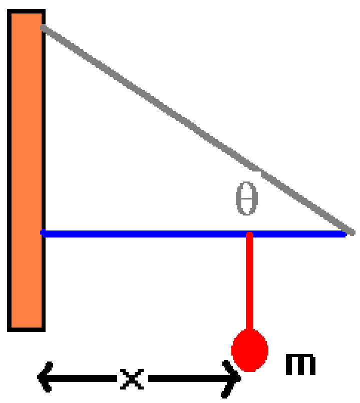

(5) A rod of mass M and length L is attached to a wall as shown. A mass m is placed on the rod at a distance x from the wall. Find the tension in the cable, and the forces on the wall.

Steps:
(a) Choose the wall where the rod touches as the axis. The tension in the cable is T. Draw Ty and Tx, then write how Ty and Tx are related to T and the angle.

(b) The rod exerts forces on the wall. The wall exerts back Reactionary Forces denoted by R. Draw a vector indicating the direction of the reactionary forces.

(c) Indicate Rx and Ry by drawing these vectors which are acting on the rod.

(d) The conditions for static equilibrium are $\sum \vec{F} = \vec{0}$ and $\sum \vec{\Gamma} = \vec{0}$.
along the y direction, you have 4 components (Ry, Ty, Mg and mg). Write the condition for Fy now.
(e) Along the x-direction you have 2 components (Rx and Tx). Write the condition for Fx now.
(f) starting at the axis, walking across, you have 3 torques which are not zero. Apply the torque equation to find the sum of the torques.
(g) Solve to the tension and the reactionary forces.

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$T_x = T\cos\theta \; : \; T_y = T\sin\theta:$

(b) The rod exerts forces on the wall. The wall exerts back Reactionary Forces denoted by R. Draw a vector indicating the direction of the reactionary forces.

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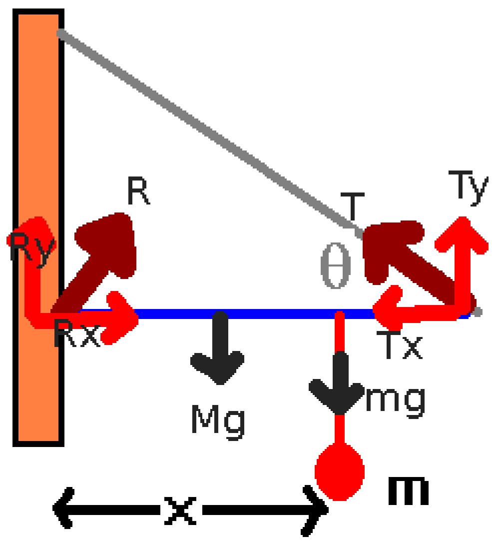

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along the y direction, you have 4 components (Ry, Ty, Mg and mg). Write the condition for Fy now.

$$\sum F_y = 0 \Rightarrow R_y - Mg - mg + T_y = 0 \quad (1)$$

(e) Along the x-direction you have 2 components (Rx and Tx). Write the condition for Fx now.

$$\sum F_x = 0 \Rightarrow R_x - T_x = 0 \quad (2)$$

(f) starting at the axis, walking across, you have 3 torques which are not zero. Apply the torque equation to find the sum of the torques.

$$\sum \vec{\Gamma} = 0 \Rightarrow -\frac{MgL}{2} - mgx + T_y L = 0 \quad (3)$$

(g) Solve to the tension and the reactionary forces.

$$(3) \Rightarrow T_y = g\left(\frac{M}{2} - m\frac{x}{L}\right) = T\sin\theta \Rightarrow T = \frac{g\left(\frac{M}{2} - m\frac{x}{L}\right)}{\sin\theta} : T_x = T\cos\theta = \cot\theta\, g\left(\frac{M}{2} - m\frac{x}{L}\right) = R_x$$

$$(1) \Rightarrow R_y = Mg + mg - T_y = Mg + mg + g\left(\frac{M}{2} - m\frac{x}{L}\right)$$

$$R = \sqrt{R_x^2 + R_y^2}$$