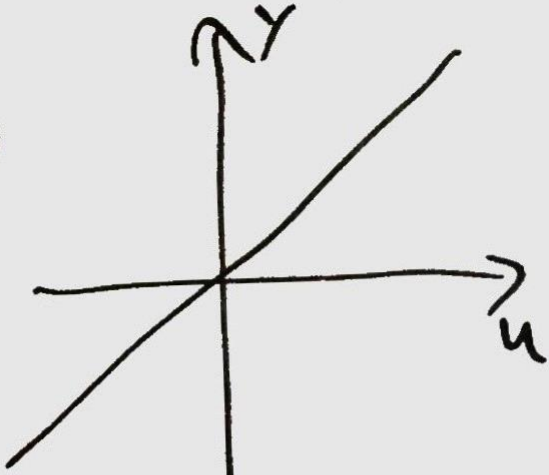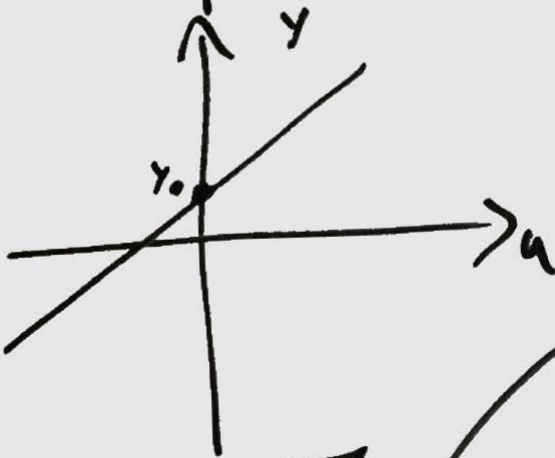**1)**

a)

$$Y(u) = \alpha u$$
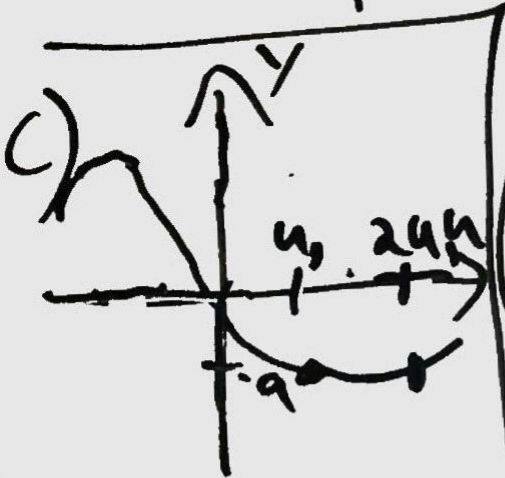
1st order Linear

b)

$$Y(u) = \alpha u + Y_0$$

Includes DC Gain...

Non-Linear

$$Y(u_1) = \alpha u_1 + Y_0$$

$$Y(u_2) = \alpha u_2 + Y_0$$

$$Y(u_1 + u_2) = \alpha(u_1 + u_2) + Y_0$$

$$\boxed{Y(u_1 + u_2) \neq Y(u_1) + Y(u_2)}$$

Not Additive

c)

Non-Linear:

$$Y(u_1) = -a$$

$$Y(2u_1) = -a$$

$$\boxed{Y(2u_1) \neq 2Y(u_1)}$$ Not Homogeneous