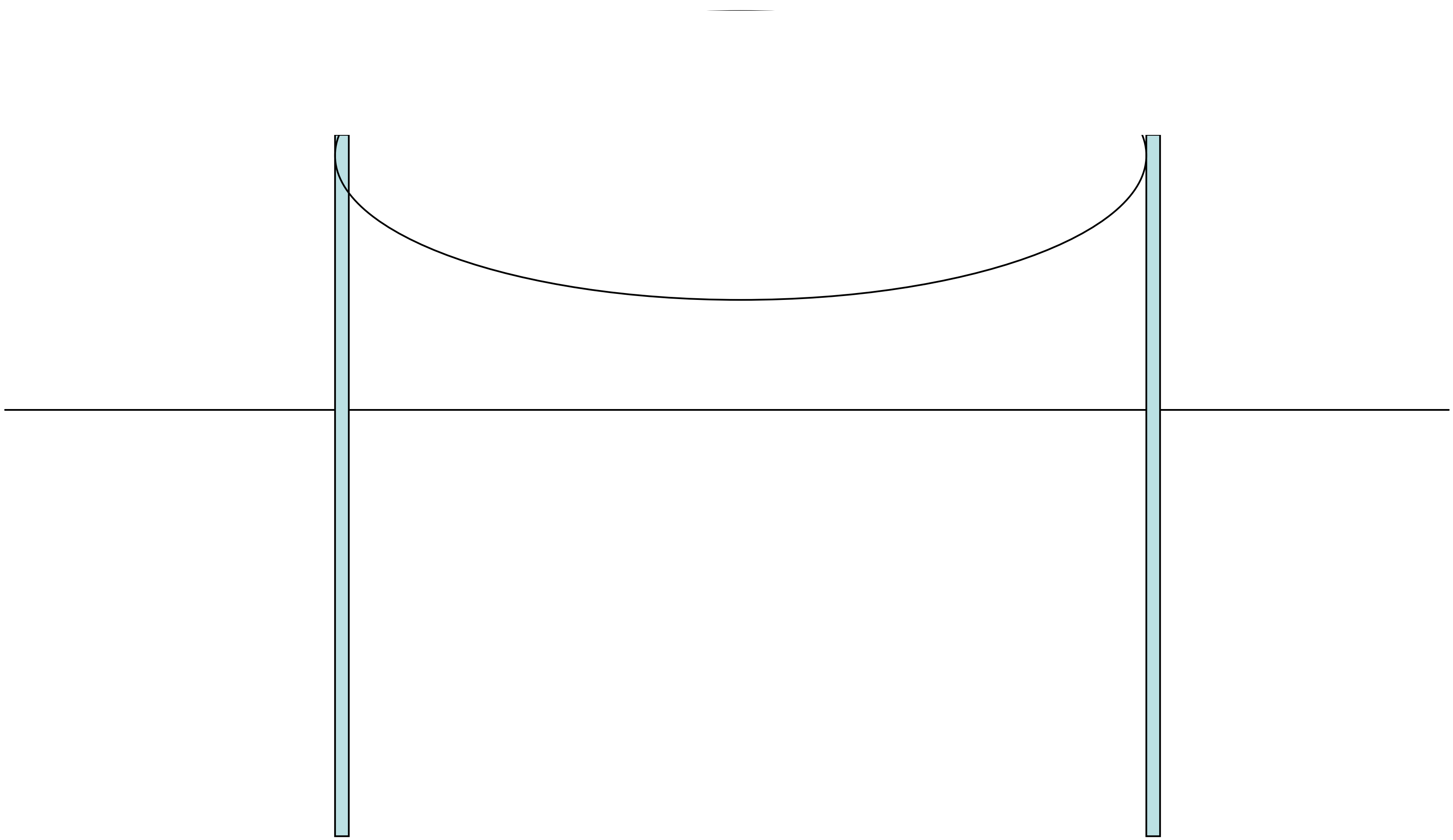
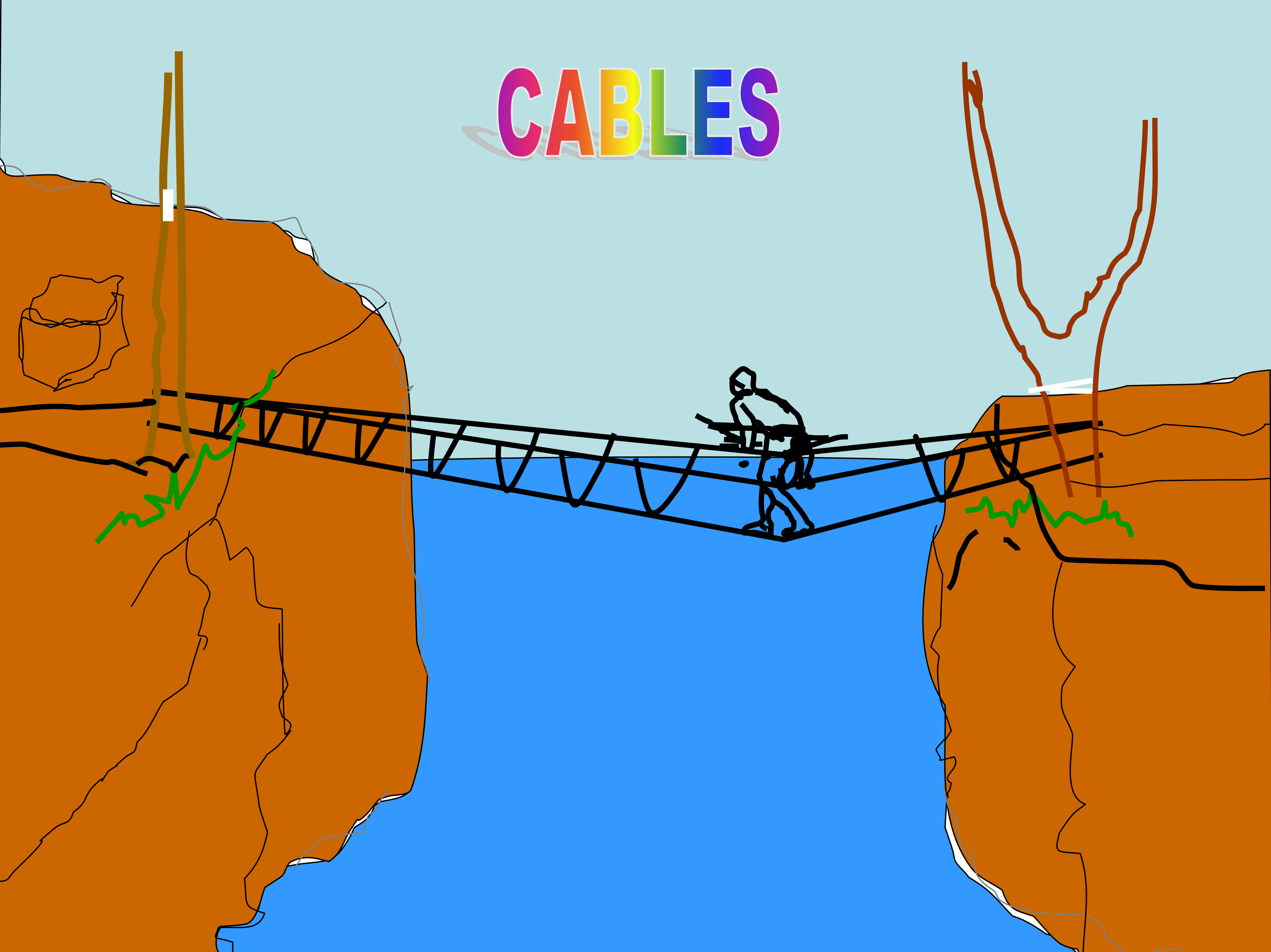
