

Solution for exercise 8.4.2 in Karlin and Pinsky

$$\begin{aligned} P\left(\max_{t \geq 0} \frac{b + B(t)}{1 + t} > a\right) &= P\left(\max_{t \geq 0} b + B(t) > a + at\right) \\ &= P\left(\max_{t \geq 0} B(t) - at > a - b\right) \\ &= e^{-2|a|(a-b)\sigma^2} = e^{-2a(a-b)} \text{ using equation 8.48} \end{aligned}$$