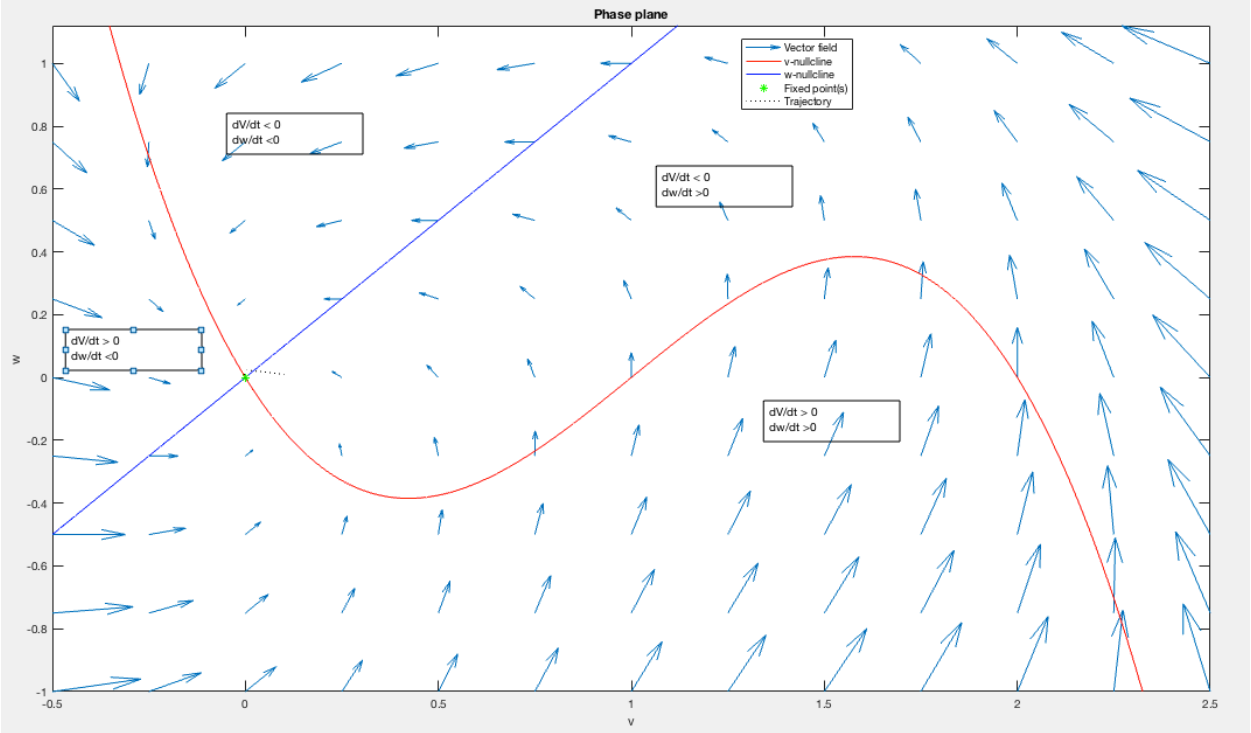
Problem 1.

(a).



