DEPARTMENT OF MATHEMATICS
MATHS 761 Laboratory 3 Notes

1. Use XPP and any other methods you know of to determine which of the following vector fields have periodic orbits. Questions with a star (*) are a bit trickier. Only attempt these when you are sure about the rest.

   (a)
   $$\dot{x} = 0.1004 + y + x^3,$$
   $$\dot{y} = x + y + y^3.$$

   (b)
   $$\dot{x} = (x^2 + y^2)^{1/2}(x - y - x^3 - xy^2 - x^2y)$$
   $$\dot{y} = (x^2 + y^2)^{1/2}(x + y + x^3 - x^2y - y^3)$$

   (c)
   $$\dot{x} = 1.004 + y^2 - \exp(xy),$$
   $$\dot{y} = xy + \cos^2(y).$$

   (d)
   $$\dot{x} = y^2 - x,$$
   $$\dot{y} = y + x^2 + yx^3.$$

   (e)
   $$\dot{x} = x - y - (x^2 + \frac{3}{2}y^2)x,$$
   $$\dot{y} = x + y - (x^2 + \frac{1}{2}y^2)y.$$

   (f)
   $$\dot{x} = x(2 - y - x),$$
   $$\dot{y} = y(4x - x^2 - 3).$$

   (g) (*)
   $$\dot{x} = y,$$
   $$\dot{y} = -0.1004 + y + 10x^2 + 10xy.$$

   (h) (*)
   $$\dot{x} = 2xy - 2y^4,$$
   $$\dot{y} = x^2 - y^2 - xy^3.$$