Problem 1

Linearise the following expressions about the according working points.

a) $\sin(\varphi)$ about φ_0

b) $\cos(\varphi)$ about $\varphi = 0$

c) e^x about $x = 0$

d) $\sqrt{1+x^2}$ about $x = ½$

e) $\frac{1}{\sqrt{a^2+x}}$ about $x = 0$, $a \in \Re$

Problem 2

Transform the differential equation

$$\dddot{y} + y^2\ddot{y} + ky = 0$$

to a system of differential equations of 1. order.

Problem 3

Linearise the system

$$\dot{x}_1 = x_1(2 - \cos x_2) + \tfrac{1}{8} x_2 x_3$$
$$\dot{x}_2 = (x_1 - x_2 + 2a)(x_3 + 4) \quad , a \neq 0$$
$$\dot{x}_3 = a^2 - (x_2 - a)^2$$

about its states of equilibrium.