Two point-like objects are located at the points A, and B, of respective masses $M_A = 2M$, and $M_B = M$, as shown in the figure below. The two objects are initially oriented along the $y$-axis and connected by a rod of negligible mass of length $D$, forming a rigid body. A force of magnitude $F = |\vec{F}|$ along the $x$ direction is applied to the object at A at $t = 0$ for a short time interval $\Delta t$. Neglect gravity. Give all your answers in terms of $M$, $D$, $F$ and $\Delta t$ as needed.

a) Describe qualitatively in words how the system moves after the force is applied: direction, translation and rotation.

b) How far is the center of mass of the system from the object at point B?

c) What is the direction and magnitude of the linear velocity of the center-of-mass after the collision?

d) What is the magnitude of the angular velocity of the system after the collision?

e) Is it possible to apply another force of magnitude $F$ along the positive $x$-direction to prevent the system from rotating? Does it matter where the force is applied?

f) Is it possible to apply another force of magnitude $F$ in some direction to prevent the center of mass from translating? Does it matter where the force is applied?