Brownian motion with drift and resetting in a finite interval

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Brownian motion that is stochastically reset with a constant rate r to its starting position $x_0 = x(t = 0)$ can effectively reduce the search time to a fixed target. But if the mean search time τ is finite when $r = 0$, then the resetting mechanism might increase τ if x_0 is too far away from the target. This yields a phase transition between searching in the phases $r > 0$ and $r = 0$ with a critical value of x_0 where this transition occur. For free Brownian motion confined to a finite interval of length L we show that there is a second order transition when the starting position is too far away from the target, such that the non-reset search phase becomes more effective. Building on that we consider the same setting but with a positive drift velocity and targets at the boundaries, $x = 0$ and $x = L$, using a different method. Interestingly we find that there is now two different phase transitions, a first order transition for x_0 closer to the origin, and a second order transition for x_0 closer to L.