Let $E$ be an arbitrary directed graph, $L_K(E)$ the Leavitt path algebra of $E$ and $C^*(E)$ the graph $C^*$-algebra $E$. We give necessary and sufficient conditions on $E$ so that $L_K(E)$ is primitive. (This is joint work with J. Bell and K.M. Rangaswamy. We then show that these same conditions are precisely the necessary and sufficient conditions on $E$ so that $C^*(E)$ is primitive. (This is joint work with Mark Tomforde.). This situation gives yet another example of algebraic/analytic properties of the graph algebras $L_K(E)$ and $C^*(E)$ for which the graph conditions equivalent to said property are identical, but for which the proof / techniques used are significantly different.