(b). Solve v-nullcline and w-nullcline analytically

$v_{null} = -v^3 + 3 * v^2 - 2v$

$w_{null} = v$

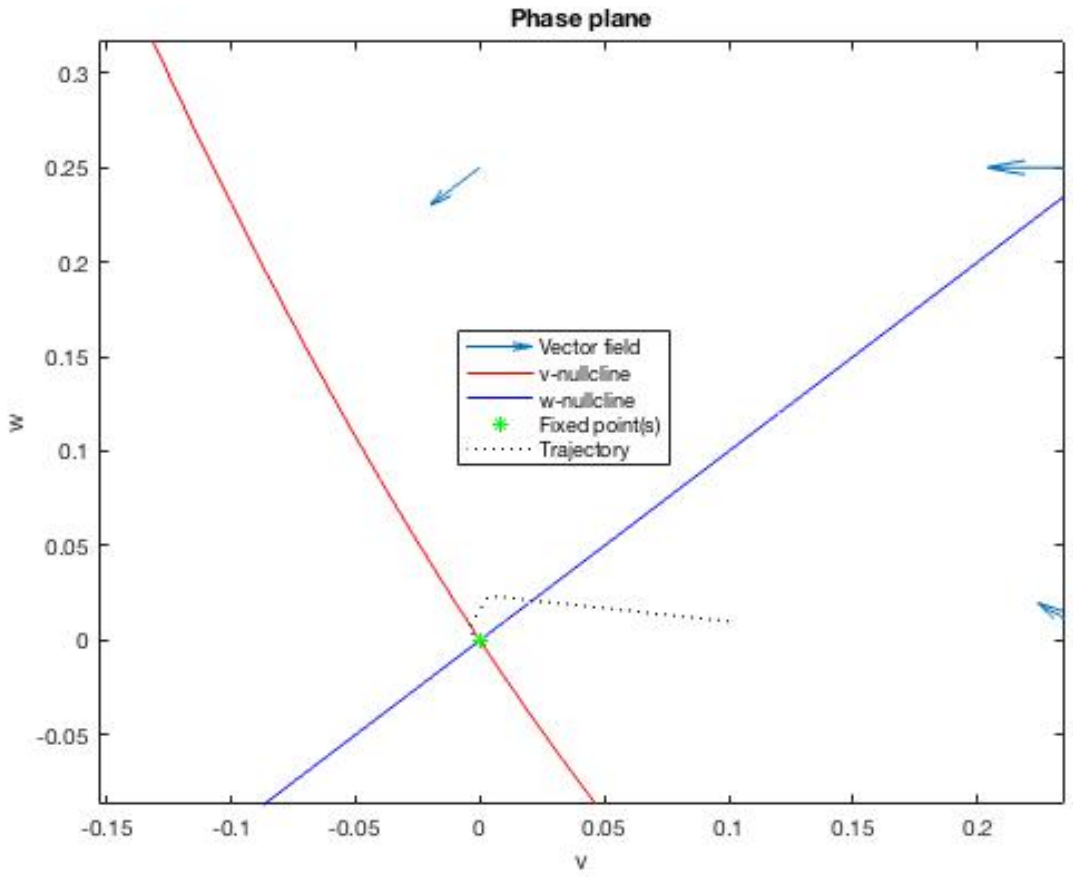
(c). [fixed_v, fixed_w] = [0,0];

I found the fixed point according to the following script:

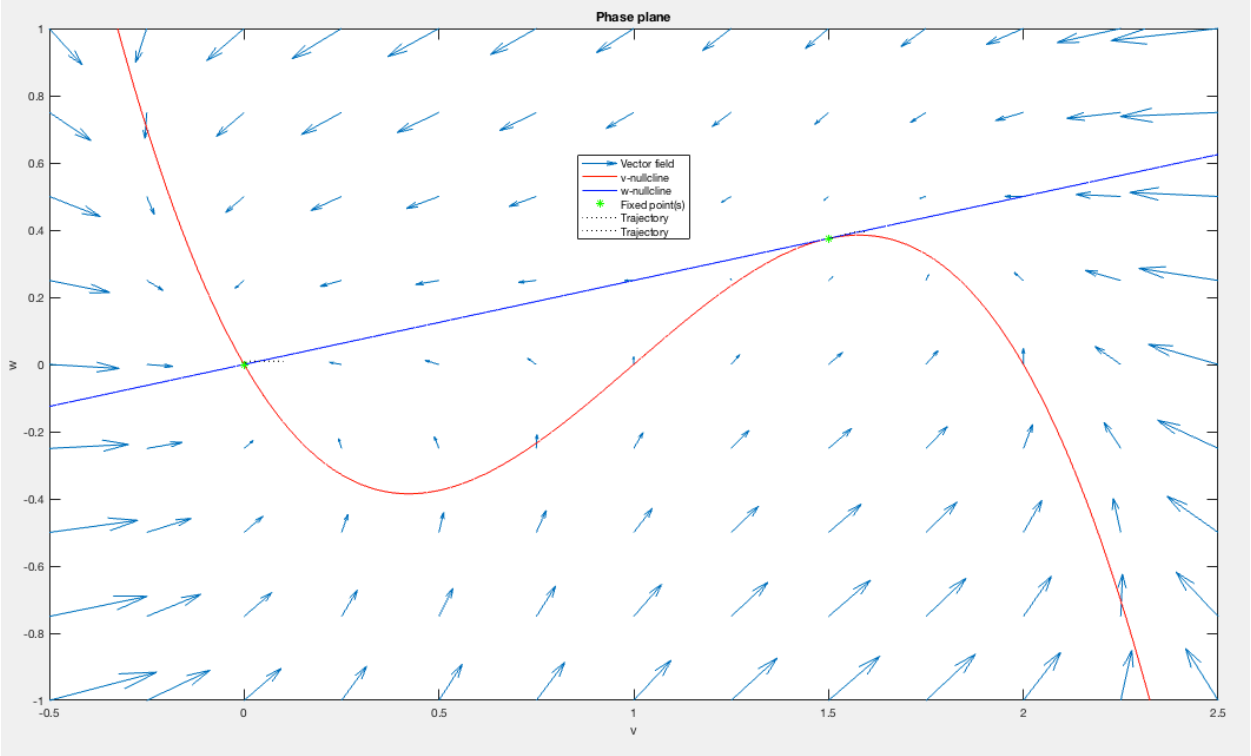
```
syms v w

%ODE system
f = [dvdt(v,w), dwdt(v,w)];

%Find fiexed points
[fixed_v, fixed_w] = solve(f(1), f(2), [v,w]);

% Throw out complex fixed points
ind = ~((imag(eval(vpa(fixed_v))) ~= 0) | (imag(eval(vpa(fixed_w))) ~= 0)); % Index of real
fixed points
fixed_v = fixed_v(ind);
fixed_w = fixed_w(ind);

% Plot fixed points
hold on
plot(fixed_v,fixed_w,'g*', 'DisplayName','Fixed point(s)')
hold off

legend('show','Location','best')
```

