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Nonlinear Dynamics: Mathematical and Computational Approaches
Lead instructor: ✉ Liz Bradley

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✓ 4.2 Saddle points and eigenvectors » Quiz

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Quiz scores are NOT recorded.
- You may come back to quizzes and take them as many times as you like
- When you are finished, clicking the "Score" button at the bottom of the test will show you the correct responses.

Question 1

All fixed points live in the bottoms of bowls in the dynamical landscape.

○ A. True

✔ ● B. False

Question 2

The following fixed points of the undamped pendulum are saddle points in the dynamical landscape (i.e., with one positive real eigenvalue and one negative real eigenvalue).

(a)
$(\theta, \omega) = (0, 0)$

○ A. True

✔ ● B. False

(b)
$(\theta, \omega) = (\pi, 0)$

✔ ● A. True

○ B. False

(c)
$(\theta, \omega) = (3\pi, 0)$

○ **A. True**

✖ ● B. False

(d)
$(\theta, \omega) = (-\pi, 0)$

✔ ● A. True

○ B. False

(e)
$(\theta, \omega) = (2\pi, 0)$

○ A. True

✔ ● B. False

Question 3

Calculate the eigenvalues s_1 and s_2 of this matrix:

$$\begin{bmatrix} 4 & 1 \\ 2 & 3 \end{bmatrix}$$

A. $s_1 = -1$, $s_2 = 5$

B. $s_1 = 1$, $s_2 = -5$

✔ ● C. $s_1 = 5$, $s_2 = 2$

D. $s_1 = -5$, $s_2 = -2$

E. Undefined

Question 4

What is the shape of this matrix?

$$\begin{bmatrix} 0 & 9.2 & \pi & e & 7 \\ 18 & 13 & 12 & -8.2 & 2\pi \end{bmatrix}$$

A. 5x2

✔ ● B. 2x5

C. 2x2

D. 5x5

E. Undefined

Question 5

A is a 2x2 matrix that captures how the state of a dynamical system evolves. How many eigenvalues does A have? (Experts: count any repeated ones individually.)

A. 0

B. 1

✔ ● C. 2

D. 3

E. Undefined

Question 6

A is a matrix that captures how the state of a dynamical system evolves. Any point on an eigenvector of A ..... stay on that eigenvector.

A. Can

✔ ● B. Must

C. Does not

Question 7

A is a 2x2 matrix that captures how the state of a dynamical system evolves. If the eigenvalues of A are negative, what kind of dynamics does that reflect? (Experts: assume that they're real-valued.)

✔ ● A. Fixed point

B. Periodic orbit

C. Chaotic

D. Divergence

Question 8

An eigenvalue defines:

A. How big a matrix is

✔ ● B. How fast a trajectory moves along the corresponding eigenvector

C. Whether or not a matrix captures the state of a dynamical system

Question 9

A matrix can give you an accurate representation of the evolution of the state of a linear dynamical system.

A. True

✖ ● B. False

Question 10

A matrix can give you an accurate *local* representation of the evolution of the state of a nonlinear dynamical system.

✔ ● A. True

B. False

Question 11

A matrix can give you an accurate *global* representation of the evolution of the state of a nonlinear dynamical system.

○ A. True

✔ ○ B. False

You got **13** out of **15** questions correct [Reset]

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