2009 F=ma Exam: Problem 19

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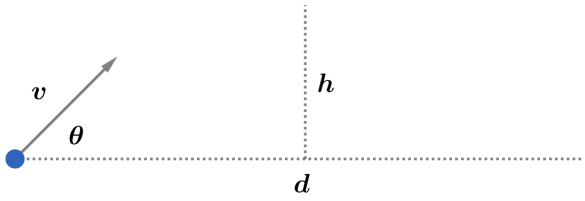

Recall from projectile motion the range and height equations,

$$R(\theta) = \frac{v^2 \sin(2\theta)}{g}$$

$$H(\theta) = \frac{v^2 \sin^2(\theta)}{2g}$$

To maximize the range, $\theta = \pi/4$ which yields $R(\pi/4) = v^2/g$ and $H(\pi/4) = v^2/4g$. In our case, we have

$$d = \frac{v^2}{g}$$

so

$$h = \frac{v^2}{4g} = \frac{d}{4} = \frac{80\,\mathrm{m}}{4} = 20\,\mathrm{m}$$

Thus, the answer is $\boxed{\text{B}}$.