

*Hjälpmedel:* Kurslitteratur, anteckningar och valfri räknare.

*Telefon:*

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1. Show that the convolution of one sequence of length  $M$  with another of length  $N$  is a sequence of length  $M + N - 1$ . (6 p)
2. Prove that, in an orthonormal MRA,  $|\hat{\psi}(\omega)|^2 + |\hat{\varphi}(\omega)|^2 = |\hat{\varphi}(\omega/2)|^2$  holds. (6 p)
3. Assume that the function  $f$  is positively homogeneous of degree  $a$ :  $f(\lambda x) = |\lambda|^a f(x)$  for all real numbers  $x$  and  $\lambda$ . Show that  $\hat{f}$  is positively homogeneous of degree  $-a - 1$ . Define the notion *positively homogeneous of degree  $a$*  for tempered distributions. (6 p)
4. Verify that the principal value of the function  $f(x) = 1/x^4$  ( $x \neq 0$ ) is a tempered distribution. (7 p)