

Determinants and areas

1. a) Compute $\begin{vmatrix} 1 & 2 \\ 3 & 4 \end{vmatrix}$.

b) Compute $\begin{vmatrix} 1 & -2 \\ -3 & 4 \end{vmatrix}$.

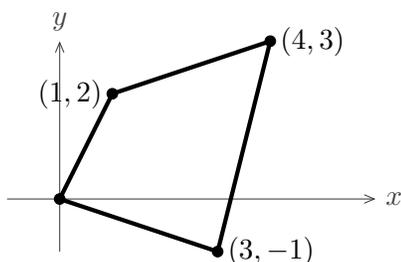
c) Compute $\begin{vmatrix} 3 & 4 \\ 1 & 2 \end{vmatrix}$.

Answer: a) $\begin{vmatrix} 1 & 2 \\ 3 & 4 \end{vmatrix} = 1 \cdot 4 - 2 \cdot 3 = -2$.

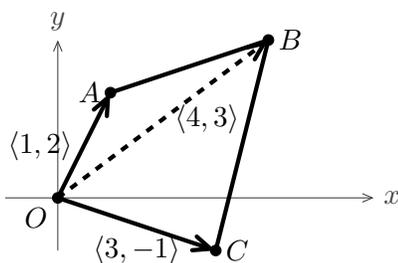
b) $\begin{vmatrix} 1 & -2 \\ -3 & 4 \end{vmatrix} = 1 \cdot 4 - (-2) \cdot (-3) = -2$.

c) $\begin{vmatrix} 3 & 4 \\ 1 & 2 \end{vmatrix} = 3 \cdot 2 - 4 \cdot 1 = 2$.

2. Find the area of the quadrilateral shown.



Answer:



We break the quadrilateral into two triangles. For convenience, on the figure, we have labeled the vertices $OABC$ and indicated the components of \vec{OA} , \vec{OB} and \vec{OC} .

$$\text{Area } \triangle OAB = \frac{1}{2} \left| \det \begin{pmatrix} 1 & 2 \\ 4 & 3 \end{pmatrix} \right| = \frac{1}{2} |-5| = \frac{5}{2}.$$

$$\text{Area } \triangle OBC = \frac{1}{2} \left| \det \begin{pmatrix} 4 & 3 \\ 3 & -1 \end{pmatrix} \right| = \frac{1}{2} |-13| = \frac{13}{2}.$$

$$\text{Thus, area of quadrilateral } OABC = \frac{18}{2} = 9.$$

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18.02SC Multivariable Calculus
Fall 2010

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