f) To validate,

$$\sin\left(\frac{2\pi u_0 x}{M} + \frac{2\pi v_0 y}{N}\right) \Rightarrow \left(\frac{jMN}{2}\right)\left[\delta(u+u_0, v+v_0) - \delta(u-u_0, v-v_0)\right]$$

Applying 2-D inverse discrete FT:

$$\frac{1}{MN}\sum_{x=0}^{M-1}\sum_{y=0}^{M-1}\left(\frac{jMN}{2}\right)\left[\delta(u+u_0, v+v_0) - \delta(u-u_0, v-v_0)\right] e^{2\pi\left(\frac{ux}{M}+\frac{vy}{N}\right)}$$

From impulse f^n $\delta(0,0) = 1$:

For part 1: $u = -u_0$; $v = -v_0$

For Part 2: $u = u_0$; $v = v_0$

OMIT ~~$\frac{1}{MN}\sum_{x=0}^{M-1}\sum_{y=0}^{N-1}\left(\frac{jMN}{2}\right)\left[\delta(u+u_0, v+v_0) - \delta(u-u_0, v-v_0)\right] e^{j2\pi\left(\frac{ux}{M}+\frac{vy}{N}\right)}$~~

Substituting eq^n:

$$= \frac{j}{2}\left[e^{j2\pi\left(\frac{-u_0 x}{M} + \frac{-v_0 y}{N}\right)} - e^{j2\pi\left(\frac{u_0 x}{M} + \frac{v_0 y}{N}\right)}\right]$$

$$= \frac{j}{2}\left[e^{-j2\pi\left(\frac{u_0 x}{M} + \frac{v_0 y}{N}\right)} - e^{j2\pi\left(\frac{u_0 x}{M} + \frac{v_0 y}{N}\right)}\right]$$

$$= \sin\left(2\pi\left(\frac{u_0 x}{M} + \frac{v_0 y}{N}\right)\right)$$

$$= \sin\left(\frac{2\pi u_0 x}{M} + \frac{2\pi v_0 y}{N}\right)$$