Fuzzy negations, complements, and intersections

Exercise 3.1
Fuzzy sets A, B have the following vertical representations:

$$\mu_A(x) = \begin{cases} \dfrac{x-1}{2}\,, & x \in [1,3]\,, \\ 1\,, & x \in [3,6]\,, \\ 4 - \dfrac{x}{2}\,, & x \in [6,8]\,, \\ 0\,, & \textit{otherwise}\,, \end{cases}$$

$$\mu_B(x) = \begin{cases} \dfrac{x-2}{3}\,, & x \in [2,5]\,, \\ 1\,, & x \in [5,6]\,, \\ \dfrac{8-x}{2}\,, & x \in [6,8]\,, \\ 0\,, & \textit{otherwise}\,. \end{cases}$$

1. *Find for which λ the formula*

$$\underset{\lambda}{\neg}\alpha = 1 - \sqrt{1-(1-\alpha)^{\lambda}}$$

   defines a fuzzy negation $\underset{\lambda}{\neg}$. Draw a graph.

2. *Find a fuzzy disjunction dual to the product conjunction with respect to the negation from part 1.*

3. *Find the fuzzy complement of A with respect to the negation $\underset{\lambda}{\neg}$ from part 1.*

4. *Find the standard, product, and Łukasiewicz intersections of A and B.*