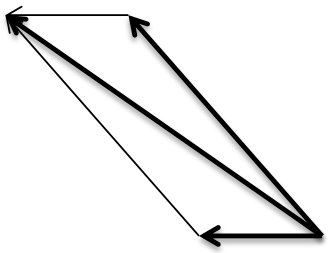
a Lady bug with a velocity of 10.0mm/s [W] crawls on a chair that is being pulled [50 N of W] at 40.mm/s. what is the velocity of the ladybug, relative to the ground?



We will used a Galilean addition of velocities:

$\vec{V} = \overrightarrow{V_0} + \overrightarrow{V'}$

where $\vec{V}$ the velocity of the ladybug, relative to the ground;

$\overrightarrow{V'}$ - the velocity of a chair;

$\overrightarrow{V}'$ - the velocity of the ladybug with respect to the chair (moving coordinate system););

From the law of cosines:

$$V^2 = V_0^2 + V'^2 - 2V_0V'\cos\alpha$$
$$= 10^2 + 40^2 + 2 * 10 * 40\cos(90 - 50) = 100 + 1600 + 800 * \cos(40) = 2313$$

V = 48.09 mm/s