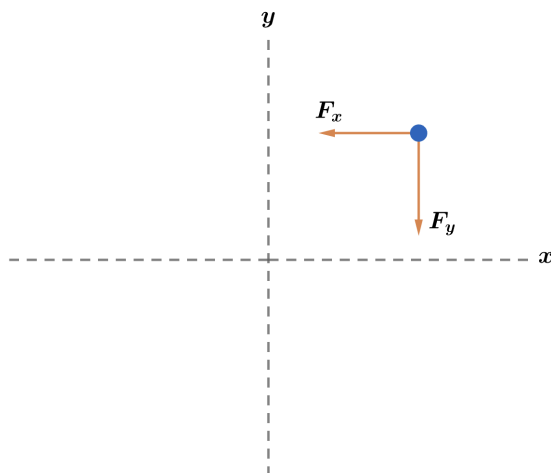


# 2019A F=ma Exam: Problem 24

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Recall

$$F_x = -\frac{dU}{dx} = -18kx$$

$$F_y = -\frac{dU}{dy} = -32ky$$

so the particle is undergoing simple harmonic motion in the  $x$  and  $y$  directions independently.

If the particle only moves in the  $x$ -direction, we have

$$T_x = 2\pi\sqrt{\frac{m}{k_x}} = 2\pi\sqrt{\frac{m}{18k}} = \frac{2\pi}{3}\sqrt{\frac{m}{2k}}$$

If the particle only moves in the  $y$ -direction, we have

$$T_y = 2\pi\sqrt{\frac{m}{k_y}} = 2\pi\sqrt{\frac{m}{32k}} = \frac{2\pi}{4}\sqrt{\frac{m}{2k}}$$

If the particle moves in both directions, then its motion is the sum of two periodic motions so its period is

$$T = \text{lcm}(T_x, T_y) = 2\pi\sqrt{\frac{m}{2k}}$$

Hence,

$$\frac{T_{\max}}{T_{\min}} = \frac{T}{T_y} = 4$$

so the answer is D.