Here, I evaluated all the intersections of $\frac{dv}{dt}$ and $\frac{dw}{dt}$ using solve and find the fixed points. Then, I throw out the fixed points without real value (complex fixed point). Then I plot this point on the phase plane plot.

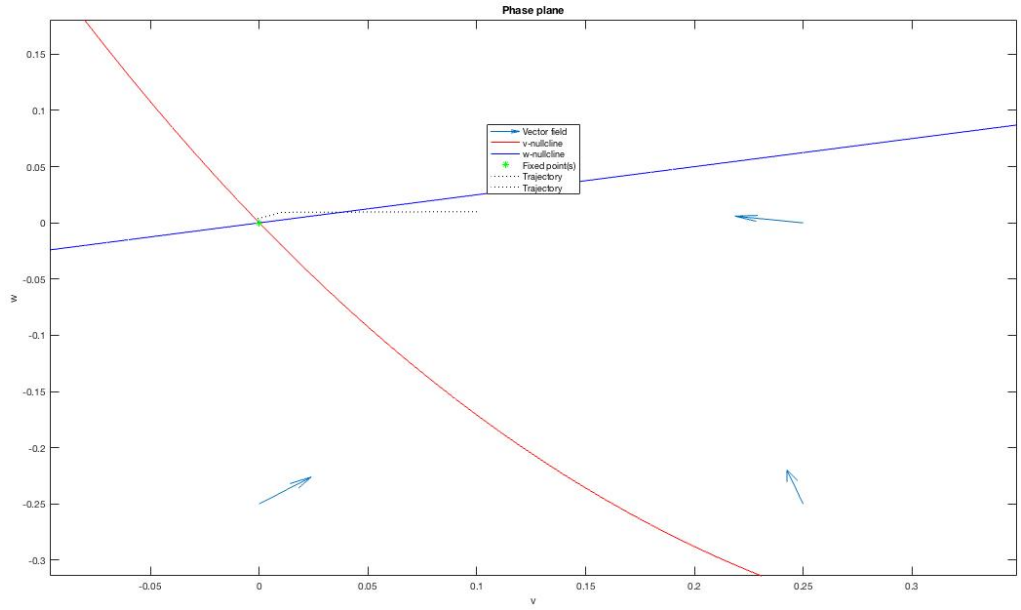
(e). The fixed point at (0,0) is stable.
Zoom in of the fixed point

