## Problem Sheet 10

## Module F13YT2/YF3

**1.** Determine the phase plane for the equations

(i)  $x' = x - x^2$ ; (ii)  $x' = \sin(x)$ .

- 2. Draw the phase planes for each of the following equations
  - $\begin{array}{ll} (i) & x'' = -x^2; \\ (ii) & x'' x^3 = 0; \\ (iii) & x'' = x^3 x. \end{array}$

In each case draw rough graphs of the solutions of the equation satisfying (i) x(0) = 0; x'(0) = 1 and (ii) x(0) = 1; x'(0) = 0.

**3.** Determine the phase plane for the equation

$$x'' + e^x = a$$

where (i) a > 0; (ii)  $a \le 0$ .

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