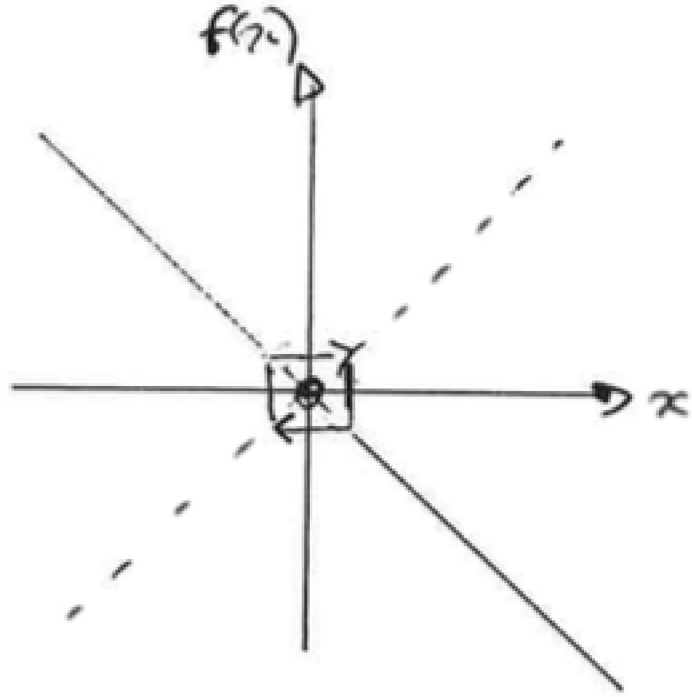
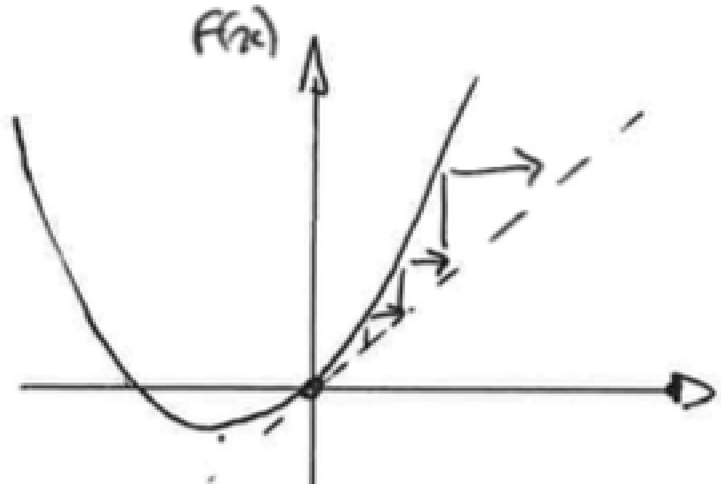
3. a) $f(x) = -x$



$f^2(x) = x$. So all points except $x=0$ are part of 2-cycles.

$x=0$ is Lyapunov stable but not quasi-asymptotically stable.

