Mean field theory has raised a lot of interest in the recent years following some papers by Lasry-Lions as well as Bensoussan and Frehse research on N persons stochastic differential games. MFG approximate an infinite number of players with common behavior by a representative agent. This agent has to solve a control problem perturbed by a field equation, representing in some way the behavior of the average infinite number of agents. The state equation is modified by the expected value of some functional on the state. This lecture will first review the linear-quadratic case. This has the advantage of getting explicit solutions leading to Riccati equations. The lecture will also provide a number of extension and prospective application to financial mathematics including in particular a mean field game approach to the classical Merton consumption model as well as other problems where both micro and macro elements combine to determine financial prices.