Problem 89

What is the component of the force vector $\vec{\mathbf{G}} = (3.0\,\hat{\mathbf{i}} + 4.0\,\hat{\mathbf{j}} + 10.0\hat{\mathbf{k}})$N along the force vector $\vec{\mathbf{H}} = (1.0\,\hat{\mathbf{i}} + 4.0\,\hat{\mathbf{j}})$N.

Solution

Take the dot product of $\vec{\mathbf{G}}$ with the unit vector in the direction of $\vec{\mathbf{H}}$.

$$\begin{aligned}
\vec{\mathbf{G}} \cdot \frac{\vec{\mathbf{H}}}{\left|\vec{\mathbf{H}}\right|} &= \frac{\vec{\mathbf{G}} \cdot \vec{\mathbf{H}}}{\left|\vec{\mathbf{H}}\right|} \\
&= \frac{\langle 3.0, 4.0, 10.0\rangle \cdot \langle 1.0, 4.0, 0\rangle}{\sqrt{(1.0)^2 + (4.0)^2 + 0^2}}\ \text{N} \\
&= \frac{(3.0)(1.0) + (4.0)(4.0) + (10.0)(0)}{\sqrt{17.0}}\ \text{N} \\
&= \frac{19}{\sqrt{17}}\ \text{N} \\
&\approx 4.6\ \text{N}
\end{aligned}$$