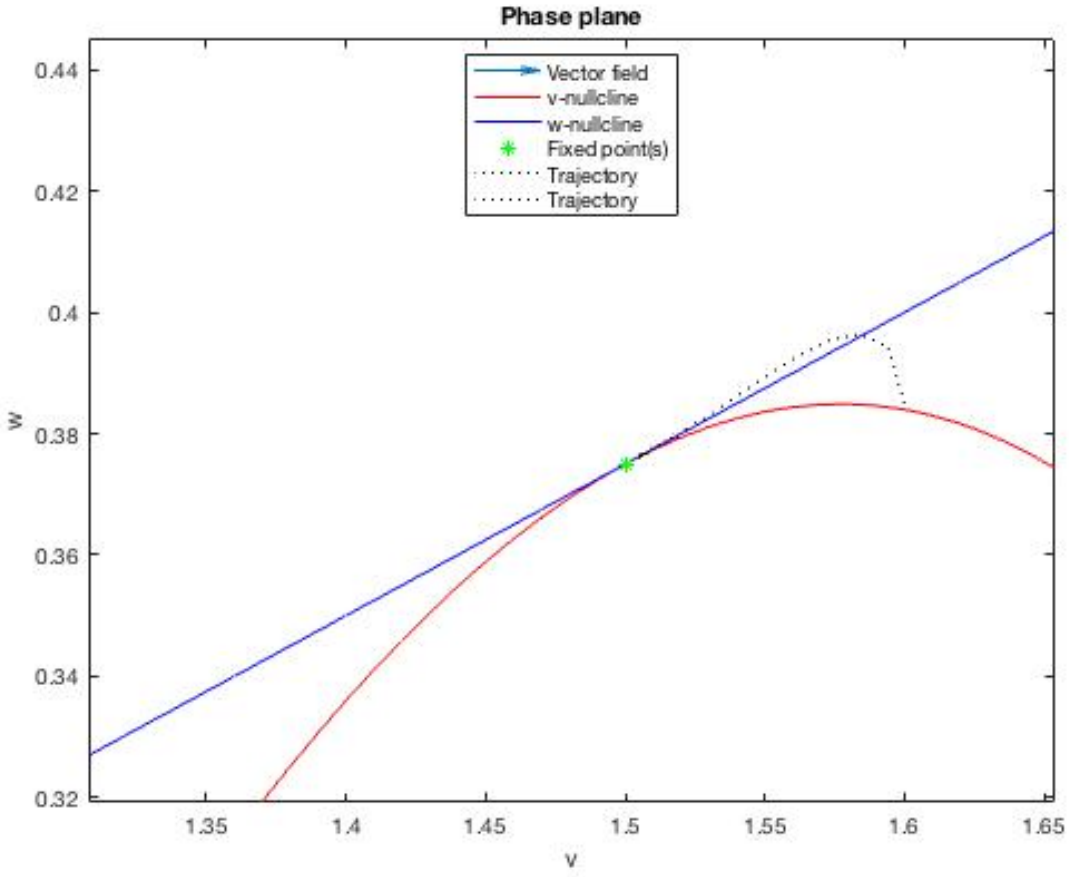


(f). In this case, b = 0.25
The fixed point at (0,0) is stable.
The fixed point at (1.5,0.375) is non-hyperbolic and therefore we cannot conclude its stability



