Dynamical Systems TIF155/FIM770
Konstantinos Zakkas
Problem set 1

1.1 Imperfect transcritical bifurcation

```
In[•]:= f[x_, h_, r_] := h + x (r - x)
        fDot[x_, r_] := r - 2 x
        sol1 = Solve[fDot[x, r] == 0, x]
```

Out[•]= $\left\{\left\{x \to \frac{r}{2}\right\}\right\}$

c)

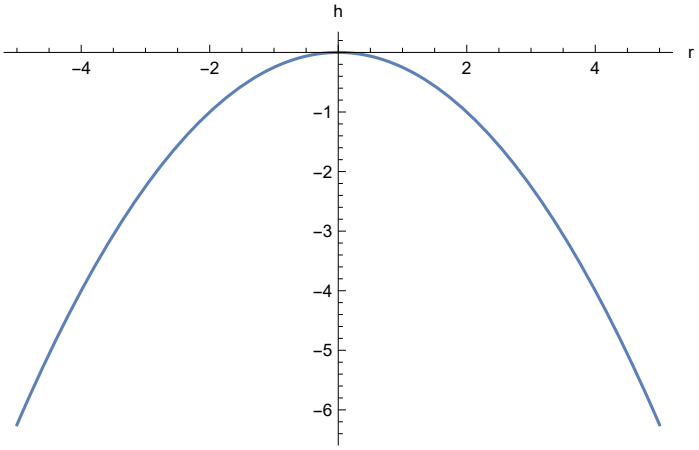
```
In[•]:= sol2 = Solve[f[x /. sol1, h, r] == 0, h]
```

Out[•]= $\left\{\left\{h \to -\frac{r^2}{4}\right\}\right\}$

a)

```
In[•]:= Plot[h /. sol2, {r, -5, 5}, AxesLabel → {"r", "h"}]
```

Out[•]=



b)

```
In[•]:= roots = Solve[f[x, h, r] == 0, x]
```

Out[•]= $\left\{\left\{x \to \frac{1}{2}\left(r - \sqrt{4h + r^2}\right)\right\}, \left\{x \to \frac{1}{2}\left(r + \sqrt{4h + r^2}\right)\right\}\right\}$

```
root1[h, r] := x /. roots[[1]]
root2[h, r] := x /. roots[[2]]
Plot3D[{root1[h, r], root2[h, r]}, {h, -10, 10}, {r, -10, 10},
 AxesLabel → {"h", "r", "x"}, PlotLabel → "Fixed Point Surface"]
```