Suppose the time function $x(t) = 2 \cos(3t) - 5 \sin(4t) + \sin(5t) \cos(5t)$ is input to a linear time-invariant system with frequency response $H(\omega) = (\omega^2 - 28|\omega| + 96)/84$. Determine the output time function $y(t)$ of the system. Is the output periodic? Prove your result.