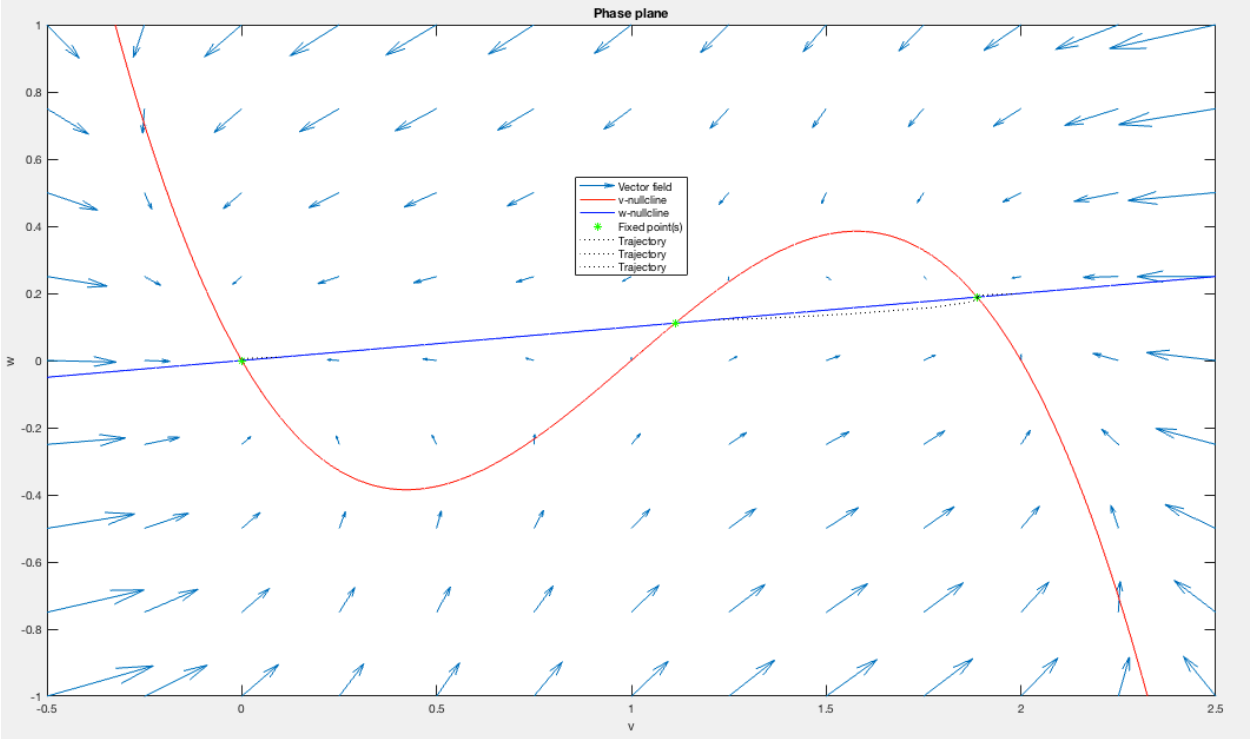
Zoom in of the fixed point



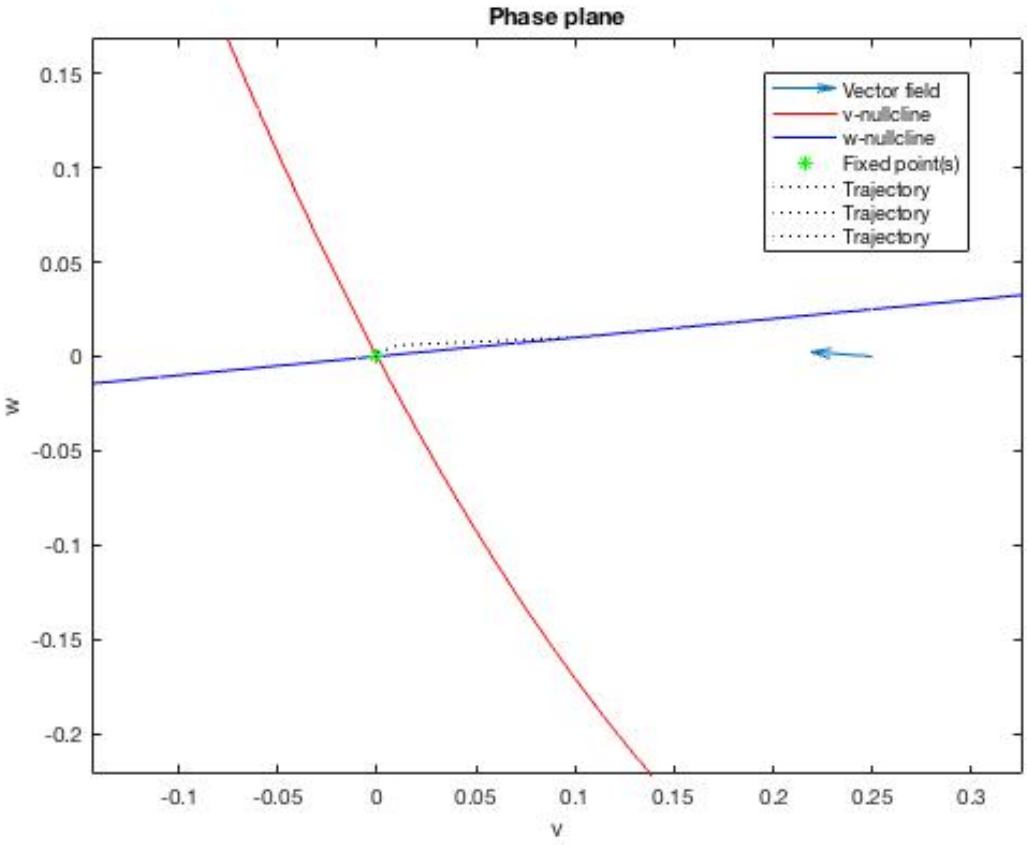


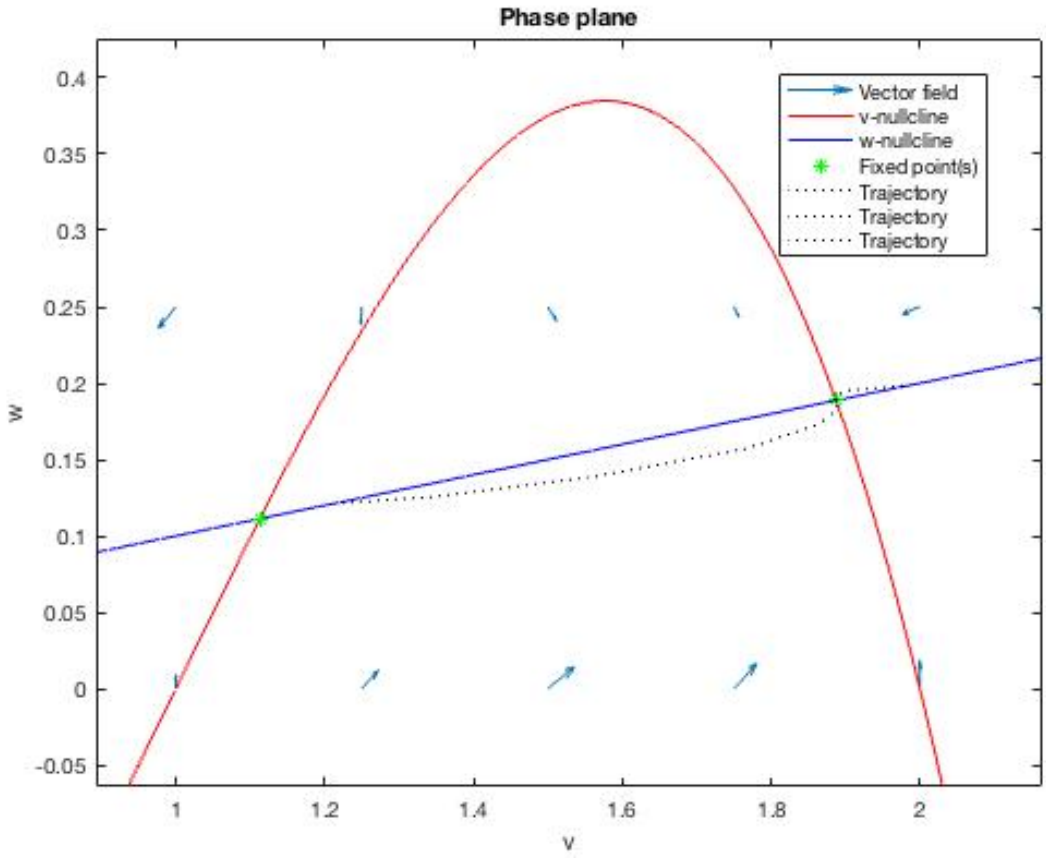
(g). In this case, I picked a value of b = 0.1
The fixed point at (0,0) is stable.
The fixed point at (1.1127,0.11127) is unstable.
The fixed point at (1.8873,0.18873) is stable.

Models of the Neuron Homework #2 Due: 09/25/2017



Zoom-in of the Fixed points


Phase plane
Vector field
v-nullcline
w-nullcline
Fixed point(s)
Trajectory
Trajectory
Trajectory
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
w
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
v


Phase plane
Vector field
v-nullcline
w-nullcline
Fixed point(s)
Trajectory
Trajectory
Trajectory
w
v
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05
1
1.2
1.4
1.6
1.8
2