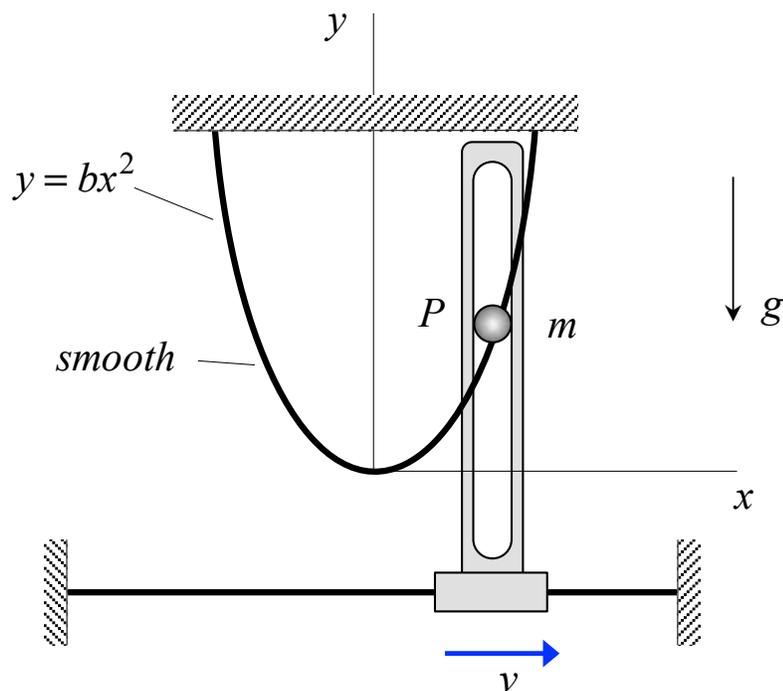


### Homework H4.E

**Given:** Particle P is constrained to move on a guide in the  $xy$ -plane with the shape of the guide being described by  $y(x) = bx^2$ , where  $x$  and  $y$  are given in terms of meters. In addition, P is constrained to remain within a vertical slot that is moving to the right with a constant speed of  $v$ . Consider all surfaces to be smooth.

**Find:** You are asked to determine the reaction forces acting on P by the parabolic guide and the vertical slot at a given position of  $x = d > 0$ .

- Draw a free body diagram (FBD) of P for an arbitrary position of  $x > 0$ .
- Write down Newton's second law for P in terms of its  $xy$ -components.
- Develop the kinematics for this problem including writing  $\ddot{y}$  and the slope of  $y(x)$  in terms of  $x$ .
- Solve your equations from (b) and (c) above for the two reaction forces. Substitute in the numerical values for the parameters to determine their numerical values.



Use the following parameters in your analysis:  $m = 10$  kg,  $b = 0.5/\text{m}$ ,  $v = 20$  m/s and  $d = 2$  m.