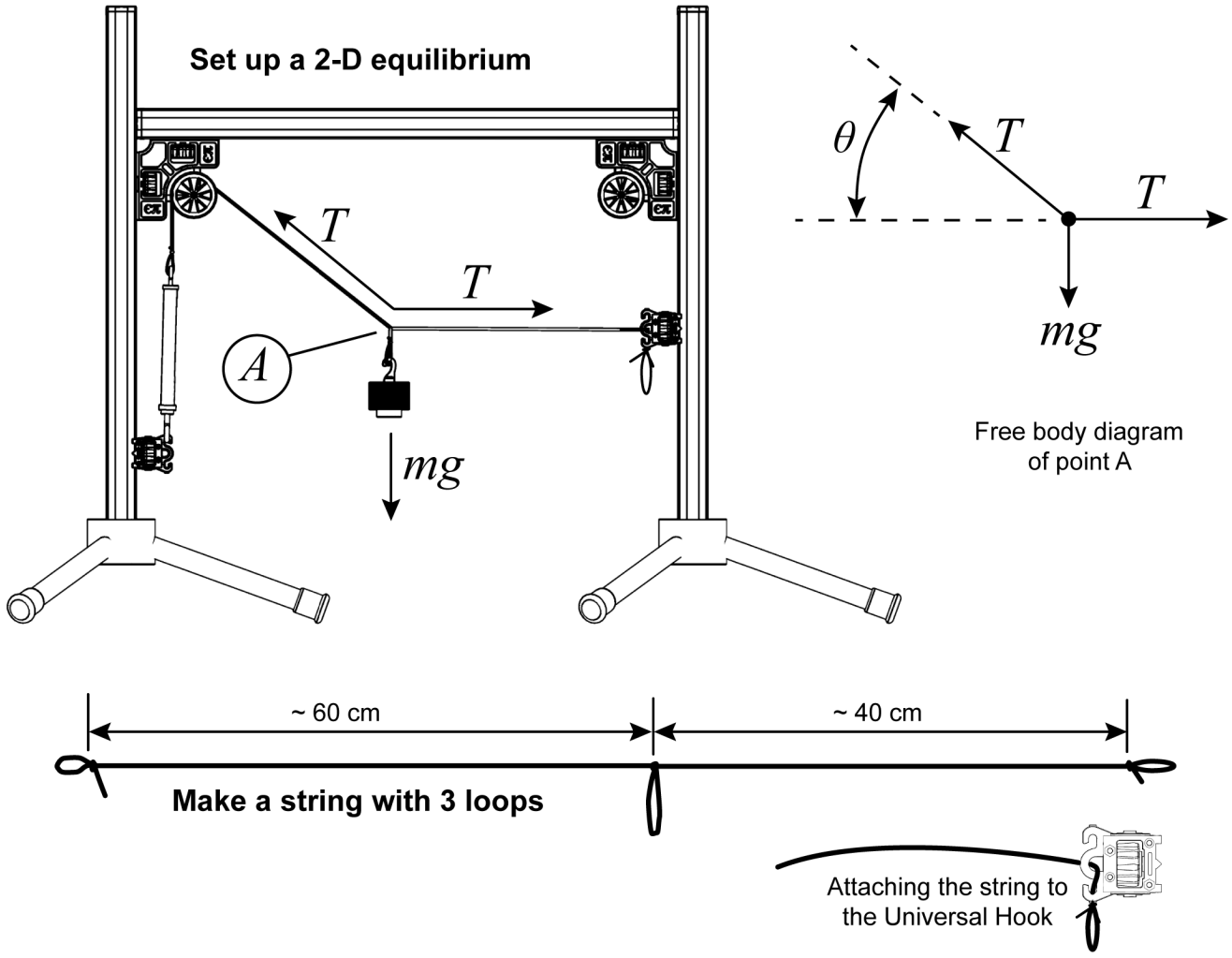
Question	How do we determine the forces that are acting in a system?



Any point (or body) that is not moving must be in equilibrium. That means the forces must sum to zero as vectors, *in each independent direction*.

1. Set up two Tripod Stands with a cross rail and two Universal Hooks as shown.
2. Make a string a little longer than 1 meter with three loops as shown.
3. Set up the equilibrium shown in the diagram. The string on the right side of the weight should be horizontal and the string on the left side should make an angle, θ, between 30 and 50 degrees.
4. Record the tension in the string with the spring scale and measure the weight and the angle, θ.
5. Adjust the position of the two Universal Hooks to make a different angle, θ, and record the new angle and string tension.

Table 1: Force and angle data

Tension in the string (N)	Weight (N)	Measured angle (θ, degrees)	Prediction

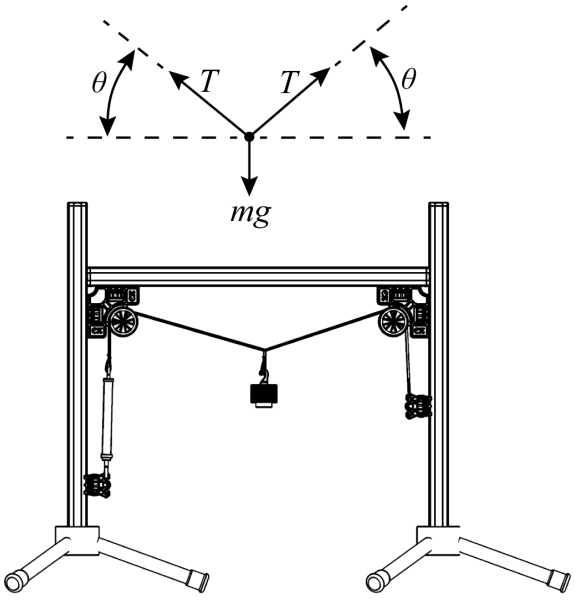
Questions and analysis:

1. Assume one side of the string is horizontal therefore exerts only an x-component of force on point A. What is the equilibrium condition for forces in the vertical direction?

2. Derive an equation for the tension in the string in terms of the angle, θ, and the weight (*mg*) of the hanging mass.

3. Use the equation you derived in part (2) to predict the tension. How does this agree with your spring scale measurements?

Part 2: the "zipline" model



Construct the equilibrium shown in the diagram on the left. You may simply hang the weight on the middle of the string to get the angles roughly equal on either side.

4. Derive an equation for the tension in the string in terms of the angle and weight.

5. Calculate the tension in the string for the mass you measured.

6. Compare your calculation with the actual measurement.