

If an object of mass  $m > 0$  is attached to a wall by a spring of stiffness  $k > 0$  and slides around on a frictionless surface, then a combination of Newton's Law and Hooke's Law says that the displacement  $x$  of the object is governed by the ODE  $mx'' = -kx$ .

1. If  $x(0) = 1$ , which of the following could be  $x(t)$ ?

(A)  $x(t) = \cos(t\sqrt{k/m})$

(B)  $x(t) = e^{t\sqrt{k/m}}$

(C)  $x(t) = e^{-t\sqrt{k/m}}$

(D) None of the above

2. True or False?

If  $\lambda$  is a repeated eigenvalue of a  $2 \times 2$  matrix, it must be defective.

3. True or False?

If  $\lambda$  is a repeated eigenvalue of a  $2 \times 2$  matrix of the form

$$A = \begin{bmatrix} 0 & 1 \\ b & a \end{bmatrix},$$

it must be defective.