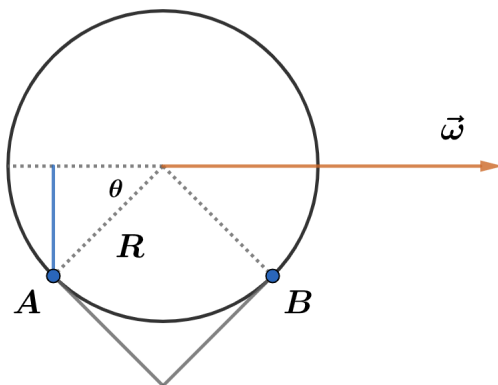


# 2020A F=ma Exam: Problem 2

Kevin S. Huang



In the frame of the ball, points A and B have instantaneous velocity  $\omega R \sin \theta$  into the page. The ball rolls without slipping, so in the lab frame

$$v_A = v_B = 0 = \omega R \sin \theta - v_{CM}$$

$$\omega = \frac{v_{CM}}{R \sin \theta} = \frac{\sqrt{2} v_{CM}}{R}$$

since  $\theta = \pi/4$  by construction. The highest point, where the contribution from rotation is largest, has the maximum speed  $v_{CM} + R\omega = (1 + \sqrt{2})v_{CM}$  so the answer is E.