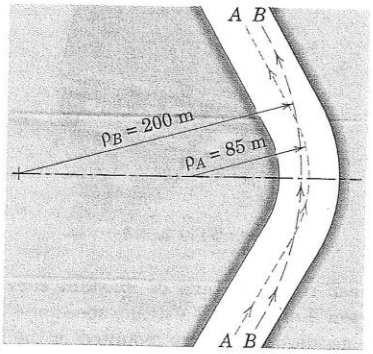
HW 2

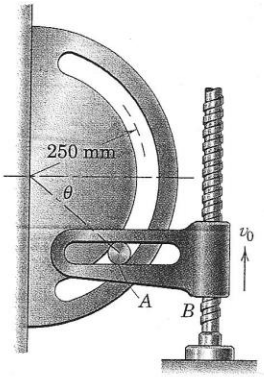
2/109 The figure shows two possible paths for negotiating an unbanked turn on a horizontal portion of a race course. Path *A-A* follows the centerline of the road and has a radius of curvature $\rho_A = 85$ m, while path *B-B* uses the width of the road to good advantage in increasing the radius of curvature to $\rho_B = 200$ m. If the drivers limit their speeds in their curves so that the lateral acceleration does not exceed $0.8g$, determine the maximum speed for each path.

Ans. $v_A = 25.8$ m/s, $v_B = 39.6$ m/s



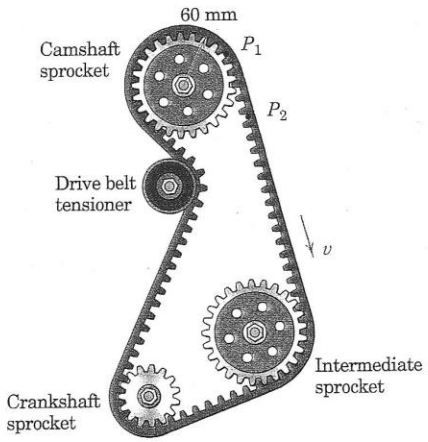
Problem 2/109

2/118 In the design of a timing mechanism, the motion of the pin A in the fixed circular slot is controlled by the guide B, which is being elevated by its lead screw with a constant upward velocity $v_0 = 2$ m/s for an interval of its motion. Calculate both the normal and tangential components of acceleration of pin A as it passes the position for which $\theta = 30°$.



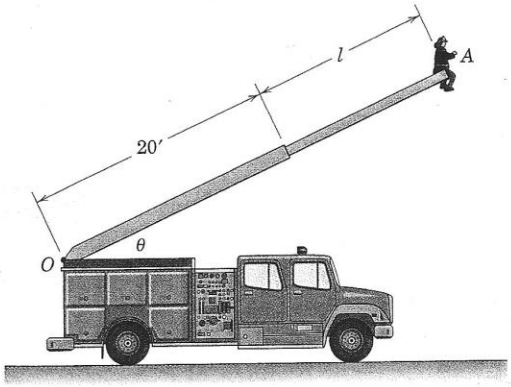
Problem 2/118

2/122 The design of a camshaft-drive system of a four-cylinder automobile engine is shown. As the engine is revved up, the belt speed v changes uniformly from 3 m/s to 6 m/s over a two-second interval. Calculate the magnitudes of the accelerations of points P_1 and P_2 halfway through this time interval.



Problem 2/122

2/136 The ladder of a fire truck is designed to be extended at the constant rate $\dot{l} = 6$ in./sec and to be elevated at the constant rate $\dot{\theta} = 2$ deg/sec. As the position $\theta = 50°$ and $l = 15$ ft is reached, determine the magnitudes of the velocity $\mathbf{v}$ and the acceleration $\mathbf{a}$ of the fireman at A.



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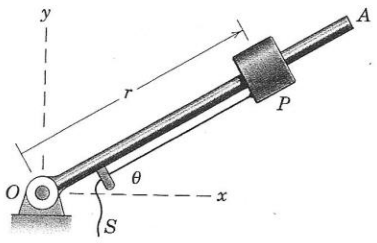
HW 2

2/155 The slider P can be moved inward by means of the string S as the bar OA rotates about the pivot O. The angular position of the bar is given by $\theta = 0.4 + 0.12t + 0.06t^3$, where θ is in radians and t is in seconds. The position of the slider is given by $r = 0.8 - 0.1t - 0.05t^2$, where r is in meters and t is in seconds. Determine and sketch the velocity and acceleration of the slider at time $t = 2$ s. Find the angles α and β which $\mathbf{v}$ and $\mathbf{a}$ make with the positive x-axis.

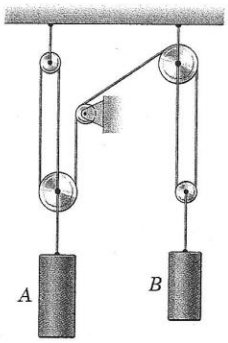
Ans. $\mathbf{v} = -0.3\mathbf{e}_r + 0.336\mathbf{e}_\theta$ m/s
$\mathbf{a} = -0.382\mathbf{e}_r - 0.216\mathbf{e}_\theta$ m/s^2
$\alpha = 195.9°, \beta = -86.4°$



Problem 2/155

2/215 At a certain instant, cylinder A has a downward velocity of 0.8 m/s and an upward acceleration of 2 m/s^2. Determine the corresponding velocity and acceleration of cylinder B.

Ans. $v_B = 1.2$ m/s up
$a_B = 3$ m/s^2 down



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