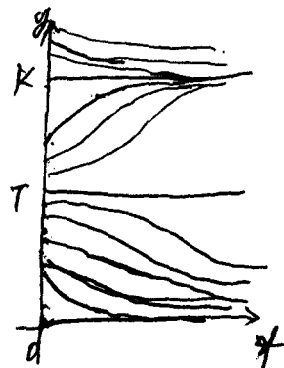
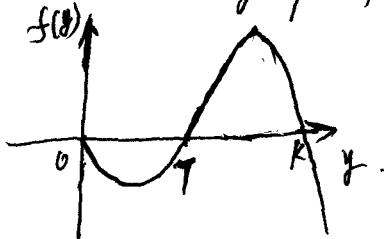


Ex: Plot the phase line for  $\frac{dy}{dt} = r y \left(1 - \frac{y}{T}\right) \left(1 - \frac{y}{K}\right)$ .  $r > 0, 0 < T < K$  and sketch several graphs of solutions in the  $t$ - $y$ -plane.

(16)

Step 1:  $f(y) = 0$ . i.e. = [find constant solutions, i.e. equilibrium soln.]  
 $-r \left(1 - \frac{y}{T}\right) \left(1 - \frac{y}{K}\right) y = 0$ ,  
 $y = 0, T, K$ . three equilibria.

Step 2. draw the graph of  $f(y)$  versus  $y$ .



\* (i) As long as  $y \in (0, T)$ .  $\frac{dy}{dt} < 0$ .

Thus the solution in  $(0, T)$  decreases as  $t \uparrow$ .

(ii) For  $y \in (T, K)$ .  $\frac{dy}{dt} > 0$ . Solutions in  $(T, K) \uparrow$  as  $t \uparrow$ .

(iii) For  $y > K$ ,  $\frac{dy}{dt} < 0$ .  $\downarrow$  as  $t \uparrow$

(iv). As  $y$  is close to  $0, T, K$ ,  $\frac{dy}{dt}$  close to zero. Solution curves becomes relatively flat.