Additional Exercises: Linearization

1. Obtain a linearized equation of:

\[
\frac{dx}{dt} = u \cdot \sin\left(\frac{\pi x}{2}\right) + 5
\]

around the operating point: \( u_{op} = 2 \) and \( x_{op} = 1 \)

2. Obtain a set of linearized equations for:

\[
\begin{align*}
\frac{dx}{dt} &= -x \cdot y + 5 \\
\frac{dy}{dt} &= 3 \cdot x^2 + 6 \cdot y
\end{align*}
\]

operating around the steady states.

3. Suppose for the process modelled by:

\[
\frac{dz}{dt} = 5 \cdot z \cdot \sqrt{u}
\]

was found to have the following linearized model,

\[
\frac{dz}{dt} = z + u + \alpha
\]

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