Given: \( m_1 = \text{mass of bullet} = 0.1 \text{kg} \)
\( m_2 = \text{mass of block} = 5.0 \text{kg} \)
\( d = \text{distance block slides} = 6.82 \text{lbm} \)
\( \mu_k = \text{coefficient of kinetic friction} = 0.3 \)
\( V_0 = \text{initial velocity of bullet} = 340.0 \text{m/s} \)

Goal: Find \( V_f \), velocity of bullet after passing through block by...

1) Use conservation of energy to find \( V_b \), velocity of block after collision.

2) With this information, use conservation of momentum to find \( V_f \).

1) Use \( \text{DVEATs} \) to solve for \( V_{bi} \), velocity of block right after collision.

Initial: block at \( x_b \), velocity of \( V_{bi} \)
Final: block at \( x_f = d \), velocity of \( V_{bf} = 0 \)

\[
V_{bf}^2 = V_{bi}^2 + 2ad
\]
\[-V_{bi}^2 = 2ad\]
\[V_{bi}^2 = -2ad\]
\[V_{bi} = \sqrt{-2ad}\]
\[V_{bc} = \sqrt{-2(-\mu_k g) d}\]
\[a = \mu_k g\]

2) Now we have the velocity of the block after the collision so we can apply conservation of momentum.

Initial: bullet + block before collision
Final: bullet + block just after collision

System: block, bullet

\[ p_i = p_f \]
\[ m_1 V_0 = m_1 V_f + m_2 V_{bi} \]
\[ m_1 V_0 - m_1 V_f = m_2 V_{bi} \]
\[ m_1 (V_0 - V_f) = m_2 V_{bi} \]
\[ V_0 - V_f = \frac{m_2 V_{bi}}{m_1} \]
\[ -V_f = \frac{m_2 V_{bi}}{m_1} - V_0 \]
\[ V_f = V_0 - \frac{m_2 V_{bi}}{m_1} \]

\[ V_f = \frac{340.0 \text{m/s} - 5.0 \text{kg} \left( \sqrt{2(0.3)(9.8 \text{m/s}^2)(6.82 \text{lbm})/0.1 \text{kg}} \right)}{0.1 \text{kg}} \]

\[ V_f = 23.2 \text{m/s} \]