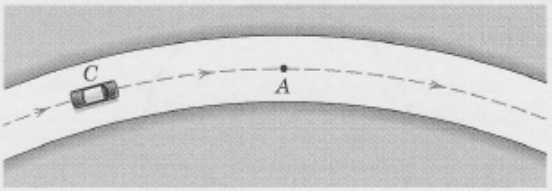
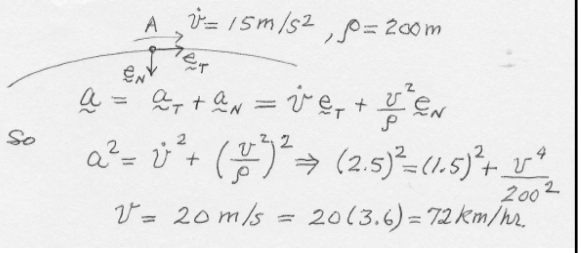
1. The car C increases its speed at the constant rate of 1.5 m/s^2 as it rounds the curve shown. If the magnitude of the total acceleration of the car is 2.5 m/s^2 at the point A where the radius of curvature is 200 m, compute the speed v of the car at this point.



1.



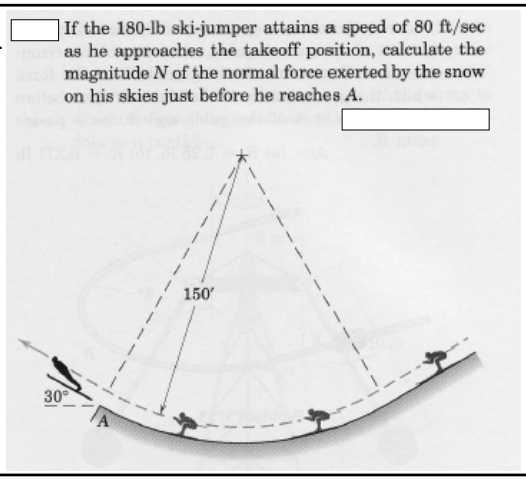
$$\underset{\sim}{a} = \underset{\sim}{a}_T + \underset{\sim}{a}_N = \dot{v}\,\underset{\sim}{e}_T + \frac{v^2}{\rho}\underset{\sim}{e}_N$$

So

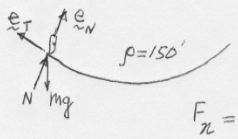
$$a^2 = \dot{v}^2 + \left(\frac{v^2}{\rho}\right)^2 \Rightarrow (2.5)^2 = (1.5)^2 + \frac{v^4}{200^2}$$

$$v = 20\ m/s = 20(3.6) = 72\ km/hr$$

2. If the 180-lb ski-jumper attains a speed of 80 ft/sec as he approaches the takeoff position, calculate the magnitude N of the normal force exerted by the snow on his skies just before he reaches A.



2.



$mg = 180\ lbs$, $v = 80\ ft/s$

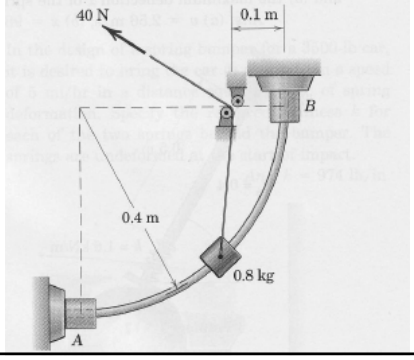
$$F_n = ma_n : N - mg\cos 30 = \frac{180}{32.2}\frac{(80)^2}{150}$$

$$a_n = \frac{v^2}{\rho}$$

$$N = 180(.866 + 1.33)$$

$$N = 394\ lb.$$

3. The 0.8-kg collar slides freely on the fixed circular rod. Calculate the velocity v of the collar as it hits the stop at B if it is elevated from rest at A by the action of the constant 40-N force in the cord. The cord is guided by the small fixed pulleys.



3. $W(s_2, s_1) = T_2 - T_1$

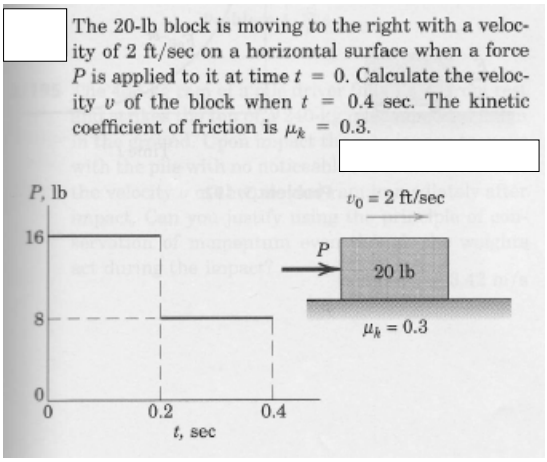
$W = F \cdot d$

$= 40\left[\sqrt{0.4^2 + 0.3^2} - 0.1\right] - .8\,(9.81)(0.4) = 12.86\ \text{J}$

$T_2 - T_1 = \frac{1}{2}(0.8)v_2^2 - 0$ So $.4v_2^2 = 12.86$

or $v_2 = 5.67\ \text{m/s}$

4. The 20-lb block is moving to the right with a velocity of 2 ft/sec on a horizontal surface when a force P is applied to it at time $t = 0$. Calculate the velocity v of the block when $t = 0.4$ sec. The kinetic coefficient of friction is $\mu_k = 0.3$.



4. $\int_0^t F_x\,dt = m(v(t) - v(0))$, $v(0) = 0$

$16(.2) + 8(.2) - 6(.4) = \frac{20}{32.2}v(t)$

$v(t) = 5.86\ \text{ft/s}$