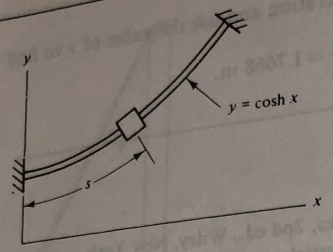


Problem 2.4

is the distance traveled and k is a constant. Derive expressions for the velocity and acceleration of the slider as a function of x.

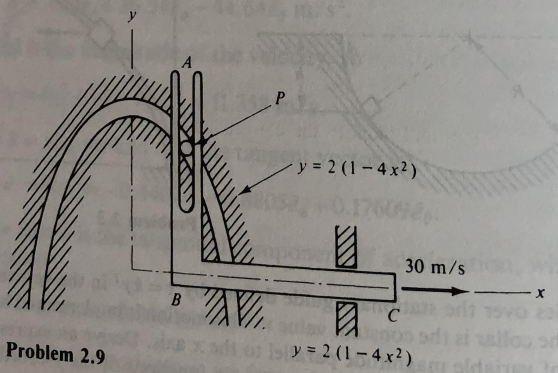
2.5 A helix is defined by $x = ec\psi$, $y = e\sin(c\psi)$, $z = -e\cos(c\psi)$. Determine the path variable unit vectors, the radius of curvature, and the torsion of this curve as a function of ψ.

2.6 A particle moves along the paraboloid of revolution $y = (x^2+z^2)/\alpha$, such that $x = -\alpha\sinh k\zeta$ and $z = \alpha\cosh k\zeta$, where x, y, and z are in meters, ζ is a parameter, and α and k are constants. At the position where $\zeta = 1/k$, the particle's speed is $5\alpha k$ and its speed is decreasing at the rate $2\alpha k^2$. Determine the velocity and acceleration at this position.

2.7 Determine the radius of curvature and the torsion of the path in Problem 2.6 at the given position.

2.8 A particle moves along the paraboloid of revolution $z = (x^2+y^2)/k$ such that $x = k\omega\zeta\sin\omega\zeta$ and $y = k\omega^2\zeta^2$, where k and ω are constants and ζ is a parameter. Consider the case where the parameter $\zeta = t^2$, where t is measured in seconds. Derive expressions for the velocity and acceleration.

2.9 Pin P is pushed by arm ABC through the groove, $y = 2(1-4x^2)$, where x and y are in meters. The velocity of arm ABC is constant at 30 m/s to the right. Determine the velocity and acceleration of the pin at the position $x = 0.25$ m.



Problem 2.9

2.10 A ball is thrown down an incline whose angle of elevation is θ. The initial velocity is u at an angle of elevation β. Derive an expression for the distance D measured along the incline at which the ball will return to the incline. Also determine the maximum