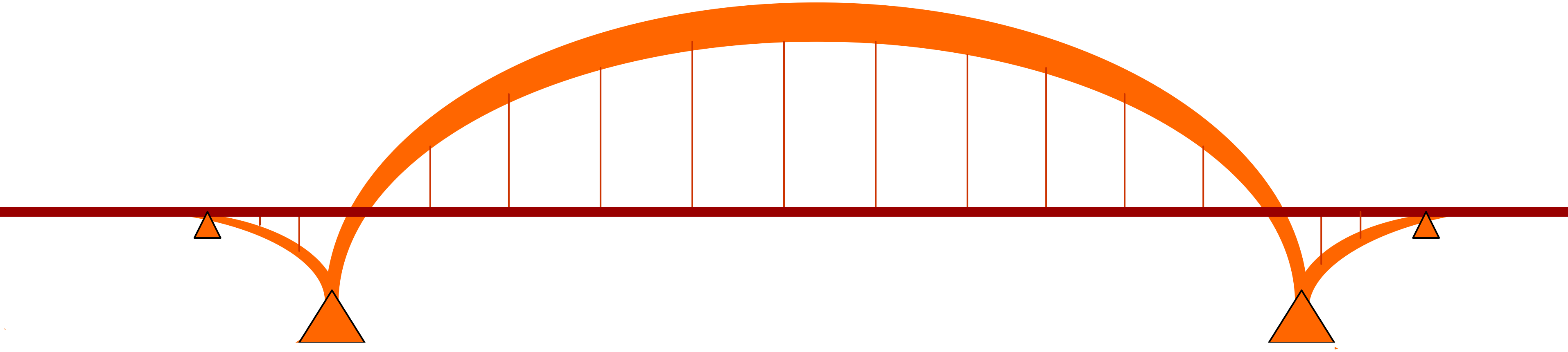
