1. Complete the derivation of the arbitrage price of the Barrier option in Section 4 of the Lecture Notes:
   (a) Use the reflection principle and the Strong Markov property to justify the identity (22).
   (b) Evaluate the integral in equation (22).

2. A Perpetual Option. Assume that the share prices of Stock and Bond are given by equations (19) and (20), respectively. Consider an option with no date of expiration that pays the owner $\exp\{-\beta \tau\}$ (dollars) at the first time $\tau$ that the share price of Stock reaches $\alpha$ (if ever). Here $\beta$ and $\alpha$ are positive real numbers, and $S_0 < \alpha$. Calculate the arbitrage price at time 0 of this option.

3. Knockin Options. Assume that the prices of Bond and Stock are governed by the differential equations
   
   (1) \hspace{1cm} dB_t = r B_t \, dt \\
   (2) \hspace{1cm} dS_t = r S_t \, dt + \sigma S_t \, dW_t.

   for constants $r, \sigma > 0$. Consider a knockin put option with strike $K$ and knockin value $H > K$. The payoff from this option at termination $t = T$ is
   
   $(K - S_T)_+ \quad \text{if} \quad \max_{0 \leq t \leq T} S_t \geq H$ \\
   $0 \quad \text{if} \quad \max_{0 \leq t \leq T} S_t < H$

   Find the arbitrage price at $t = 0$. HINT: Write the price as a discounted expectation, using indicator variables to get rid of the subscript $+$ on $(K - S_T)$. Break this expectation into two expectations, and then evaluate each by using the Cameron–Martin theorem and the reflection principle.