Static Equilibrium - 1

Push-up (1):

$$d_1\, m\, g = (d_1 + d_2)\, F_2\,, \quad d_1\, F_1 = d_2\, F_2\,.$$

Static Equilibrium between Two Blocks (2): T_2 is determined by M_2 and gravity. Then,

$$T_3\, cos(\theta) = T_2, \quad T_1 = T_3\, \sin(\theta)\,, \quad T_1 = M\, g\, \mu_s\,.$$

Two Scales and Three Blocks (3). Note that the weight of block X contributes with $d = d_1 + d_2 + d_3$ to scales A and B as follows:

$$A = \frac{d_2 + d_3}{d}\, X + \dots \quad \text{and} \quad B = \frac{d_1}{d}\, X + \dots \quad .$$

Treat the weights of the other blocks correspondingly.

Static Equilibrium - 2

Horizontal Bar (4). With $T_{y\mathrm{max}} = T_{\mathsf{max}} \sin(\theta)$ solve the torque equation

$$L\, T_{y\mathrm{max}} = x\, W_M + \frac{L}{2}\, W_L$$

for x. Then, $T_{x\mathrm{max}} =$? and $F_y =$? at A.

Painter on a Ladder (5). Replace ladder and painter by a weightless ladder with one weight added at its top and a second at its bottom. Write the upper weight vector as a sum of the tension down the ladder and a vector perpendicular towards the wall. Then deal with the lower end of the ladder. Draw all vectors involved at the upper as well as at the lower end.

Pole on an Incline (6):

$$\mu_s\, F_{\mathrm{per}} = F_{\mathrm{par}}\,,$$

where F_{per} is the force perpendicular and F_{par} the force parallel to the incline (acting where the pole touches the incline).

Static Equilibrium - 3

Wheel on an Incline (7). Consider an infinitesimal movement by ds of the wheel down the incline. Calculate the corresponding potential energy differences for (a) the cm of the the wheel, and (b) the mass m. Calculate the mass m for which the summed up potential energy difference is zero.