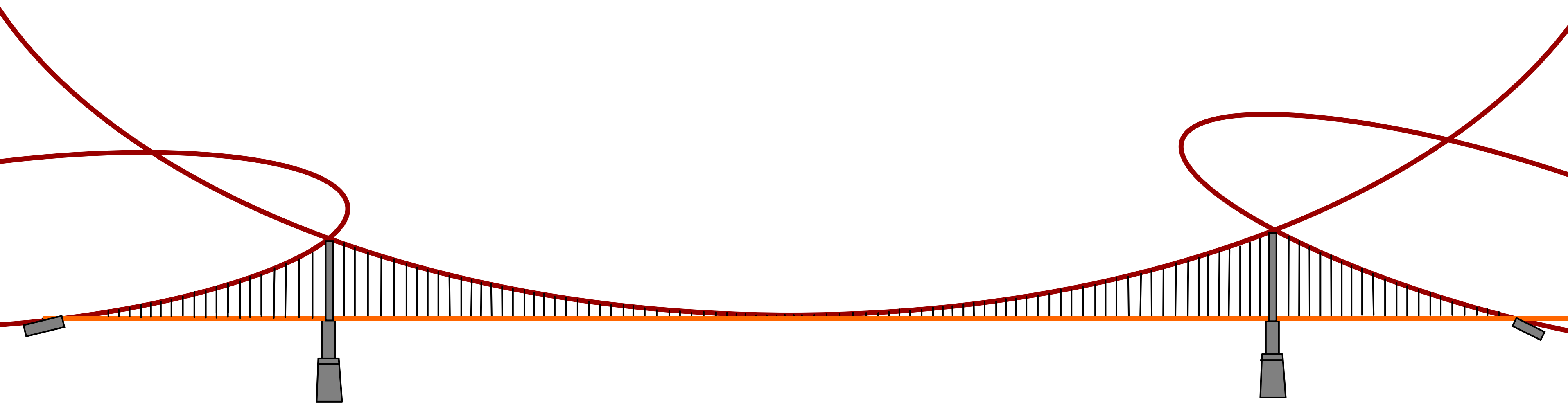
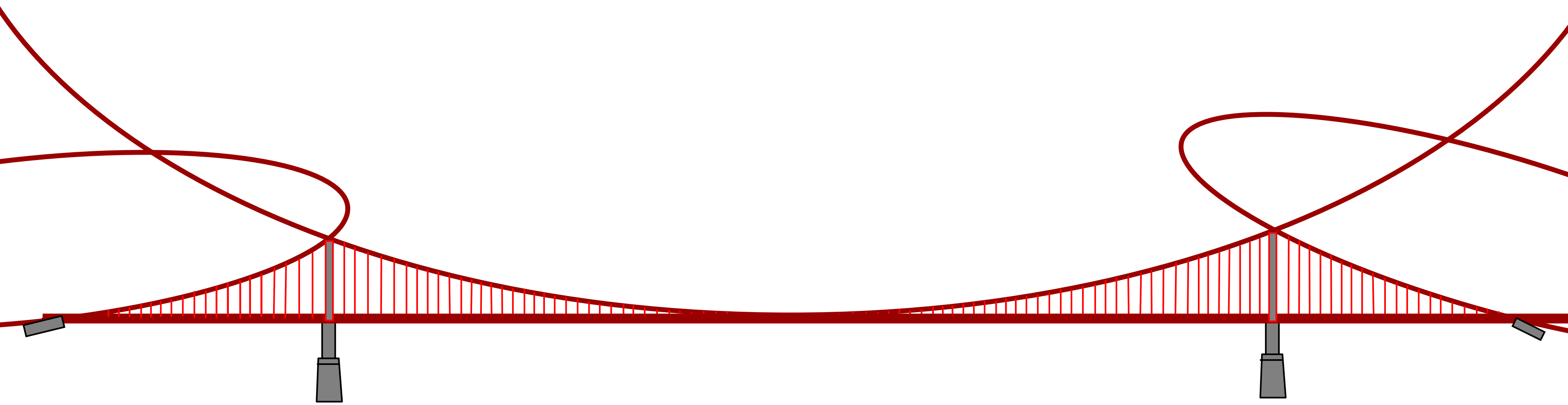



