A white Gaussian noise process $X(t)$ with power spectral density (PSD) $N_0/2=0.1$ is input to an LTI filter with a transfer function $H(f)$ given by

$$H(f) = \begin{cases} 2, & |f| \le W \\ 0, & otherwise \end{cases}$$

The output is denoted $Y(t)$.

(1) Find the autocorrelation function $R_X(t)$ of $X(t)$.
(2) Find $E[Y(t)]$.
(3) Find the PSD of $Y(t)$.
(4) Determine a W such that $E[Y^2(t)] = 10$.
(5) Find the first-order PDF of $Y(t)$, i.e., $f_{Y(t)}(y)$, when $E[Y^2(t)] = 10$.
(6) Find the probability $P(Y(t)>3)$, when $E[Y^2(t)] = 10$.