MATH 448 — Homework 5

Exercise 8.1. Classify the equilibrium (node, saddle, spiral, or center; stable or unstable where relevant) for $\dot{R} = -2R + 3J$, $\dot{J} = R - 4J$.

Exercise 8.2 (*computer exploration*) In the MATLAB code below, try $A = \begin{pmatrix} 1 & 0.5 \\ 0.5 & 1 \end{pmatrix}$ and $A = \begin{pmatrix} 0.2 & 1 \\ -1 & 0.2 \end{pmatrix}$. For each, classify the equilibrium by hand first, then run the code and check that the picture matches your prediction.

```
A = [0 1; -1 0]; % change this matrix to try other cases
[R,J] = meshgrid(-3:0.4:3, -3:0.4:3);
dR = A(1,1)*R + A(1,2)*J;
dJ = A(2,1)*R + A(2,2)*J;
quiver(R,J,dR,dJ)
hold on
for R0 = [-2 -1 1 2]
    [t,Y] = ode45(@(t,Y) A*Y, [0 10], [R0;0]);
    plot(Y(:,1), Y(:,2))
end
xlabel('R'); ylabel('J')
```