Pretest: Harmonic motion in two dimensions Name ______________________________

Consider an object that moves along a horizontal frictionless surface (*e.g.,* an air hockey puck on a level air table). Suppose that the object moves under the influence of a net force expressed as follows:

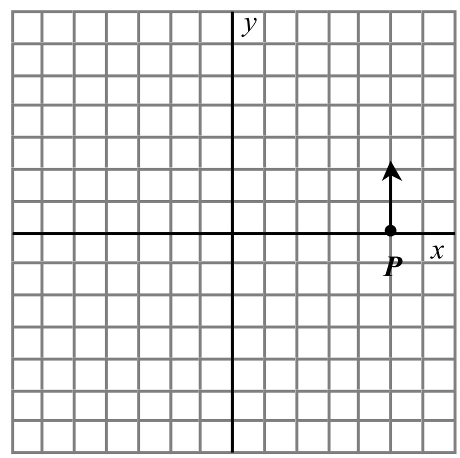
$$\vec{F}_{net}(x,y) = \left(-k_x x\hat{i}\right) + \left(-k_y y\hat{j}\right)$$

Note: The above net force can be modeled by two long springs connecting the air hockey puck to two edges of the air table. One spring, with force constant k_x, would be oriented in one direction; the other spring with force constant k_y would be oriented perpendicular to the first spring.

Each diagram below corresponds to a specific experiment. The relative values of the force constants k_x and k_y and the initial conditions of the motion are given in each case.

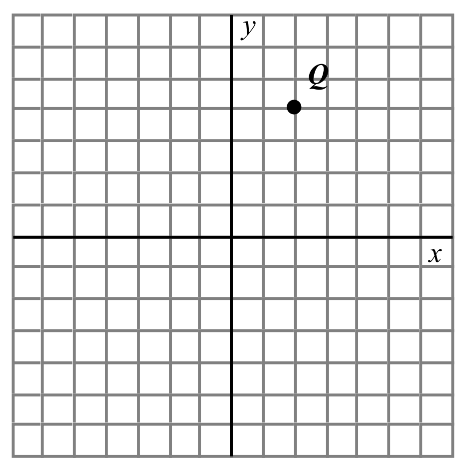
For each case below, carefully sketch a qualitatively correct *x*-*y* trajectory that the object might follow. Explain the reasoning you used to decide how to draw the trajectory for each case.

a. The force constants are **equal, $k_x = k_y$,** and the object is launched from point *P* in the +*y* direction.



$\boldsymbol{k_x = k_y}$

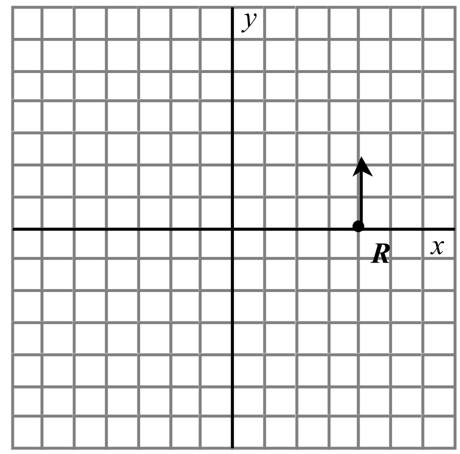
b. The force constants are **equal, $k_x = k_y$,** and the object is launched from rest at point *Q*.



$\boldsymbol{k_x = k_y}$

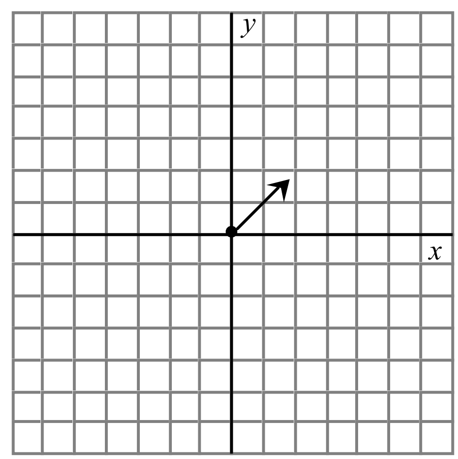
(continued on other side)

c. The force constants differ by a factor of 4, with $\mathbf{k_y = 4k_x}$, and the object is launched from point *R* in the +*y* direction.



$\mathbf{k_y = 4k_x}$

d. The force constants differ by a factor of 4, with $\mathbf{k_y = 4k_x}$, and the object is launched from the origin in the direction shown.



$\mathbf{k_y = 4k_x}$