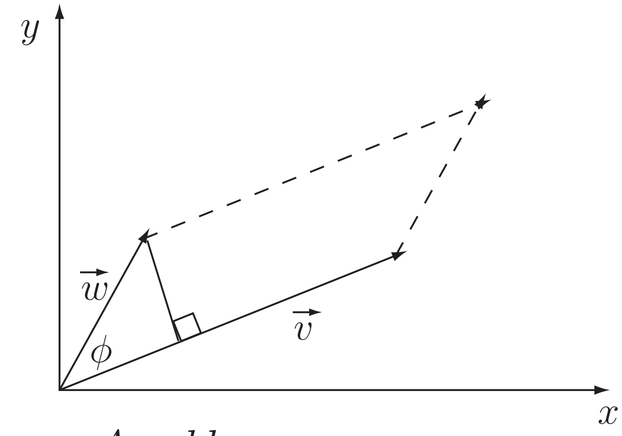

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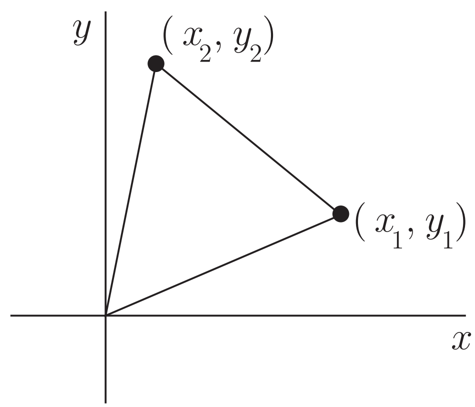
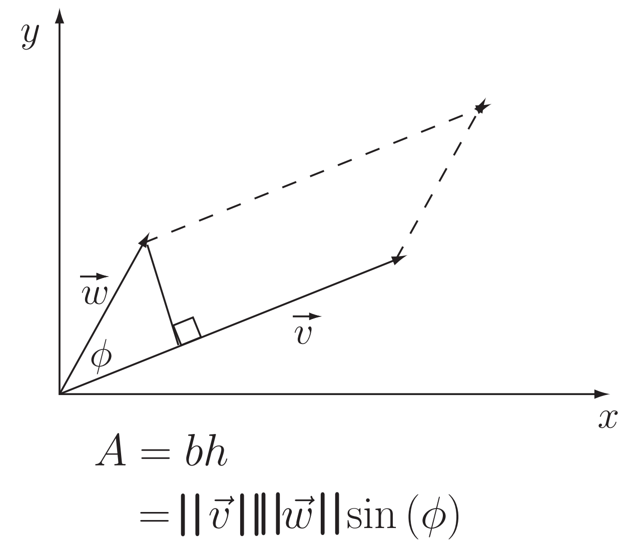
Consider triangular area:

How is the result above useful here?



Area



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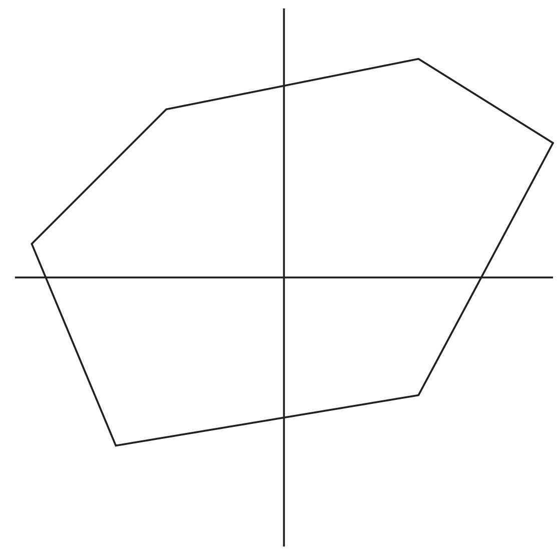
Or here?



