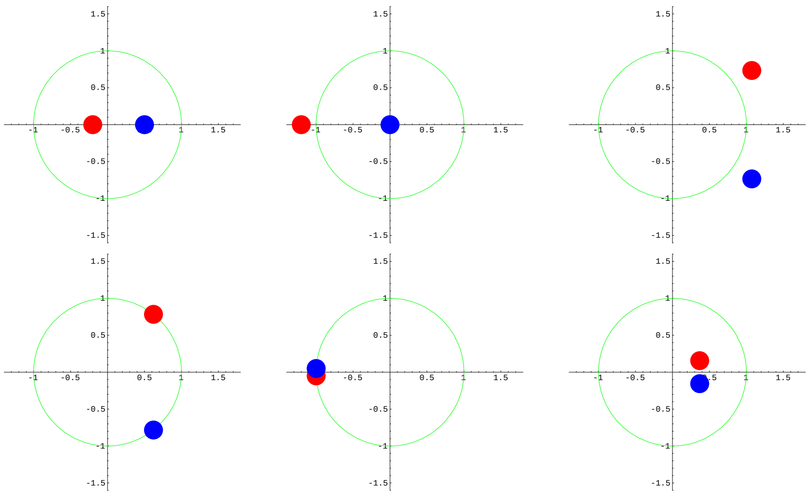
2/28/05 QUIZZ NR 4 — Math118, O.Knill

Name:

1) Which of the following differential equations produces an area-preserving flow?

a) $\frac{d}{dt}x = x + y^2, \frac{d}{dt}y = -y + x^2$
b) $\frac{d}{dt}x = -x + x^2, \frac{d}{dt}y = y - y^3$
c) $\frac{d}{dt}x = 1, \frac{d}{dt}y = 2$
d) $\frac{d}{dt}x = y^2, \frac{d}{dt}y = x^2$

2) Which of the following 6 pictures of eegenvalues a Jacobean $DF(x_0, y_0)$ at an equilibrium point (x_0, y_0) which is stable?



3) What happens at a Hopf bifurcation?

a) A pair of eigenvalues crosses the unit circle.
b) A pair of eigenvalues crosses the imaginary axes.
c) A single eigenvalues crosses the unit circle.
d) A single eigenvalues crosses the imaginary axes.
e) An attractive equilibrium point becomes repelling.

4) Which of the following formulations is the Poincare Bendixson theorem?

a) An orbit in the plane which stays in a bounded region is either asymptotic to an equilibrium point or to a limit cycle.
b) An orbit in the plane which is not asymptotic to a limit cycle is attracted to an equilibrium point.
c) Every orbit of a differential equation in the plane is either asymptotic to a limit cycle or to an equilibrium point.

5) A differential equation of the form $\frac{d}{dt}x(t) = H_y(x, y), \frac{d}{dt}y(t) = -H_x(x, y)$, where $H(x, y)$ is a function of two variables.

a) produces an area-preserving flow.
b) is integrable.
c) has an attractive limit cycle.
d) has at least one attractive equilibrium point.

6) Which of the following differential equations is called the **van der Pol oscillator** ?

a) $\frac{d^2}{dt^2}x = -x.$
b) $\frac{d^2}{dt^2}x + c(x^2 - 1)\frac{d}{dt}x + x = 0.$
c) $\frac{d^2}{dt^2}x + c(x^2 - 1)\frac{d}{dt}x + \sin(x) = 0.$

7) Lienard systems have

a) exactly one repelling limit cycle.
b) exactly one attracting limit cycle.
c) exactly one repelling equilibrium point.
d) exactly one attractig equilibrium point.