Sol:

a) $\cos\theta = \dfrac{\vec{u}\cdot\vec{v}}{\|\vec{u}\|\,\|\vec{v}\|} = \dfrac{-11}{(3)(7)} = \dfrac{-11}{21}$

Thus $\theta = \cos^{-1}\left(\dfrac{-11}{21}\right) \simeq 2.12\pi$

$\simeq 121.6$

b) $\cos\theta = \dfrac{\vec{u}\cdot\vec{w}}{\|\vec{u}\|\,\|\vec{w}\|} = \dfrac{0}{\|\vec{u}\|\,\|\vec{v}\|} = 0$

$\therefore \theta = \cos^{-1}(0) = \dfrac{\pi}{2} = 90^\circ$

متعامدين

$\therefore \vec{u}$ & $\vec{w}$ are perpendicular vectors.

c) $\cos\theta = \dfrac{\vec{u}\cdot\vec{z}}{\|\vec{u}\|\,\|\vec{z}\|} = \dfrac{-27}{(3)(9)} = -1$

$\therefore \theta = \pi = 180^\circ$

Note: We call $\vec{i} = (1,0,0)$, $\vec{j} = (0,1,0)$ and $\vec{k} = (0,0,1)$ the unit perpendicular vectors of $\mathbb{R}^3$ (Standard Base for $\mathbb{R}^3$)

Which means that each vector $\vec{v} \in \mathbb{R}^3$ can be written as:

$\vec{v} = (v_1, v_2, v_3) = v_1(1,0,0) + v_2(0,1,0) + v_3(0,0,1)$