Section Exploration: Geometric Applications of Determinants
Answers to Recommended Problems

Below are answers to the recommended problems from the "Exploration: Geometric Applications of Determinants" section.

1. (a) 3**i**+3**j**-3**k**

   (b) -3**i**-3**j**+3**k**

   (c) **0**

   (d) **i**-2**j**+**k**

2. We evaluate **v**×**w** using whichever technique we prefer and then compute the dot product **u**·(**v**×**w**), expanding our answer. Separately, we compute the determinant of the 3x3 matrix on the right-hand side by (for example) expanding across the first row, and again we expand our answer. Comparing the two results, they should be equal.

4. Treating **u** and **v** as vectors in $\mathbb{R}^3$ with their third components equal to zero as per the hint, we find **u**×**v** by expanding about the third column and show it equals $\mathbf{k}\det\begin{bmatrix} u_1 & u_2 \\ v_1 & v_2 \end{bmatrix}$. Using the fact the area of the parallelogram equals the length of **u**×**v**, we find that the area therefore equals $\left|\det\begin{bmatrix} u_1 & u_2 \\ v_1 & v_2 \end{bmatrix}\right|$ since $\|\mathbf{k}\| = 1$, which in turn is equivalent to $\left|\det\begin{bmatrix} u_1 & v_1 \\ u_2 & v_2 \end{bmatrix}\right|$.

6. (a) 11

   (b) 5