$$B = e^{-(x/2\sigma^2)} \tag{1}$$

$$B^2 = e^{-(x/2\sigma^2)} \times e^{-(x/2\sigma^2)} \tag{2}$$

$$B^2 = e^{-(x/2\sigma^2 + x/2\sigma^2)} \tag{3}$$

$$B^2 = e^{-(x/\sigma^2)} \tag{4}$$

$$\sigma'^2 \equiv \frac{1}{2}\sigma^2 \tag{5}$$

$$\sigma^2 = 2\sigma'^2 \tag{6}$$

$$B^2 = e^{-(x/2\sigma'^2)} \tag{7}$$

Therefore, B^2 is a Gaussian with new width $\sigma' = \frac{1}{\sqrt{2}}\sigma$.