3.2 Exponentials of the form $e^{-\alpha r^2}$ with α a positive constant, are useful for constructing smooth intensity transformation functions. Start with this basic function and construct transformation functions having the general shapes shown in the following figures. The constants shown are input parameters, and your proposed transformations must include them in their specification. (For simplicity in your answers, L0, is not a required parameter in the third curve.)

3.7 Suppose that a digital image is subject to histogram equalization. Show that a second pass of histogram equalization (on the histogram-equalized image) will produce exactly the same result as the first pass.

3.12 Propose a method for updating the local histogram for us in a local enhancement technique discussed in Section 3.3.3. *Hint:* In your formula you need to take into account that you are moving a square window from left to right and that by doing so, you are deleting a column of pixels and adding a new one, so you do not have to re-compute the entire local histogram again.

3.21 The three images shown were blurred using square averaging masks of sizes n=23, 25, and 45, respectively. The vertical bars on the left lower par of (a) and (c) are blurred, but clear separation exists between them. However, the bars have merged in image (b), in spite of the fact that the mask that produced this image is significantly smaller than the mask that produced image (c). Explain the reason for this. *Hint:* the original figure for this problem is Fig. 3.33. Relate the width of the mask to the width of the bars plus the distance between them.

3.28 Show that subtracting the Laplacian from an image is proportional to unsharp masking. Use the definition for the Laplacian given in eq. (3.6-6).