CABLES

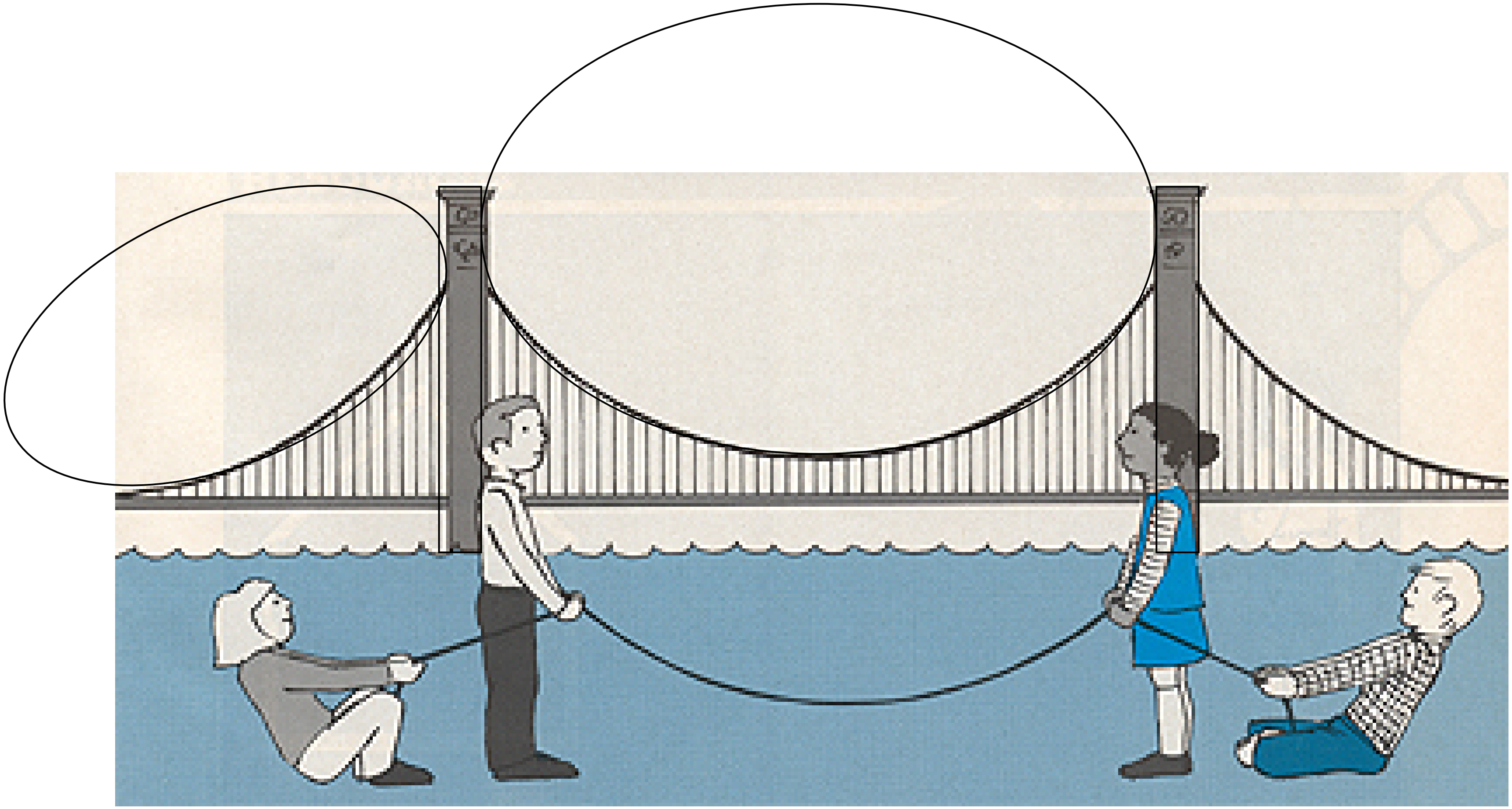
CABLES







CABLES




CABLES

ASSIGNMENT

Assignment on Arches: page 193 problem 3.30 & 3.32

Due: on Friday

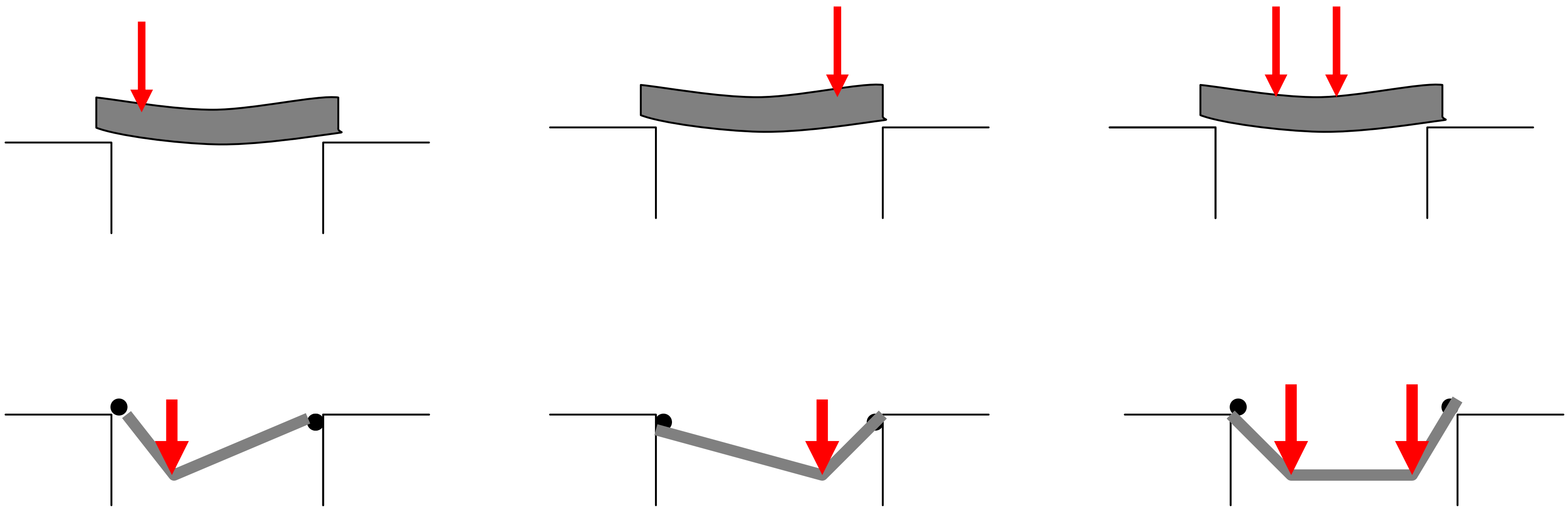
ANALYSIS OF SELECTED DETERMINATE SYSTEMS

CABLES

LEARNING OBJECTIVES

- You will be able to distinguish between RIGID and FLEXIBLE structural elements
- You will be able to tell why a cable cannot be perfectly horizontal when carrying a load
- You will be able to tell how a suspension bridge evolved
- You will be able to calculate the tension in a cable and the reactions at the supports ,when the cable is subjected to concentrated loads.

RIGID and FLEXIBLE STRUCTURES



Structural Forms can be classified according to their stiffness characteristic. RIGID elements such as Beams do not undergo appreciable changes the action of a load or under changing loads. They are really bent or bowed to a small degree by the action of the load.

FLEXIBLE elements ,such as cables, are those in which the element assumes and changes shape under one loading condition and changes shape drastically when the nature of the loading changes

Few types of structures have so consistently appealed to the imagination of builders as the hanging cable and the arch.

We saw that a cable subjected to external loads will obviously deform in a way that is dependent on the magnitude and location of the external forces. The form is often called he funicular shape.

