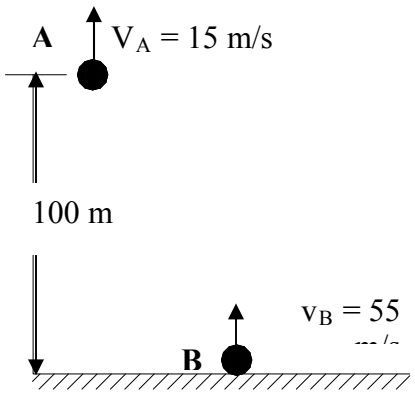
Alexandria Higher Institute of Engineering & Technology (AIET)		
General		Preparatory Year
ME001	Mechanics II	Final, August, 21, 2010
Examiners:	Dr. Rola Afify	Time: 3 hours

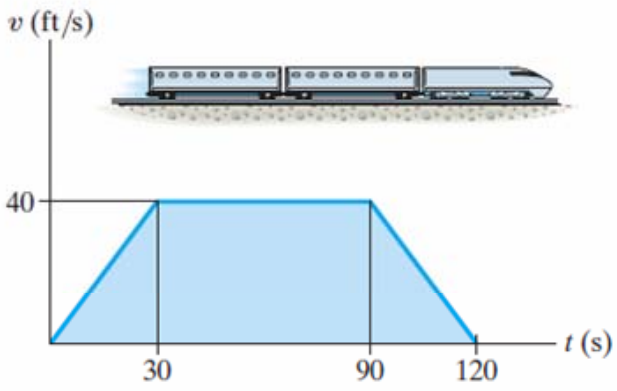
Answer the following questions:

1- The acceleration of a particle as it moves along a straight line is given by $a = 2t - 1$, in m/s^2, where t is in seconds. If s = 1 m and v = 2 m/s when t = 0, determine the particle's velocity and position when t = 6 s. Also determine the total distance the particle travels during this time period.

2- Ball A is launched vertically with an initial velocity of 15 m/s from height 100 m. At the same time, another ball B is launched from the ground with an initial velocity of 55 m/s. Calculate the time and height at which the two balls are passing each other, also calculate the velocity of each ball at that time.



3- The v-t diagram for the motion of a train as it moves from station A to station B is shown. Draw the s-t and a-t graphs during the same time period.



Hint:
For the first inclined line, use this equation

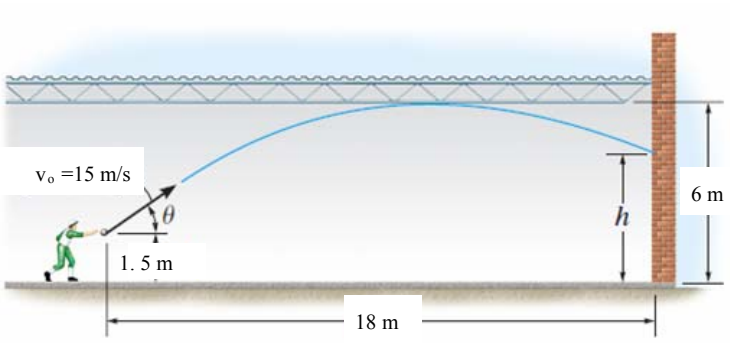
$$\frac{v-0}{t-0}=\frac{40-0}{30-0}$$

and for the second inclined line, use this equation

$$\frac{v-40}{t-90}=\frac{0-40}{120-90}$$

4- A particle moves in a curvilinear motion such that its displacement is given $\vec{s} = \left\{ \left(t^4 - 2t^2\right) \vec{i} + \left(2t^3 - 3t\right)\vec{j} \right\}$ m. Determine the particle's velocity and acceleration at t = 3s.

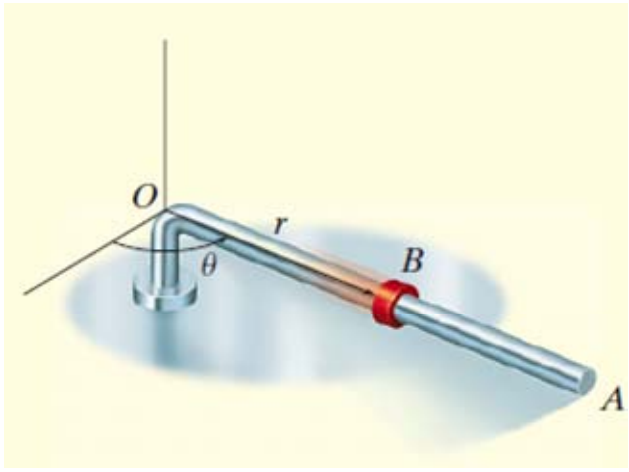
5- The man stands 18 m away from the wall and throws a ball at it with a speed $v_o =$ 15 m/s. Determine the angle θ at which he should release the ball so that it strikes the wall as shown in the figure. The room has a ceiling height of 6m. Calculate the height (h).



6- a) In Polar coordinates starting from $\vec{r} = r\vec{u}_r$, proof that

$\vec{v} = \left(\dot{r}\right)\vec{u}_r + \left(r\dot{\theta}\right)\vec{u}_\theta$ and $\vec{a} = \left(\ddot{r} - r\dot{\theta}^2\right)\vec{u}_r + \left(r\ddot{\theta} + 2\dot{r}\dot{\theta}\right)\vec{u}_\theta$

b) The rod OA, shown in figure, is rotating in the horizontal plane such that $\theta = t^3$, rad. At the same time, the collar B is sliding outward along OA so that $r = 100t^2$, mm. If in both cases t is in seconds, determine the velocity and acceleration of the collar when t = 2 s.



Good Luck 2/2