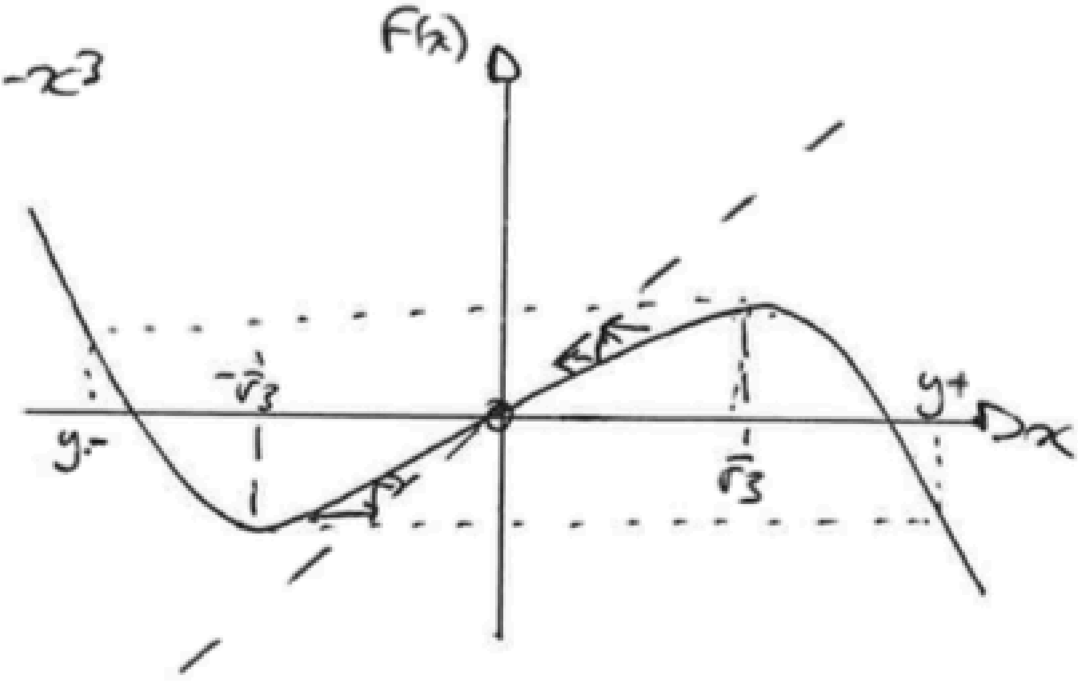
b) $f(x) = x + x^2$



If $x_n > 0$ then $x_n \to \infty$ as $n \to \infty$ since $x_{n+1} - x_n = x_n^2 > 0$

Hence $x=0$ is neither Lyapunov nor quasi-asymptotically stable.

c) $F(x) = x - x^3$



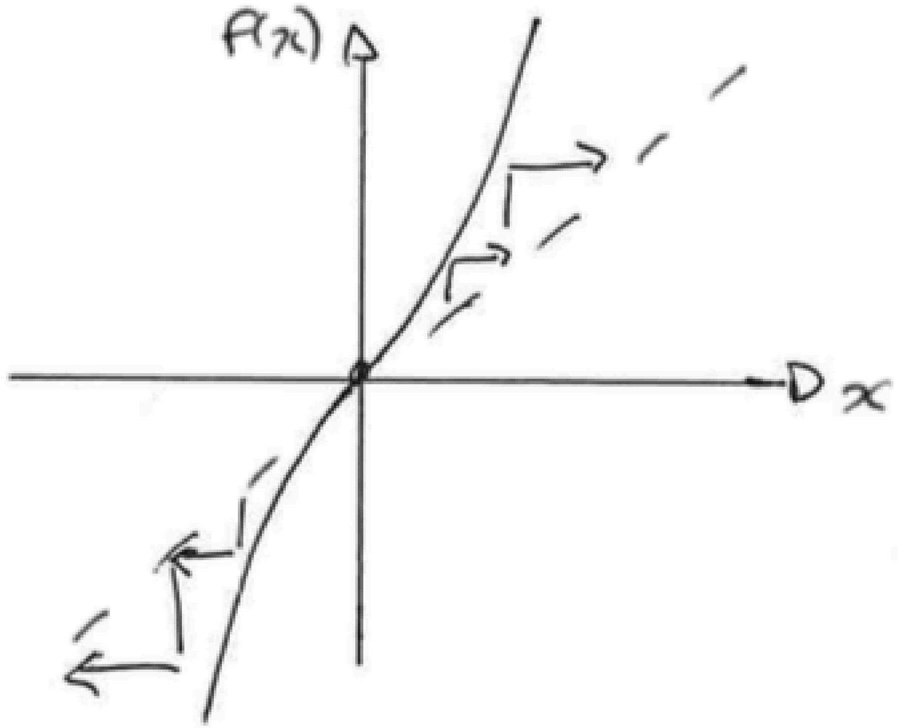
$F(x)$ has turning points at $x = \pm\frac{1}{\sqrt{3}}$.

Let $y^{\pm}$ be such that $F(y^{\pm}) = \mp\frac{1}{\sqrt{3}}$.

Then all points in $[y-, y+]$ tend to 0.

Hence $x=0$ is Lyapunov and quasi-asymptotically stable.

d) $f(x) = x + x^3$



$x=0$ is Lyapunov and quasi-asymptotically unstable.