Exercise 19

Find all values of x such that $(7, x, -10)$ and $(3, x, x)$ are orthogonal.

Solution

For two vectors to be orthogonal, their dot product has to be zero.

$$\begin{aligned}(7, x, -10) \cdot (3, x, x) &= 0 \\ (7)(3) + (x)(x) + (-10)(x) &= 0 \\ x^2 - 10x + 21 &= 0 \\ (x - 3)(x - 7) &= 0\end{aligned}$$

Therefore,

$$x = \{3, 7\}.$$