2015 F=ma Exam: Problem 1

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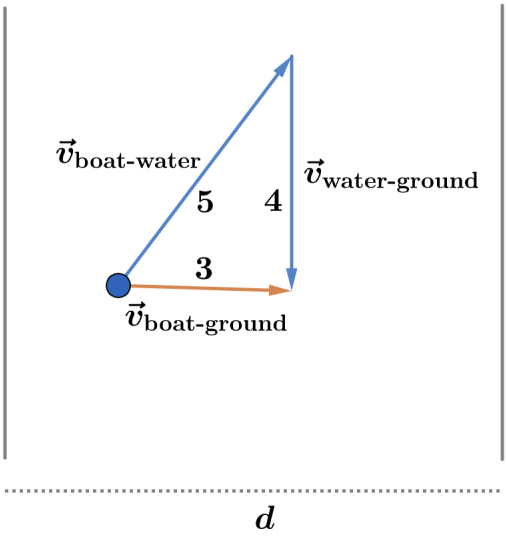

By the addition of relative velocities, we have

$$\vec{v}_{\text{boat-ground}} = \vec{v}_{\text{boat-water}} + \vec{v}_{\text{water-ground}}$$

We are given that these three vectors form a right triangle with hypotenuse $v_{\text{boat-water}} = 5\,\text{m/s}$ and $v_{\text{water-ground}} = 4\,\text{m/s}$. Thus,

$$v_{\text{boat-ground}} = \sqrt{v_{\text{boat-water}}^2 - v_{\text{water-ground}}^2} = \sqrt{5^2 - 4^2}\,\text{m/s} = 3\,\text{m/s}$$

To travel across a distance d, it takes time

$$t = \frac{d}{v_{\text{boat-ground}}} = \frac{600\,\text{m}}{3\,\text{m/s}} = 200\,\text{s}$$

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