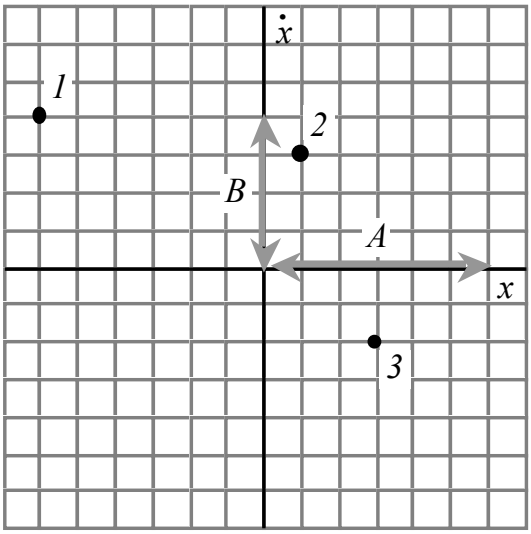
Pretest: Phase space diagrams: Self-limiting oscillators Name _____

Consider an oscillator in which the damping force is non-linear, *i.e.,* the damping force is not simply proportional to the speed of the oscillating mass. The equation of motion for one such an oscillator is as follows (all constants are positive):

$$\ddot{x} + \gamma'\left(\frac{x^2}{A^2} + \frac{\dot{x}^2}{B^2} - 1\right)\dot{x} + \omega_o^2 x = 0$$

The oscillator is set into motion from a variety of starting points *(1 – 3)* labeled in the phase space diagram at right. Note the parameters *A* and *B* labeled on the diagram.



Consider the motion of the oscillator immediately after it begins to move. **For each labeled starting point,** just after the oscillator begins to move:

i. Would the damping force experienced by the oscillator be exerted in *the same direction as its velocity, in the opposite direction from its velocity,* or *neither?* Explain how you can tell.

ii. Would the total energy of the oscillator *increase, decrease,* or *remain the same?* Explain how you can tell.

Point *1*	Point *2*	Point *3*
i.	i.	i.
ii.	ii.	ii.