1. A particle moves on a space curve governed by $x = 6 \cos \omega t$, $y = 4 \sin \omega t$, and $z = 3 t^2$ where x, y, and z are in inches, t is in seconds, and $\omega = 2$ rad/sec. Describe the path of the particle and compute the magnitude of its acceleration a when t = 4 sec. (20%)

2. A long-range artillery rifle at A is aimed at an angle of $45°$ with the horizontal, and its shell is just able to clear the mountain peak at the top of its trajectory. Determine the magnitude u of the muzzle velocity, the height H of the mountain above sea level, and the range R to the sea. (15%)
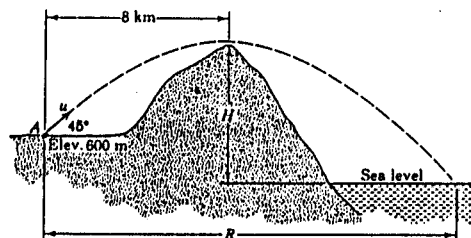
Problem 2

3. Cylinder B has a downward velocity in feet per second given by $v_B = t^2/2 + t^3/6$ where t is in seconds. Calculate the acceleration of A when t = 2 sec. (15%)
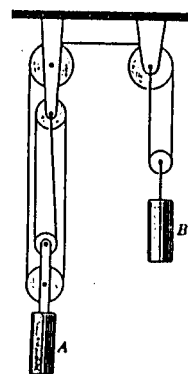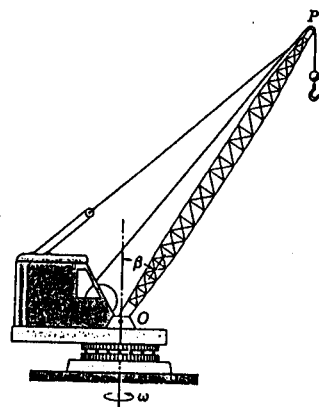
4. The car of mass m accelerates on a level road under the action of the driving force F from a speed v_1 to a higher speed v_2 in a distance s. If the engine develops a constant power output P, determine v_2. Treat the car as a particle under the action of the single horizontal force F. (20%)

Problem 3

Problem 4

5. The boom OP of the revolving crane has a length of 24 m, and the crane is revolving about the vertical axis at the constant rate of 2 rev/min in the direction shown. Simultaneously the boom is being lowered at the constant rate $\dot\beta = 0.10$ rad/s. Calculate the magnitudes of the velocity and acceleration of the end P of the boom for the instant when it passes the position $\beta = 30°$. (30%)

Problem 5

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