	Alexandria Higher Institute of Engineering & Technology (AIET)		
	All Departments		0-Level
	ME002	**Engineering Mechanics II**	Final of 2-nd Term, June 12, 2010
	Examiners:	Prof. Abdel-Nasser Zayed and Dr. Rola Afify	Time: 3 hours

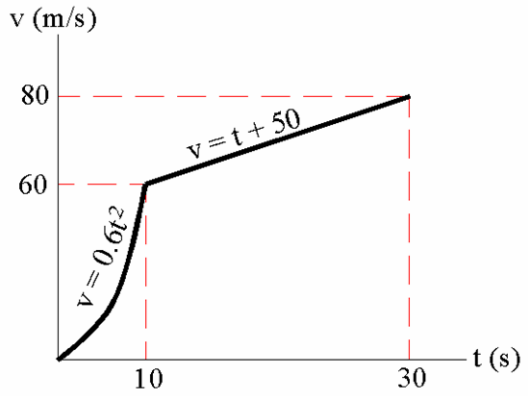
Question 1: (8 points)

A particle starts to move on straight line with initial velocity $\mathbf{v_o = -10\ m/s}$ at $s_o = 0$. The car acceleration is given as $\mathbf{a = 6t\ m/s^2}$, where t is the time in seconds. Calculate:

a) The position, velocity and acceleration of the particle at t = 8 s.
b) The total distance traveled during the first 8 seconds.
c) The average velocity and the average speed during the first 8 seconds.

Question 2: (8 points)

The v–t graph for the motion of a car as it moves along a straight road is shown. Draw the s–t and a-t graphs of the car during the 30-s time interval, where the car starts from rest at s = 0.



Question 3: (6 points)

A particle moves in curvilinear motion where its position is determined as

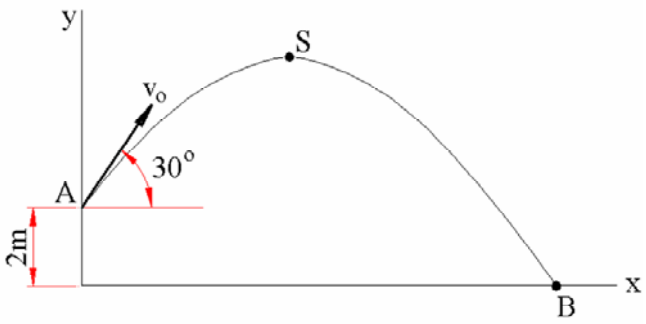
$$\vec{r} = (2t^2 - 5)\vec{i} + (t^3 - 11t)\vec{j}$$

where t is the time in seconds. At t = 5 s, calculate:

a) The position vector, magnitude and directions.
b) The velocity vector, magnitude and directions.
c) The acceleration vector, magnitude and directions.

Question 4: (10 points)

A particle was launched from point "A" with initial velocity v_o and angle $\theta = 30^o$ to impact the ground at point "B". The time taken from A to B was 2s. Calculate:



a) the value of the initial velocity v_o
b) the horizontal distance x_B
c) the maximum height y_S
d) the path equation
e) the velocity vector at point "B"
f) the radius of curvature at point "B"

Question 5: (12 points)

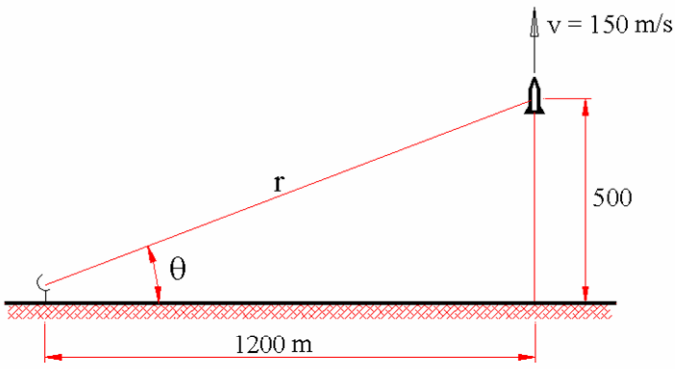
a) In Polar coordinates starting from $\vec{r} = r\,\vec{u}_r$, proof that

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

b) A rocket is launched vertically with constant velocity of 150 m/s. The rocket is observed by a radar at distance 1200m from the launching point. Calculate the main parameter of the polar coordinates

$$(r,\ \dot{r},\ \ddot{r},\ \theta,\ \dot{\theta},\ \ddot{\theta})$$

when the rocket is at height of 500m.

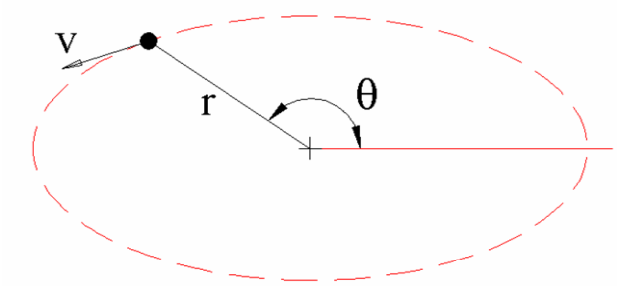


Question 6: (10 points)

A particle rotates in a circular path of radius 20m. The angle θ is changed with time as $\theta = 0.1t^3$ rad. At t = 3s, Calculate the particle velocity and acceleration:

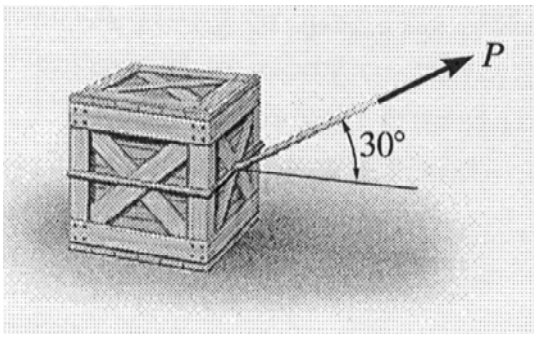
a) in polar coordinates

b) in Tangential & Normal Coordinates



Question 7: (10 points)

The 30-kg crate rests on a horizontal plane for which the coefficient of kinetic friction is $\mu_k = 0.3$. The crate is subjected to a force P = $(30t^2 + 200)$ N, determine the velocity of the crate after 3s starting from rest.



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