Let $\mathbf{u} = \begin{pmatrix} 5 \\ -1 \\ -3 \end{pmatrix}$ and $\mathbf{v} = \begin{pmatrix} 2 \\ -1 \\ 3 \end{pmatrix}$.

(a) Determine $\mathbf{u} \cdot \mathbf{v}$.
(b) Determine the angle in degrees (to the nearest degree) between $\mathbf{u}$ and $\mathbf{v}$.

Solution
(a) $\mathbf{u} \cdot \mathbf{v} = 5 \cdot 2 + -1 \cdot -1 + -3 \cdot 3$
$= 10 + 1 - 9$
$= 2$
(b) From (a) $\mathbf{u} \cdot \mathbf{v} = 2$.
$\|\mathbf{u}\| = \sqrt{5^2 + (-1)^2 + (-3)^2}$
$= \sqrt{35}$
$\|\mathbf{v}\| = \sqrt{2^2 + (-1)^2 + 3^2}$
$= \sqrt{14}$
$\mathbf{u} \cdot \mathbf{v} = \|\mathbf{u}\|\|\mathbf{v}\| \cos \theta$
So $2 = \sqrt{35}\sqrt{14} \cos \theta$.
Therefore $\theta = \arccos \dfrac{2}{\sqrt{35}\sqrt{14}}$
So $\theta \approx XX^\circ$