1. a. Define: Average velocity (prose form)
   b. List two attributes of a vector
   c. State Newton's 2nd Law in prose form. (THE NEWTON'S LAW)
   d. State Newton's 3rd Law in prose form.

2. a.) Given $\vec{r}(t) = [1\ m/s^3\ t^3 + 4\ m]\ \hat{i} + [2\ m - 1\ m/s\ t]\ \hat{j}$

   $\vec{v}(t) =$

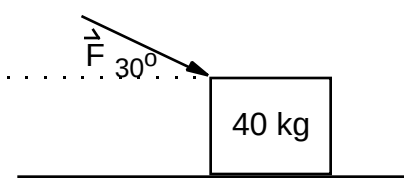
   $\vec{a}(t) =$

   $\vec{v}_{av}(0 \rightarrow 2s) =$

   b.) As a midshipman's mind wandered while running the mile and one half, she estimated that she was rounding the curved portion of the track at constant speed of 4 m/s and that the track at that point was the arc of a circle of radius about 32 meters. Give the magnitude of her acceleration and describe its direction.

For maximum credit and partial credit include free body diagrams, force tables, equations of motions and SHOW YOUR WORK.

3.

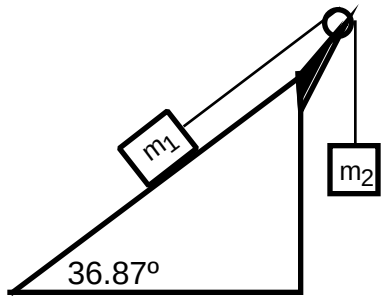


A force $\vec{F}$ is applied at 30° below the horizontal to push a 40 kg box across a floor for which $\mu_s = 0.25$ and $\mu_k = 0.2$.

a. Find the maximum magnitude of $\vec{F}$ such that the block does not begin to slide.

b. Find the acceleration of the box if the magnitude of $\vec{F}$ is held steady at 140 N.

4.



$m_1 = 100$ kg; $m_2 = 100$ kg; $\theta = 36.87°$
no friction

a. Find the acceleration of mass m_2.

b. Find the tension in the string.

over

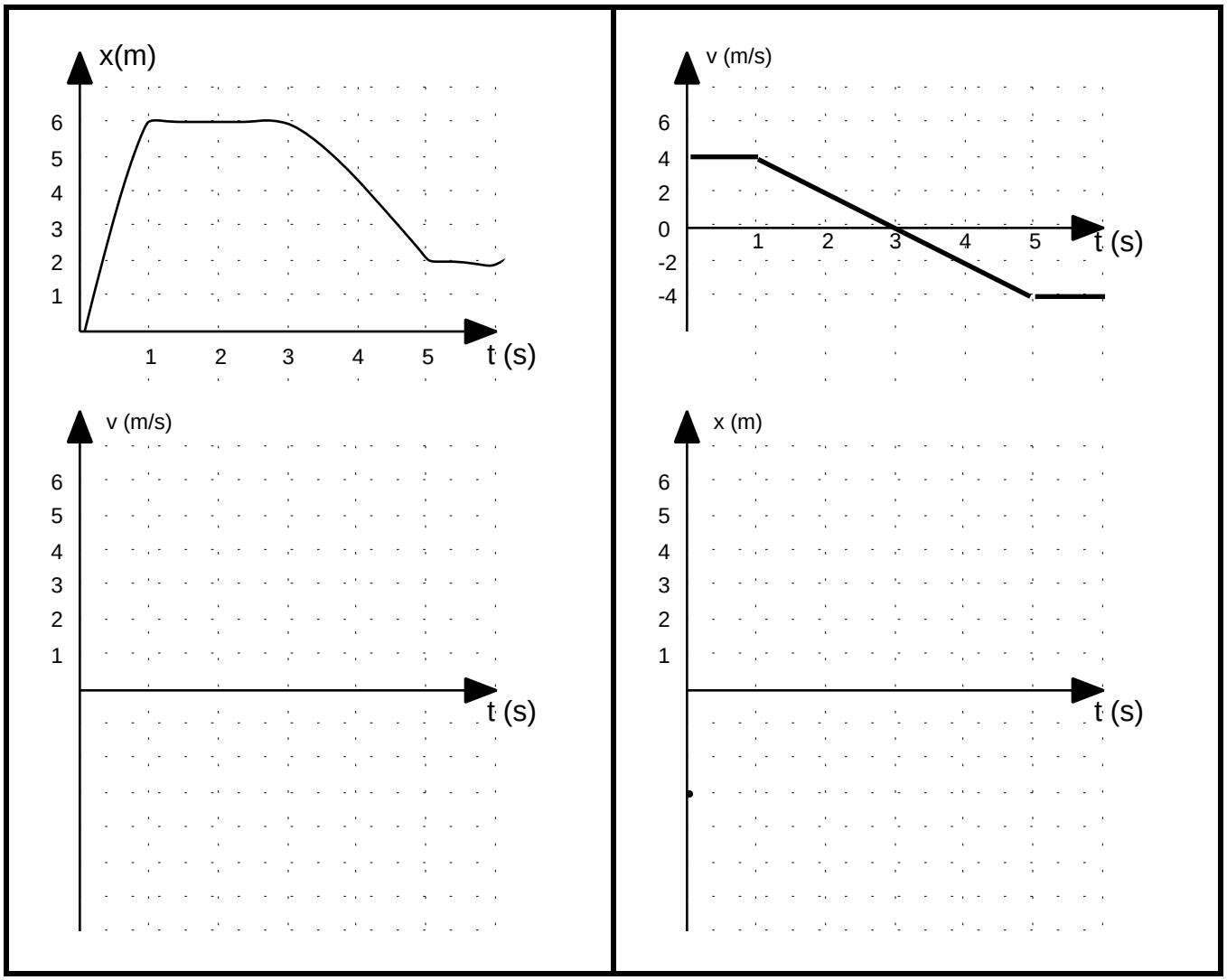
5. A surgical tubing water cannon (a large slingshot) launches a water balloon at 49 $^{m}/_{s}$ and 36.87° above the horizontal from ground level in a test firing.
Launch time t_1 = 0 s; g = 9.80 $^{m}/_{s^2}$

a.) Give equations for the horizontal and vertical positions of the balloon as a function of the time t elapsed after firing. Launch point = (0m, 0m).

b.) Give the equations for the horizontal and vertical components of velocity of the balloon as a function of the elapsed time t.

c.) Find t_{max}, the time required for the balloon to reach the high point of its trajectory.

d.) Find h_{max}, the maximum height above the firing point for its trajectory.

e.) Find the range for this water cannon when fired over a level field at 36.87°.

Extra Credit Sketch the corresponding v vs t curve below the given x vs t curve and the corresponding x vs t curve below given that x(0s) = - 3 m and the v vs t curve