1.2.14 Find the area of the parallelogram using vector notation. Compare your result with that found graphically. *Note: Diagram not shown.*

The magnitude of the vector product of two vectors is equal to the area of the parallelogram formed by those vectors. Let the two vectors $\mathbf{A} = \begin{pmatrix} 2 & 4 & 0 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 6 & 0 & 0 \end{pmatrix}$ be the two adjacent sides of the parallelogram that start at the origin. Note that both vectors have a $\mathbf{u_z}$ component that is equal to zero because the vector product is defined in three dimensions, and $\mathbf{A}$ and $\mathbf{B}$ lie in the xy plane.

$$\begin{aligned}
||\mathbf{A} \times \mathbf{B}|| &= ||(2\mathbf{u_x} + 4\mathbf{u_y} + 0\mathbf{u_z}) \times (6\mathbf{u_x} + 0\mathbf{u_y} + 0\mathbf{u_z})|| \\
&= ||0\mathbf{u_x} + 0\mathbf{u_y} - 24\mathbf{u_z}|| \\
&= \sqrt{0^2 + 0^2 + (-24)^2} \\
&= 24
\end{aligned}$$

This value matches the result obtained when counting the area graphically. The parallelogram may be split into a central square with side length 4 and two triangles that together form a rectangle of 2 by 4 units. This gives an area of $4 \cdot 4 + 2 \cdot 4 = 24$.