Cables in Construction

- In Bridges
  - Suspension Bridges
  - Cable stayed bridges
- In Buildings

Simple Cable Statics

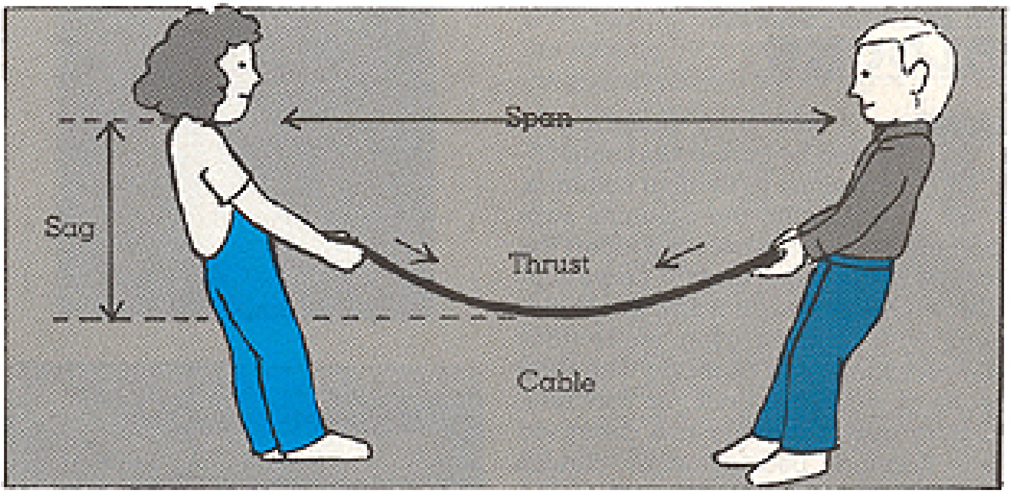
A flexible cable will assume a specific geometry when acted on by one or more point loads. This geometry is dependent on the relative magnitude and location of each load, the length of the cable, and the height of the supports,

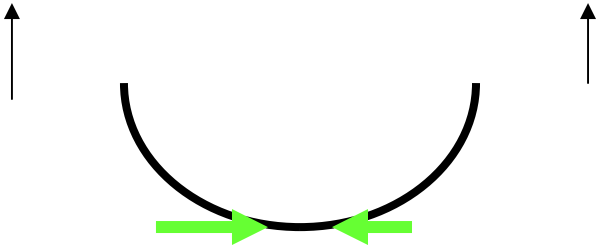
The designer has usually little control over the loads but can select the length of the cable, thereby controlling the sag, and the support locations. In general, the greater the sag, the less will be the force in the cable.

- Analysis of cable is made simple by the fact that a cable has zero moment resistance.

- It acts like a link chain and ,if assumed weightless, will take a straight line geometry between the loads.

- Each cable segment then acts like a two force tension member. Each load point is a PARTICLE SYSTEM

