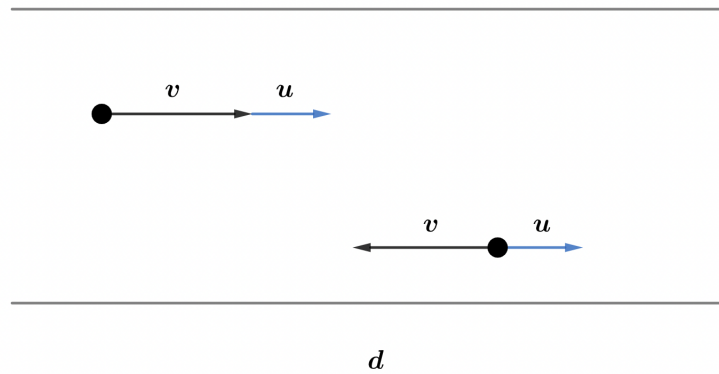# 2022B F=ma Exam: Problem 5

Kevin S. Huang

By definition of average speed,

$$v_{\text{ave}} = \frac{2d}{t_{\text{tot}}}$$

Going downstream takes time:

$$t_d = \frac{d}{v + u}$$

Going upstream takes time:

$$t_u = \frac{d}{v - u}$$

Then,

$$t_{\text{tot}} = t_d + t_u = \frac{d}{v + u} + \frac{d}{v - u} = \frac{2dv}{v^2 - u^2}$$

$$v_{\text{ave}} = \frac{v^2 - u^2}{v}$$

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