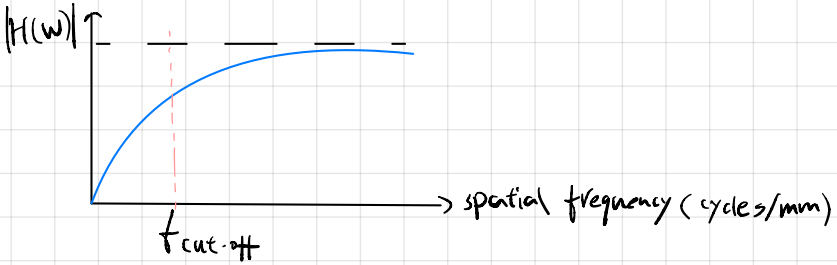
Q1

a) This uses high-pass filter. After filtering, the outer regions with low-frequency components are attenuated while the center with high-frequency components remain relatively unchanged. The high pass filter was applied to enhance fine details.

b) 

c) Intensity is greatly attenuated outside the diameter of 20mm

$C = \pi D = 20\pi$ mm

# of cycles = 36

$\therefore f_c = \frac{36 \text{ cycles}}{20\pi \text{ mm}} = 0.57 \text{ mm}^{-1}$

Q2

$|F(x,y)| = \sqrt{f_1^2(x,y) + f_2^2(x,y)}$ for the disk

$|G(x,y)| = \sqrt{g_1^2(x,y) + g_2^2(x,y)}$ for the square

Now a new function $H(x,y) = 4F(x,y) - G_1(x,y)$

$= 4(f_1 + jf_2) - (g_1 + jg_2)$

$= (4f_1 - g_1) + j(4f_2 - g_2)$

$\therefore |H(x,y)| = \sqrt{(4f_1 - g_1)^2 + (4f_2 - g_2)^2}$

$= \sqrt{16|F(x,y)|^2 + (G(x,y)|^2 - 16(f_1 g_1 + f_2 g_2)}$

$= \sqrt{16 \times 1^2 + 2^2 - 16(f_1 g_1 + f_2 g_2)}$

$= 2\sqrt{5 - 4(f_1 g_1 + f_2 g_2)}$