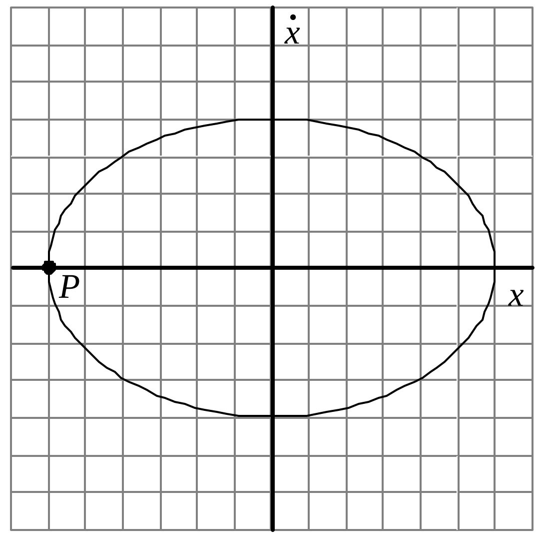
Pretest: Phase space diagrams: Damped harmonic motion Name ___________________________

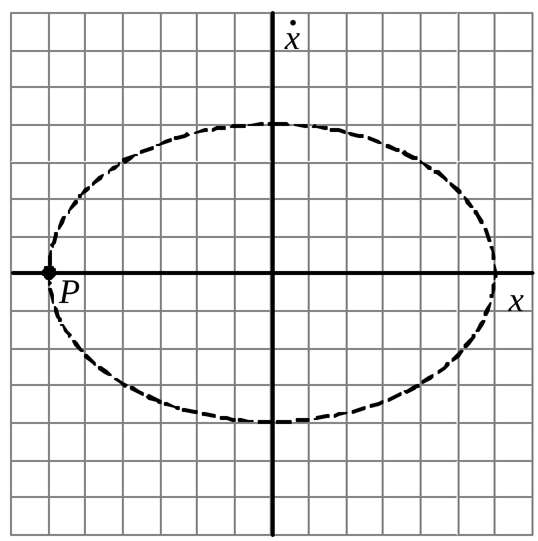
A block, initially at rest at a location along the *negative-x* axis, undergoes simple harmonic motion, as illustrated by the phase space diagram at right. The point labeled *P* denotes the initial conditions for the motion of the block.



Now suppose that the block were released from rest at the <u>same location</u> as before, *except* that a retarding force is now applied to the block. Assume that the retarding force is proportional to the velocity of the block.

a. Consider the case in which the retarding force causes the block to undergo *underdamped* motion.

   i. In the space at right, sketch how the phase space trajectory of the block would differ from the original trajectory (shown as a dashed curve). Explain your reasoning.



   ii. Consider the first moment after release when the block would attain a maximum speed. At that moment would the block be located *to the left of* $x = 0$, *to the right of* $x = 0$, or *exactly at* $x = 0$? Explain.

(continued on other side)

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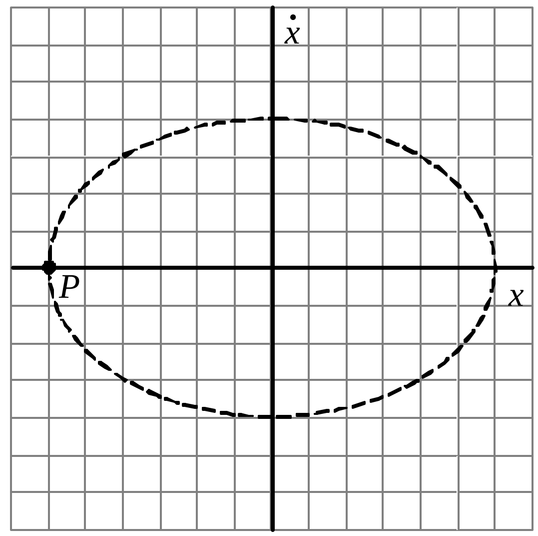
b. Consider instead the case in which the retarding force is great enough to cause the block to undergo *critically damped* motion.

In the space at right, sketch how the phase space trajectory of the block would differ from the original trajectory (shown as a dashed curve). Explain your reasoning.



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