2022B F=ma Exam: Problem 24

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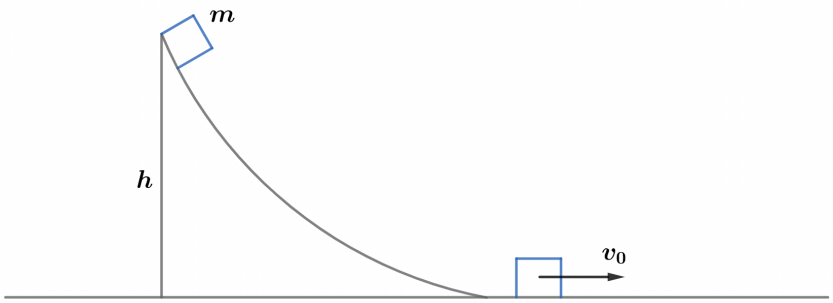
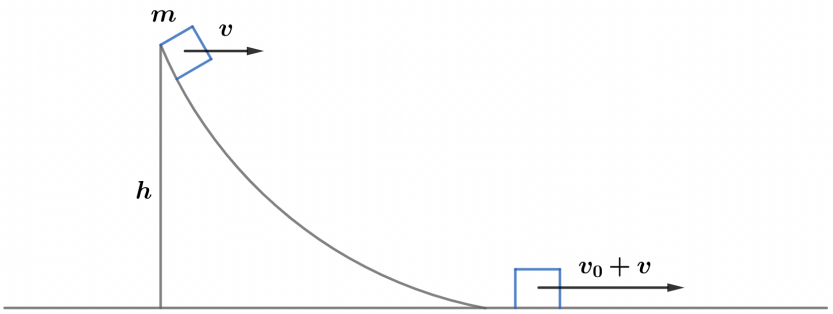


In the moving frame of the ramp, the block slides down a height h and leaves with velocity v_0. Conserving energy, we have

$$mgh = \frac{1}{2}mv_0^2$$
$$v_0 = \sqrt{2gh}$$



Thus in the ground frame, the block leaves with velocity $v_0 + v$. The change in kinetic energy is

$$\Delta K = \frac{1}{2}m(v_0 + v)^2 - \frac{1}{2}mv^2$$
$$= \frac{1}{2}mv_0^2 + mv_0 v$$
$$= mgh + mv\sqrt{2gh}$$

so the answer is $\boxed{\text{C}}$.