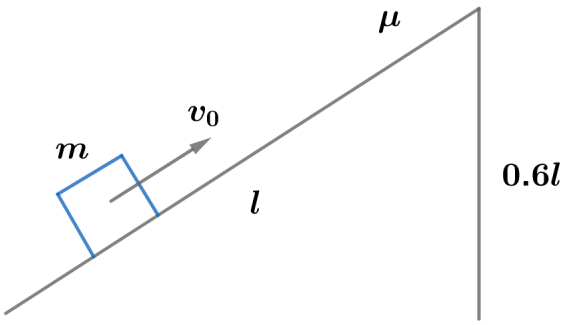
2019B F=ma Exam: Problem 20

Kevin S. Huang



From our kinematics equations, we have going up:

$$d = v_f t - \frac{1}{2}at^2$$
$$d = \frac{1}{2}a_u t_u^2$$

We have going down:

$$d = v_0 t + \frac{1}{2}at^2$$
$$d = \frac{1}{2}a_d t_d^2$$

Then

$$a_u t_u^2 = a_d t_d^2$$
$$\frac{t_d}{t_u} = \sqrt{\frac{a_u}{a_d}}$$

where

$$ma_u = mg\sin\theta + \mu mg\cos\theta$$
$$ma_d = mg\sin\theta - \mu mg\cos\theta$$

so

$$\frac{t_d}{t_u} = \sqrt{\frac{\sin\theta + \mu\cos\theta}{\sin\theta - \mu\cos\theta}} = \sqrt{\frac{0.6 + 0.5(0.8)}{0.6 - 0.5(0.8)}} = \sqrt{5}$$

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