**Static Equilibrium**

**Name and section number:**

**Partner’s name and section number:**

1. What are the conditions for equilibrium, expressed in both words and equations? The title “Static Equilibrium” implies that there is be another kind of equilibrium. Name and describe it.

2. For the case with the pin in place, sketch the two horizontal string forces acting on the extended object. Show their correct orientations, relative magnitudes, and relative positions. The coordinates, object, symbols, and vectors are provided for your convenience. Move the coordinate system to the location of the pin.



**F2**

**F1**

**r1**

**r2**

θ**2**

θ**1**

**i**

**j**

3. Fill in this table to see if you have met the condition for rotational equilibrium.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| i | mi [ ] | |**Fi**| [ ] | θi [ ] | **Fi** [ ] | **ri** [ ] | |**τi**| [ ] | **τi** [ ] |
| 1 |  |  |  | **i** **j** | **i** |  | **k** |
| 2 |  |  |  | **i** **j** | **i** |  | **k** |
|  |  |  |  |  | **∑| τi |, ∑ τi** = |  | **k** |
|  |  |  |  |  |  | ∑ **τi** /∑| **τi** | = | **k** |

4. For the case of no pin, sketch the three forces, in the same way as for Question 2.



**i**

**j**

θ**3**

θ**2**

θ**1**

**F3**

**F2**

**F1**

**r3**

**r1**

**r2**

5. Fill this in to see if you have met the conditions for rotational and translational equilibrium.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| i | mi [ ] | |**Fi**| [ ] | θi [ ] | **Fi** [ ] | **ri** [ ] | | **τi** | [ ] | **τi** [ ] |
| 1 |  |  |  | **i** **j** | **i** |  | **k** |
| 2 |  |  |  | **i** **j** | **i** |  | **k** |
| 3 |  |  |  | **i** **j** | **i** |  | **k** |
|  | **∑|Fi|** = |  | **∑Fi** = | **i** **j** | **∑| τi** **|,** **∑ τi** = |  | **k** |
|  |  |  | ∑**Fi**/∑|**Fi**| = | **i** **j** |  | ∑ **τi** /∑| **τi** | = | **k** |

6. *Individually, v*isually estimate the force from the pin on the extended object and place a third red vector, properly scaled and oriented, on the sketch in Question 2 to reflect your thinking. There is no need to label the red vector, although you should have labeled the other vectors with the given symbols. Here is a red vector. In the box below, describe the role of the pin force.