1. \[ \overrightarrow{R_5} = 14 \text{ m} \quad \overrightarrow{g_3} = 0 \]

\[ \overrightarrow{v_B} = 12.5 \text{ m/s} \]

2. Bobby is in the car frame, which is moving with respect to the earth at

\[ \overrightarrow{v_{CE}} = \overrightarrow{v_B} = 12.5 \text{ m/s} \]

Bobby throws the rock in the car frame at a velocity of \( \overrightarrow{v_{RC}} = 18 \text{ m/s} \) \( \uparrow \)

The net velocity of the rock in the earth frame is the velocity it has due to the car, plus what Bobby gives it by throwing. The velocity of the rock in the earth frame is therefore

\[ \overrightarrow{v_{RE}} = \overrightarrow{v_{CE}} + \overrightarrow{v_{RC}} \]

\[ (= \overrightarrow{v_{RC}} + \overrightarrow{v_{CE}}) \]
3. The path of the rock over the ground is a straight line in the direction of \( \vec{\mathbf{v}}_{\text{RC}} \):

\[
|\vec{\mathbf{v}}_{\text{RC}}| = |\vec{\mathbf{v}}_{\text{CE}} + \vec{\mathbf{v}}_{\text{RC}}| = |12.5 + 18.5| \text{ m/s} = \sqrt{12.5^2 + 18.5^2} \text{ m/s} = 21.0 \text{ m/s}
\]
The triangle $OCS$ is similar to the triangle formed by $\vec{v}_{ac}$ and $\vec{u}_{ac}$.

Therefore,

$$\frac{d}{x_s} = \frac{|\vec{v}_{sc}|}{|\vec{v}_{ac}|}$$

$$d = x_s \frac{|\vec{v}_{sc}|}{|\vec{v}_{ac}|} = 14 \text{ m} \times \frac{12 \text{ m/s}}{21.6 \text{ m/s}} = 7.8 \text{ m}$$

5. y component of $\vec{v}_{sc}$ is constant and same as $\vec{v}_{co}$, so the y coordinate of the rock is always the same as the y coordinate of the car.