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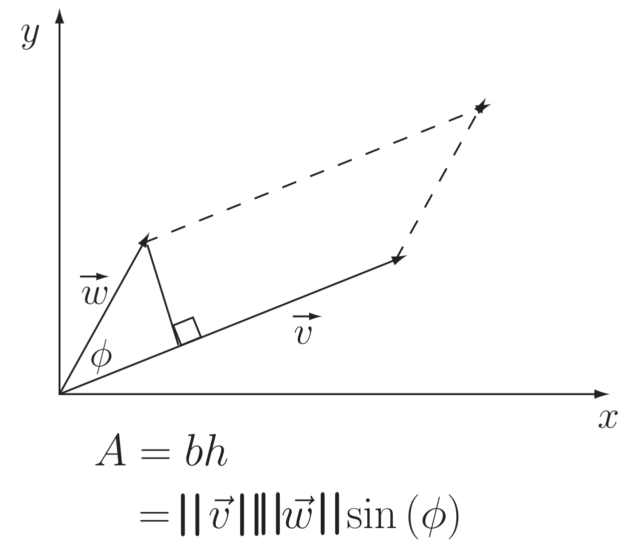

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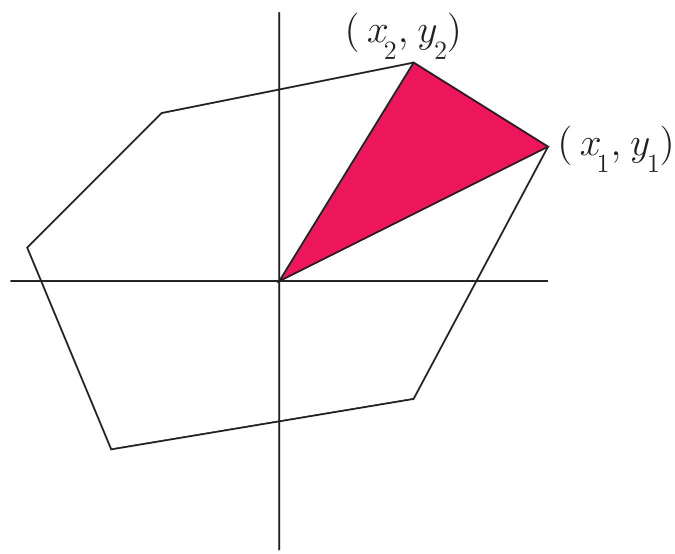

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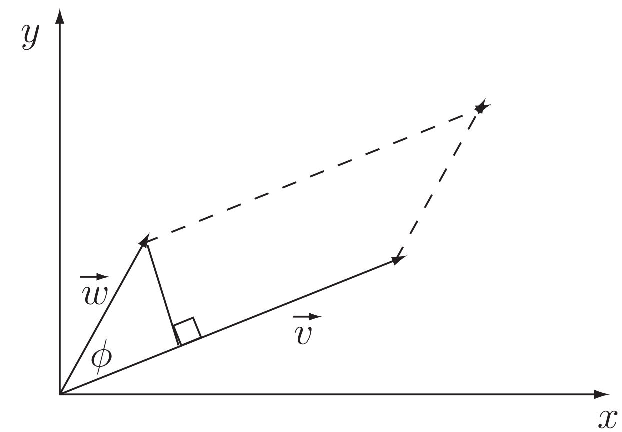

