Topic 5 problems: cue combination

1. What is the maximum likelihood cue combination rule for three cues D_1, D_2, and D_3, with standard deviations σ_1, σ_2, and σ_3, respectively? Take a similar approach to the one we used for two cues.

2. (A harder problem.) Derive the maximum likelihood cue combination rule without using the fact (which we relied on in class) that a pointwise product of Gaussians is also a Gaussian. You can do this by following these steps.

   (a) Write down the formula for the likelihood of a depth estimate d, given measurements from two cues, x_1 and x_2. Replace ϕ with the exponential formula for the normal pdf. We want to find the value of d that maximizes this expression.

   (b) Remove scale factors and use monotonic transformations (e.g., $\log(x)$) to turn the expression you wrote down in (a) into a simpler expression that has the same maximum. (Hint: you should be able to turn it into a polynomial.)

   (c) Take the derivative of the expression in (b).

   (d) Solve the equation that says the expression in (c) is zero.