Marginal cost

       Marginal cost is the change in total cost associated with producing one more unit of output. However, since total cost is the sum of both variable cost and fixed cost, how is marginal cost related to these latter two cost concepts?

       We can relate both fixed cost and variable cost to output as follows: Let the former be $FC(Q)$ and the latter $VC(Q)$. Total cost is the sum of these two. $TC(Q) = FC(Q) + VC(Q)$. By definition, $MC = \dfrac{\mathrm{d}TC(Q)}{\mathrm{d}Q}$. Substituting for $TC(Q)$, $MC = \dfrac{\mathrm{d}FC(Q)}{\mathrm{d}Q} + \dfrac{\mathrm{d}VC(Q)}{\mathrm{d}Q}$. The first term is zero by definition: fixed costs do not vary with output. We then have the following result: $MC = \dfrac{\mathrm{d}TC(Q)}{\mathrm{d}Q} = \dfrac{\mathrm{d}VC(Q)}{\mathrm{d}Q}$. In words, marginal cost is both the change in total cost and the change in total variable cost associated with increasing output by one unit.