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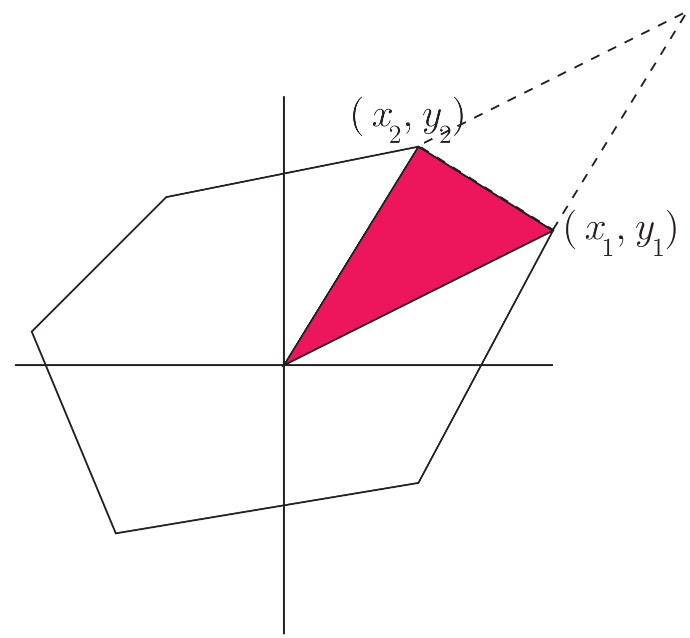
Or here?



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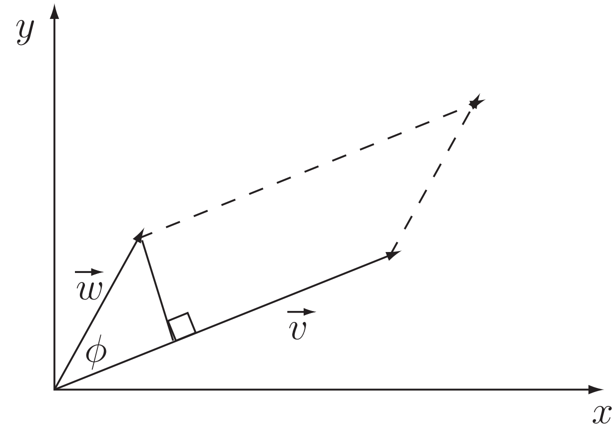

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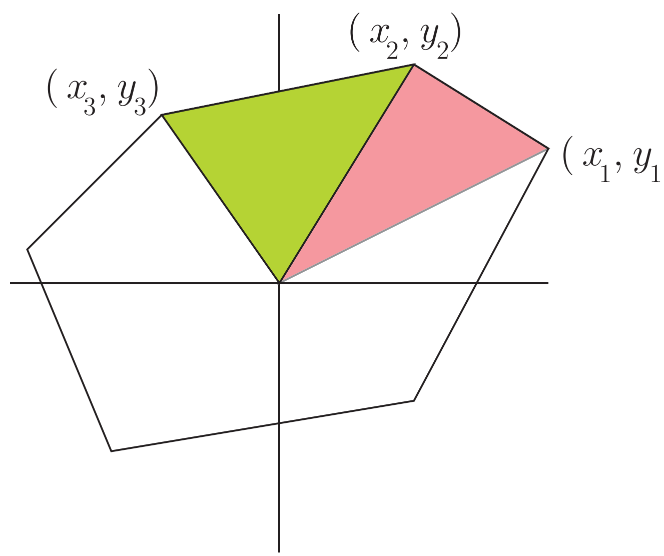

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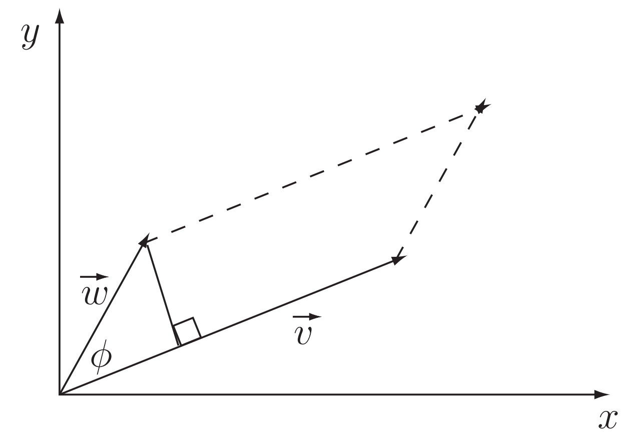

