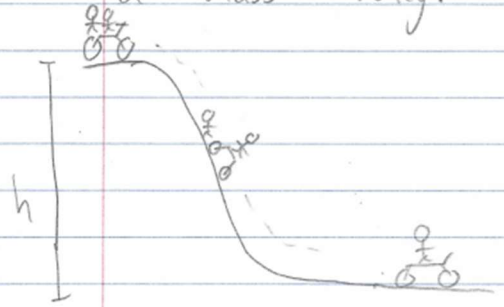
③ A two-seater bicycle is rolling down a 30m hill. halfway down the hill, one of the passengers falls off the bike. Determine the velocity at the bottom of the hill if the bike has a mass 15kg and each passenger has a mass 70kg.



State 1: mgh

State 2: $\frac{mgh}{2} + \frac{1}{2}mv_2^2$

State 3: $\frac{1}{2}mv_3^2$

v_2

$mgh = \frac{mgh}{2} + \frac{1}{2}mv_2^2$ $\quad v_2 = \sqrt{\frac{mgh}{2} \times \frac{2}{m}} = \sqrt{gh} = 17.15 \frac{m}{s}$

$m_i v_i = m_f v_f$

$m_i = 70 \times 2 + 15 = 155$

$m_f = 85$

$v_i = v_2 = 12.13 \frac{m}{s}$

$v_f = 22.119 \frac{m}{s}$

$\frac{mgh}{2} + \frac{1}{2}mv_f^2 = \frac{1}{2}mv_g^2$

$v_3 = 25.727 \frac{m}{s}$ ✓