University of California, Merced

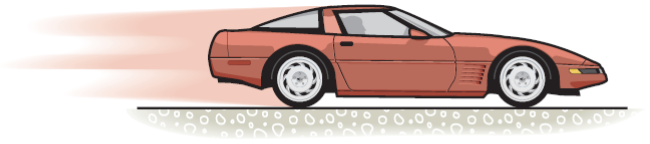
ENGR 057 Statics and Dynamics: Assignment #5

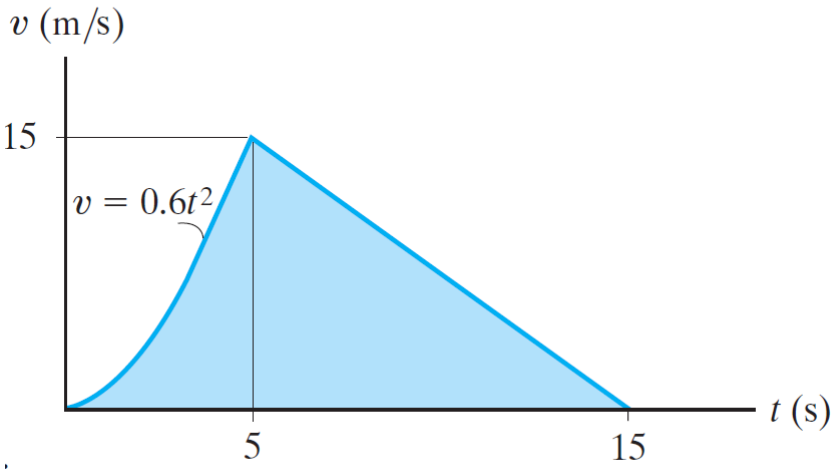
Summer - 2022

Due: August 4, 2022

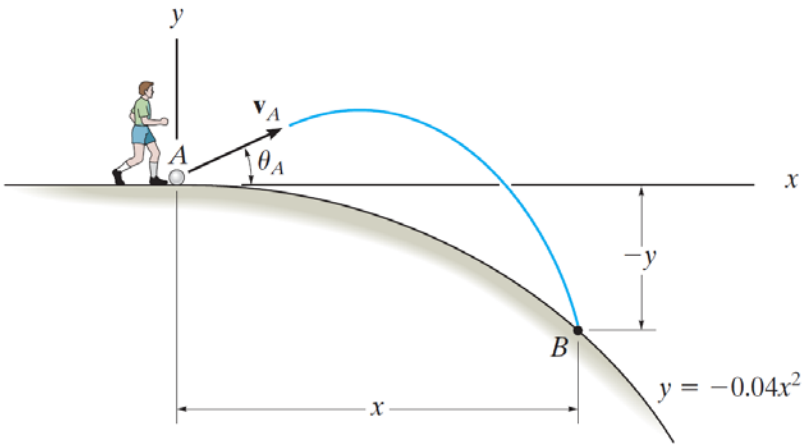
Problem 1. Two particles *A* and *B* start from rest at the origin s = 0 and move along a straight line such that $a_A = (6t - 3)$ ft/s^2 and $a_B = (12t^2 - 8)$ ft/s^2, where *t* is in seconds. Determine the distance between them when *t* = 4 s and the total distance each has traveled in *t* = 4 s.

Problem 2. 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. Also determine the average speed and the distance traveled for the 15-s time interval. When t = 0, s = 0.



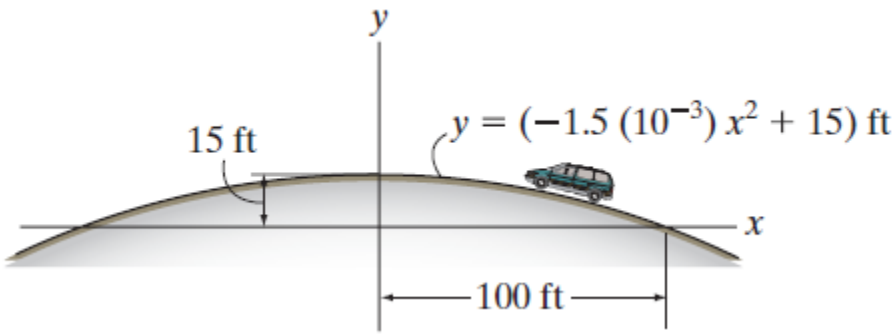


Problem 3. The ball at A is kicked with a speed v_A = 80 ft/s and at an angle θ_A = 30°. Determine the point (x, –y) where it strikes the ground. Assume the ground has the shape of a parabola as shown.

