

14. We choose our positive direction in the direction of the rebound (so the ball's initial velocity is negative-valued). We evaluate the integral  $J = \int F dt$  by adding the appropriate areas (of a triangle, a rectangle, and another triangle) shown in the graph (but with the  $t$  converted to seconds). With  $m = 0.058 \text{ kg}$  and  $v = 34 \text{ m/s}$ , we apply the impulse-momentum theorem:

$$\begin{aligned}
 \int F_{\text{wall}} dt &= m\vec{v}_f - m\vec{v}_i \\
 \int_0^{0.002} F dt + \int_{0.002}^{0.004} F dt + \int_{0.004}^{0.006} F dt &= m(+v) - m(-v) \\
 \frac{1}{2}F_{\text{max}}(0.002 \text{ s}) + F_{\text{max}}(0.002 \text{ s}) + \frac{1}{2}F_{\text{max}}(0.002 \text{ s}) &= 2mv \\
 F_{\text{max}}(0.004 \text{ s}) &= 2(0.058 \text{ kg})(34 \text{ m/s})
 \end{aligned}$$

which yields  $F_{\text{max}} = 9.9 \times 10^2 \text{ N}$ .