EXERCISE 1

$$W(x) = \begin{cases} 1, & |x| < R \\ 0, & \text{else} \end{cases}$$

$$\tilde{W}(x) = \int_{-\infty}^{\infty} W(x) e^{-ikx} dx$$

$$= \int_{-\infty}^{-R} 0 \cdot e^{-ikx} dx + \int_{-R}^{R} 1 \cdot e^{-ikx} dx + \int_{R}^{\infty} 0 \cdot e^{-ikx}$$

$$= \int_{-R}^{R} e^{-ikx} dx = \left[\frac{i}{k} e^{-ikx}\right]_{-R}^{R} = \frac{i}{k}\left(e^{-ikR} - e^{ikR}\right)$$

$$= \frac{2}{k} \sin(Rk)$$

For small k, we have that $\sin(Rk) \approx k$, $k \ll 1$, meaning that

$$\tilde{W}(0) = 2R$$

EXERCISE 3

(1) $\int_{-\infty}^{\delta_{crit}} d\delta \, P_{nc}(\delta|M)$ denotes the probability that

a mass is not larger than δ_{crit} and therefore not part of a collapsed object.

$1 - \int_{-\infty}^{\delta_{crit}} d\delta \, P_{nc}(\delta|M)$ therefore denotes the probability

that a perturbation is part of a collapsed object

(2)