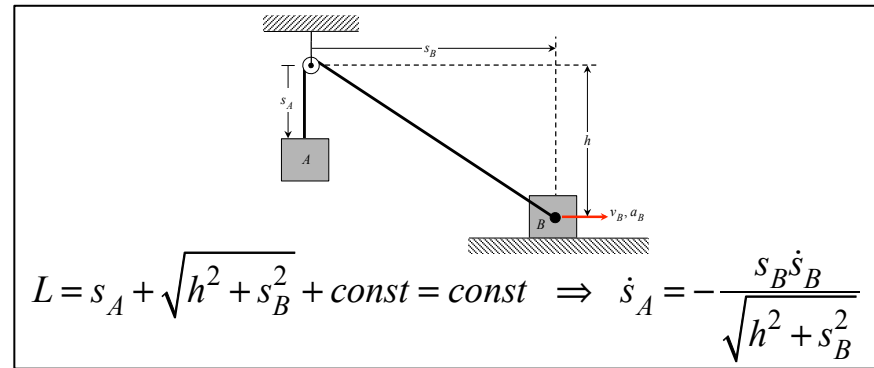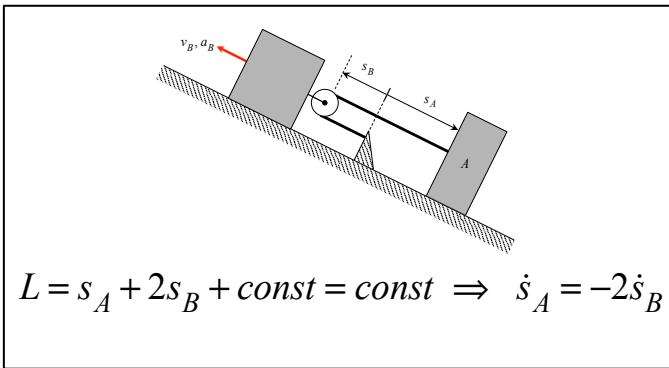# *Summary*: Particle Kinematics – Constrained and Relative Motion

PROBLEM: Two bodies connected by inextensible cable.
Write down the length of the cable in terms of motion variables and differentiate.

$$L = s_A + 2s_B + const = const \implies \dot{s}_A = -2\dot{s}_B$$

$$L = s_A + \sqrt{h^2 + s_B^2} + const = const \implies \dot{s}_A = -\frac{s_B \dot{s}_B}{\sqrt{h^2 + s_B^2}}$$

PROBLEM: The motion of one point relative to another point.

$$\vec{r}_{B/A} = \vec{r}_B - \vec{r}_A = position\ of\ B\ with\ respect\ to\ A$$

$$\vec{v}_{B/A} = \frac{d\vec{r}_{B/A}}{dt} = \vec{v}_B - \vec{v}_A = velocity\ of\ B\ with\ respect\ to\ A$$

$$\vec{a}_{B/A} = \frac{d\vec{v}_{B/A}}{dt} = \vec{a}_B - \vec{a}_A = acceleration\ of\ B\ with\ respect\ to\ A$$