36. The problem consists of two distinct parts: the completely inelastic collision (which is assumed to occur instantaneously, the bullet embedding itself in the block before the block moves through significant distance) followed by simple harmonic motion (of mass $m + M$ attached to a spring of spring constant k).

(a) Momentum conservation readily yields $v' = mv/(m + M)$.

(b) Since v' occurs at the equilibrium position, then $v' = v_m$ for the simple harmonic motion. The relation $v_m = \omega x_m$ can be used to solve for x_m, or we can pursue the alternate (though related) approach of energy conservation. Here we choose the latter:

$$\begin{aligned} \frac{1}{2}(m+M)\left(v'\right)^2 &= \frac{1}{2}kx_m^2 \\ \frac{1}{2}(m+M)\frac{m^2v^2}{(m+M)^2} &= \frac{1}{2}kx_m^2 \end{aligned}$$

which simplifies to

$$x_m = \frac{mv}{\sqrt{k(m+M)}} \ .$$