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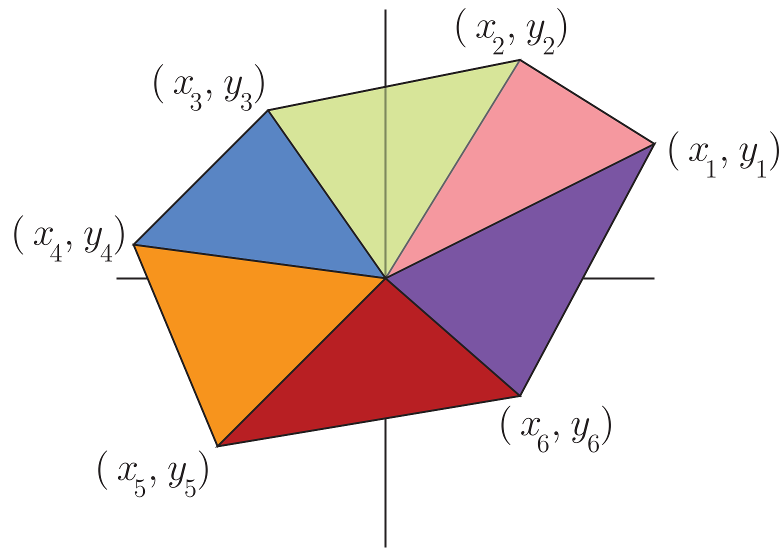

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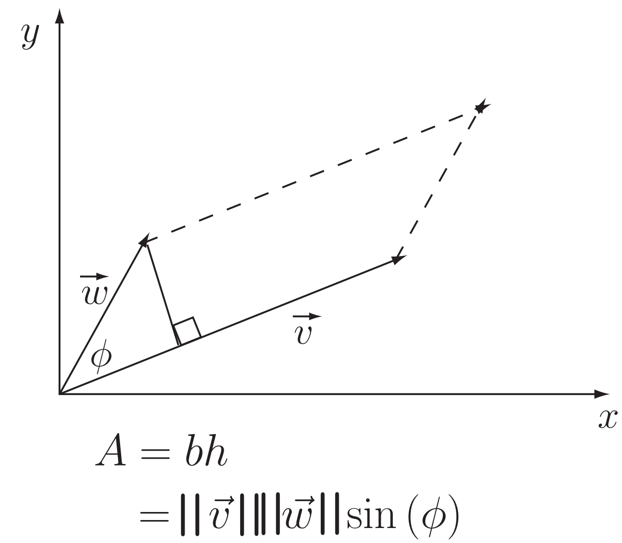
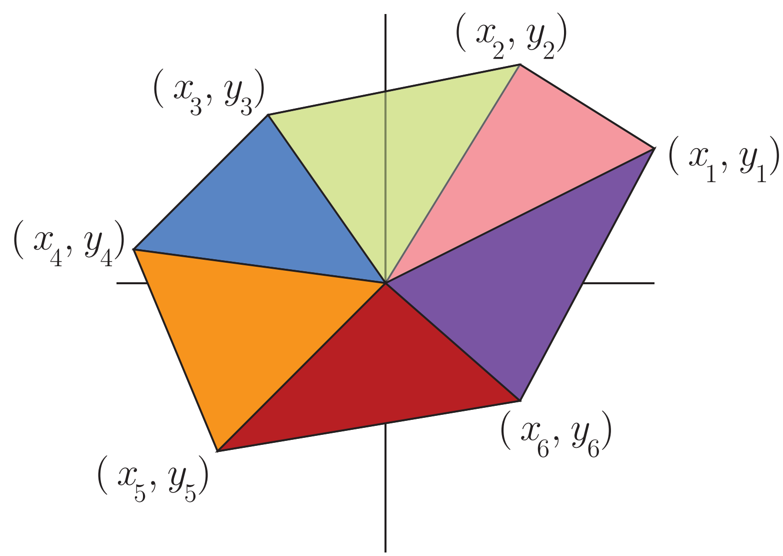