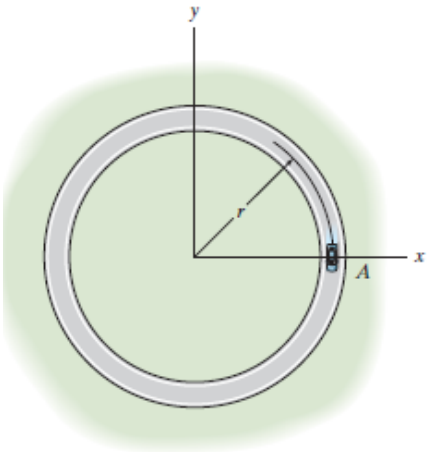


Problem 4. The velocity of a particle is given by $v = \{16t^2\mathbf{\hat{i}} + 4t^3\mathbf{\hat{j}} + (5t + 2)\mathbf{\hat{k}}\}$, where *t* is in seconds. If the particle is at the origin when *t* = 0, determine the magnitude of the particle's acceleration when *t* = 2s. Also, what is the *x*, *y*, *z* coordinate position of the particle at this instant?

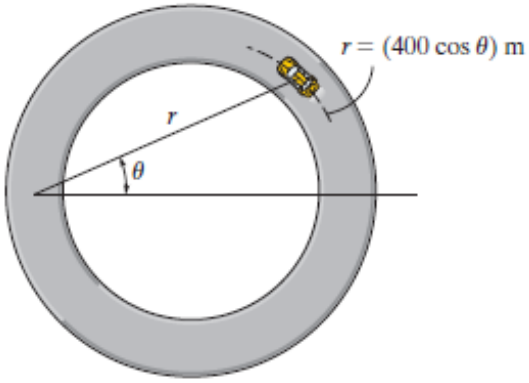
Problem 5. The van travels over the hill described by $y = (1.5(10^3)x^2 + 15)$ft. If it has a constant speed of 75 ft/s, determine the *x* and *y* components of the van's velocity and acceleration when *x* = 50 ft.



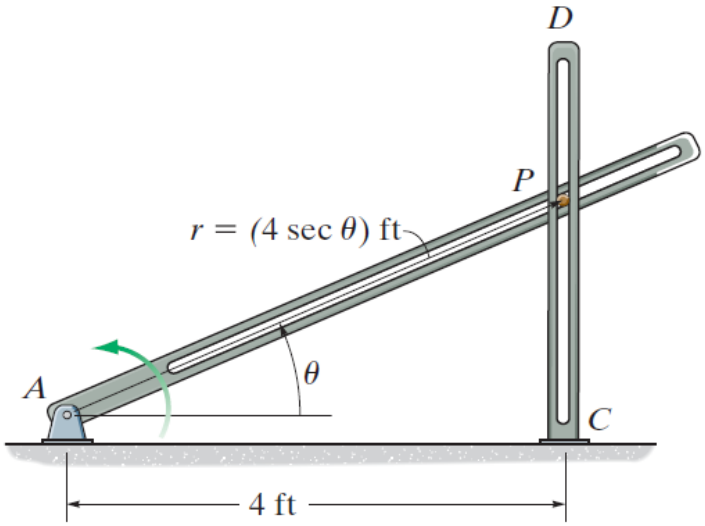
Problem 6. The car travels around the portion of a circular track having a radius of r = 500 ft such that when it is at point A it has a velocity of 2 ft/s, which is increasing at the rate of $\dot{v} = (0.002t)$ ft/s2, where t is in seconds. Determine the magnitudes of its velocity and acceleration when it has traveled three-fourths the way around the track.



Problem 7. The car travels around the circular track with a constant speed of 20 m/s. Determine the car's radial and transverse components of velocity and acceleration at the instant θ = π/4 rad.



Problem 8. If the slotted arm *AB* rotates counterclockwise with a constant angular velocity of $\dot{\theta} = 2$ rad/s, determine the magnitudes of the velocity and acceleration of peg *P* at $\theta = 30°$. The peg is constrained to move in the slots of the fixed bar *CD* and rotating bar *AB*.



Problem 9. If the end *A* of the cable is moving at v_A = 3 m>s, determine the speed of block B. (Note: there are two cords in the system).