# Exercise 22

What restrictions must be made on the scalar $b$ so that the vector $2\mathbf{i} + b\mathbf{j}$ is orthogonal to (a) $-3\mathbf{i} + 2\mathbf{j} + \mathbf{k}$ and (b) $\mathbf{k}$?

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**Solution**

For two vectors to be orthogonal with one another, their dot product must be zero.

**Part (a)**

$$\begin{aligned}(2\mathbf{i} + b\mathbf{j}) \cdot (-3\mathbf{i} + 2\mathbf{j} + \mathbf{k}) &= 0 \\ (2)(-3) + (b)(2) + (0)(1) &= 0 \\ 2b - 6 &= 0 \\ b &= 3\end{aligned}$$

**Part (b)**

$$\begin{aligned}(2\mathbf{i} + b\mathbf{j}) \cdot (\mathbf{k}) &= 0 \\ (2)(0) + (b)(0) + (0)(1) &= 0 \\ 0 &= 0\end{aligned}$$

No restrictions on $b$ are necessary for the vectors to be orthogonal.