Can you show that in general

$$A = \frac{1}{2}\left[\begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \end{vmatrix} + \begin{vmatrix} x_2 & y_2 \\ x_3 & y_3 \end{vmatrix} + \cdots + \begin{vmatrix} x_n & y_n \\ x_1 & y_1 \end{vmatrix}\right]$$

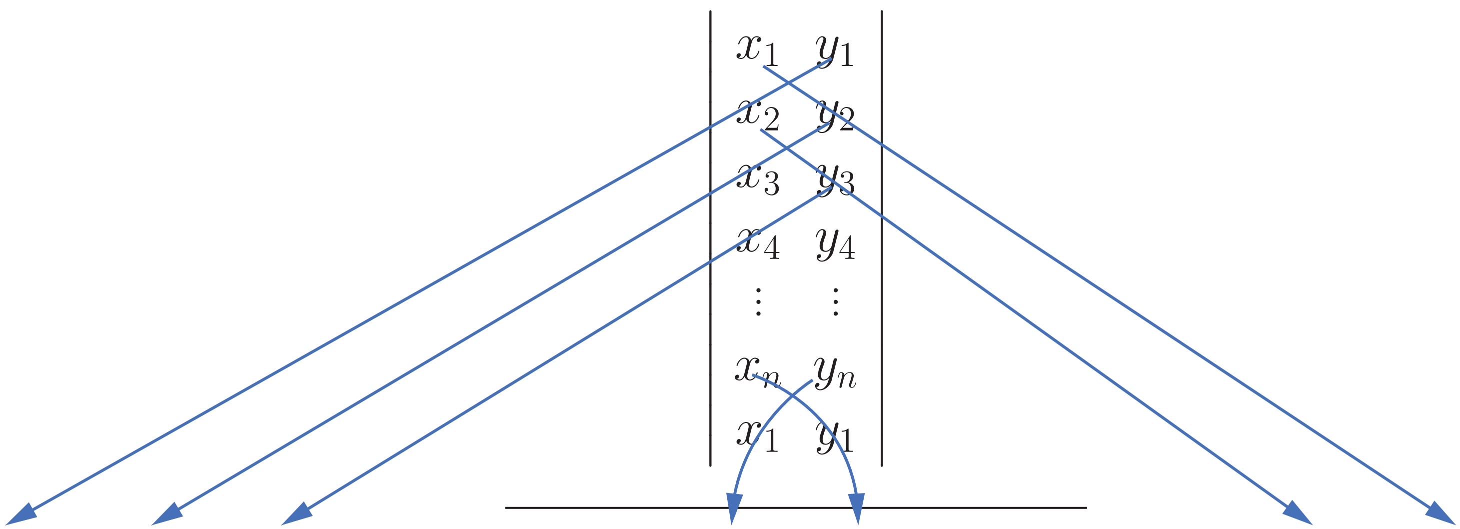


Area

The formula for find the area of a polygon given the coordinates of its vertices,

$$A = \frac{1}{2}\left[\begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \end{vmatrix} + \begin{vmatrix} x_2 & y_2 \\ x_3 & y_3 \end{vmatrix} + \cdots + \begin{vmatrix} x_n & y_n \\ x_1 & y_1 \end{vmatrix}\right]$$

is often called the Surveyor's Algorithm, Gauss's Area Formula (of course), or The Shoestring Formula. It can also be evaluated like this:



$$A = \tfrac{1}{2}[-y_1x_2 - y_2x_3 - y_3x_4 - \cdots - y_{n-1}x_n - y_nx_1 + x_ny_1 + x_{n-1}y_n + \cdots + x_2y_3 + x_1y_2]$$