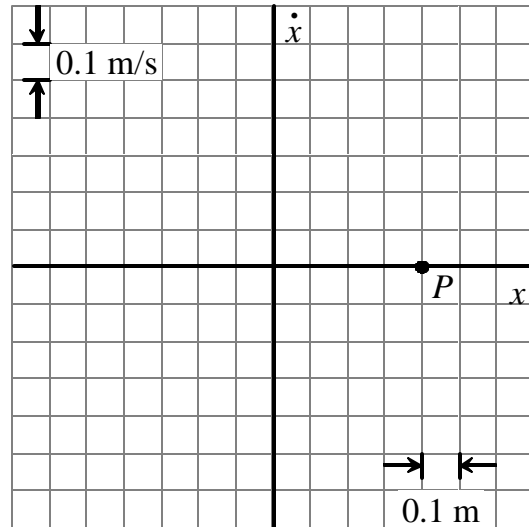


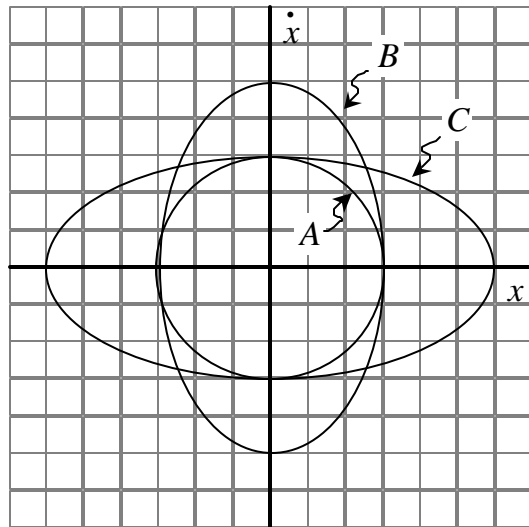
1. A mass $m = 750$ g is connected to a spring with spring constant $k = 1.5$ N/m. At $t = 0$ the mass is set into simple harmonic motion (no damping) with the initial conditions represented by the point P in the phase space diagram at right.



- Using the given information, sketch an *accurate* phase space plot for the oscillator. Explain your reasoning and show all work.
- On the phase space trajectory you have drawn, label the point Q that represents the position and velocity of the oscillator *one-quarter period after* $t = 0$. Explain your reasoning.

2. Consider the phase space plots (A, B, and C) shown below.

- Could all three plots correspond to the same simple harmonic oscillator (*i.e.*, same mass and same spring constant)? Explain why or why not.
- Which pair of plots could be used to show the effect of keeping the *total energy constant* but *increasing the spring constant*? Clearly indicate which plot would correspond to the larger spring constant. Explain *without* performing any calculations.



- Which other pair of plots could be used to show the effect of keeping the *total energy constant* but *decreasing the mass*? Clearly indicate which plot would correspond to the smaller mass. Explain *without* performing any calculations.

3. Consider again phase space **trajectory B** shown in problem 2. Suppose that each unit along the horizontal axis corresponded to 10 cm and that each unit along the vertical axis corresponds to 10 cm/s. Using $m = 400$ g, determine the following quantities for the oscillator represented by trajectory B. Explain your reasoning and show all work.

- (i) angular frequency, (ii) period, (iii) total energy, (iv) spring constant