

Problem Set 2

(discussion on April 3rd)

1. Diffusion with absorbing boundaries

Consider diffusion in the presence of two concentric 2-dimensional (d-dimensional) absorbing circles (spheres) A and B with radius $R_A = 1$ and $R_B = R > 1$. Find the conditional absorbing probabilities $P_A(r)$ and $P_B(r)$ when the diffusion is started at time zero at a point \vec{r} with distance $0 \leq r \leq \infty$ to the center. Find the mean times to absorption for $0 \leq r \leq R$. Draw your results in a diagram.

2. Biased diffusion in front of a boundary (1d)

The drift-diffusion equation for a biased diffusion is $\partial_t \phi = -v\phi' + D\phi''$. Solve this equation for the initial condition $\phi(x, 0) = \delta(x - x_0)$ with $x_0 > 0$ and a reflecting (or absorbing) boundary at zero. The reflecting boundary condition here is $j(0) = 0$ with $j = v\phi - D\phi'$ and the absorbing boundary condition $\phi(0) = 0$.