Additional Exercises: Linearization

1. Obtain a linearized equation of:

$$\frac{d}{dt}x = u \cdot \sin\left(\frac{\pi}{2} \cdot x\right) + 5$$

around the operating point: $u_{op} = 2$ and $x_{op} = 1$

2. Obtain a set of linearized equations for:

$$\frac{d}{dt}x = -x \cdot y + 5$$

$$\frac{d}{dt}y = 3 \cdot x^2 + 6 \cdot y$$

operating around the steady states.

3. Suppose for the process modelled by:

$$\frac{d}{dt}z = 5 \cdot z - z \cdot \sqrt{u}$$

was found to have the following linearized model,

$$\frac{d}{dt}z = z + u + \alpha$$

Determine the operating point: z_{op} and u_{op}. Also, what is the value of α in order for the linearization to be consistent?