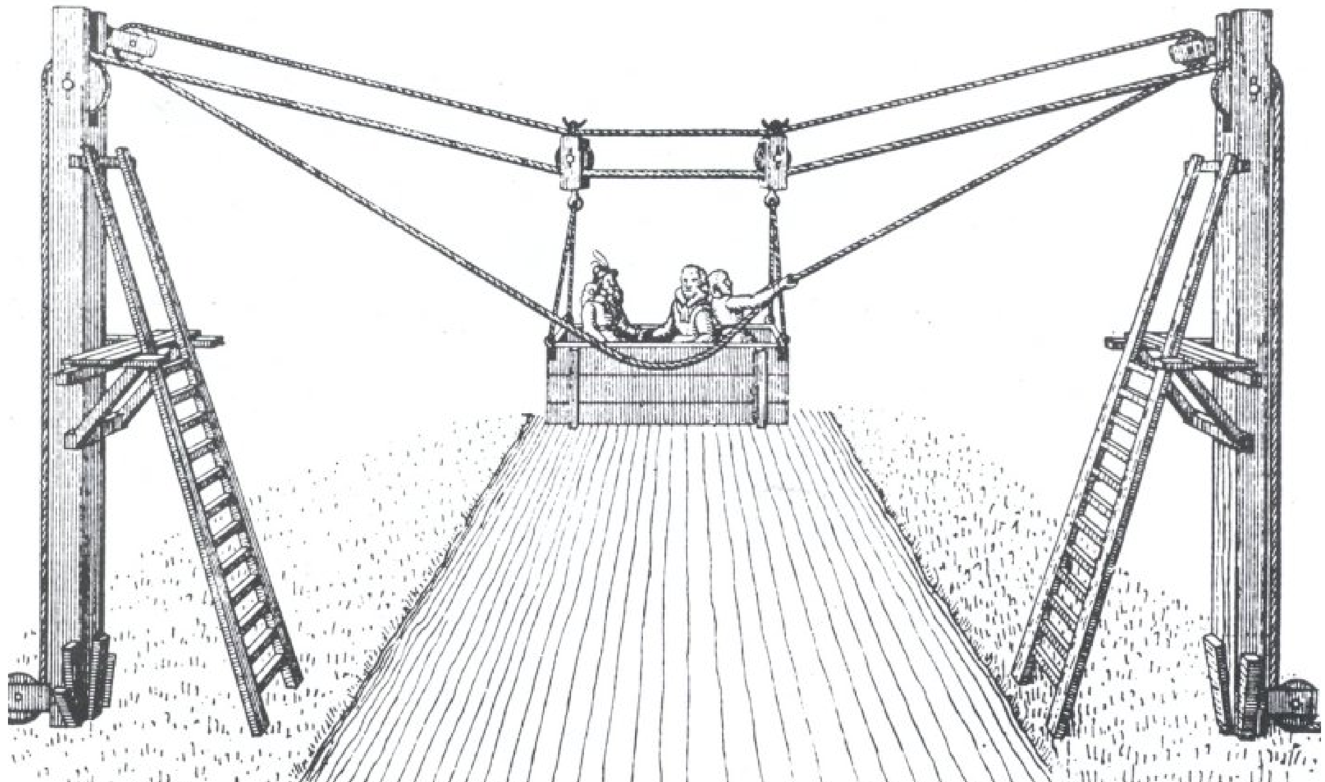




Cannot take Compression

Cannot take shear

Cannot take moment

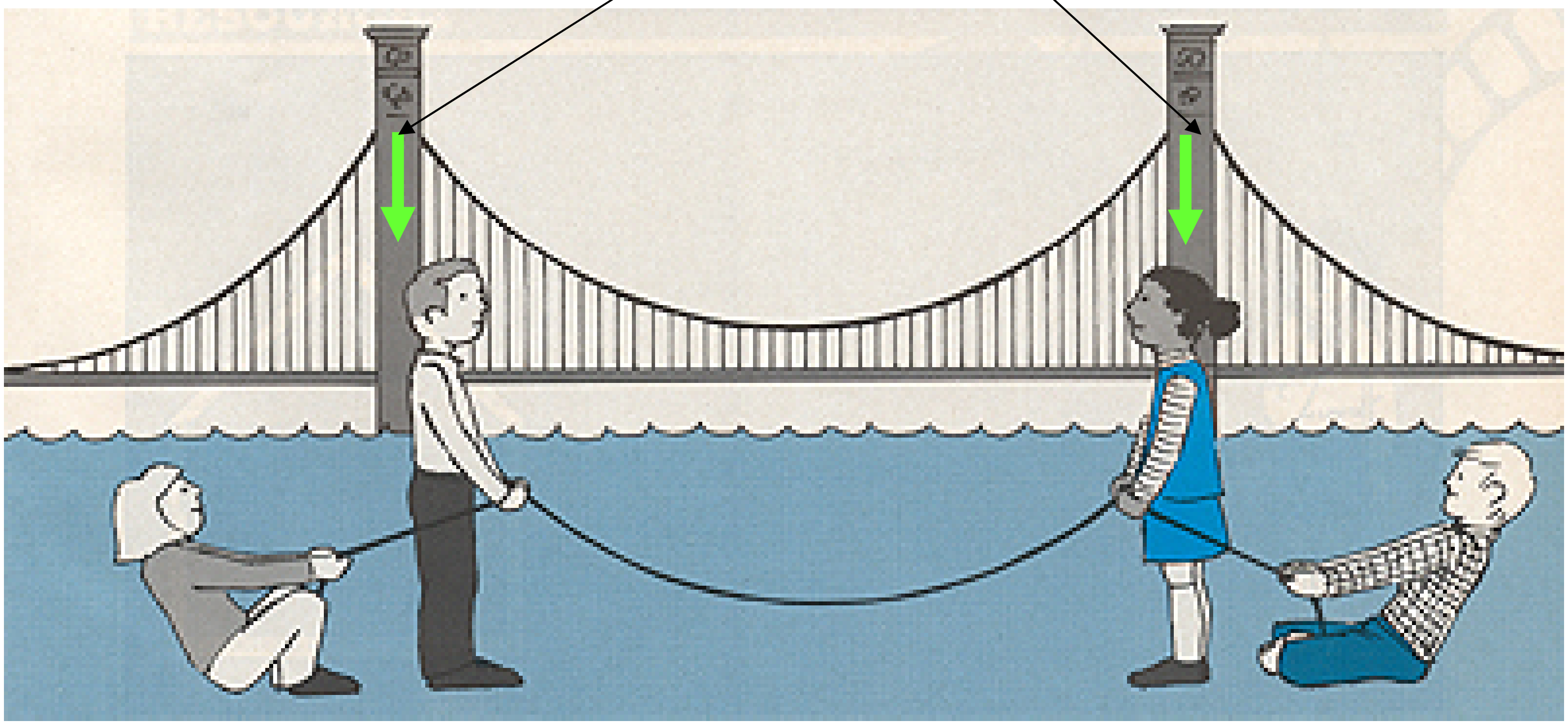


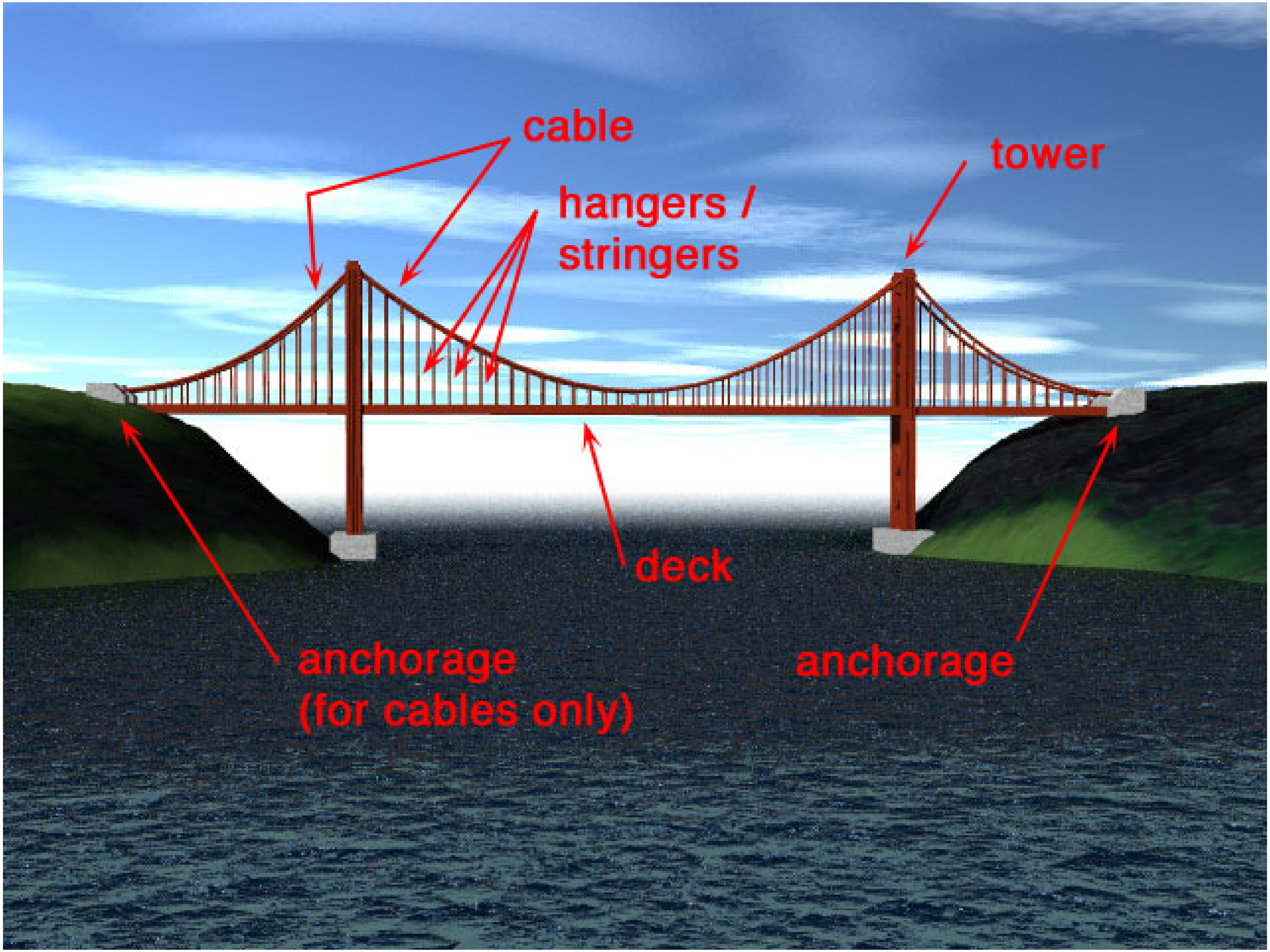
From Elevator World

From Doppelmayr

From Doppelmayr

$$\Sigma F_x = 0$$




cable
tower
hangers /
stringers
deck
anchorage
(for cables only)
anchorage

Akashi Kaikyo Bridge

Brooklyn Bridge

San Francisco bay bridge

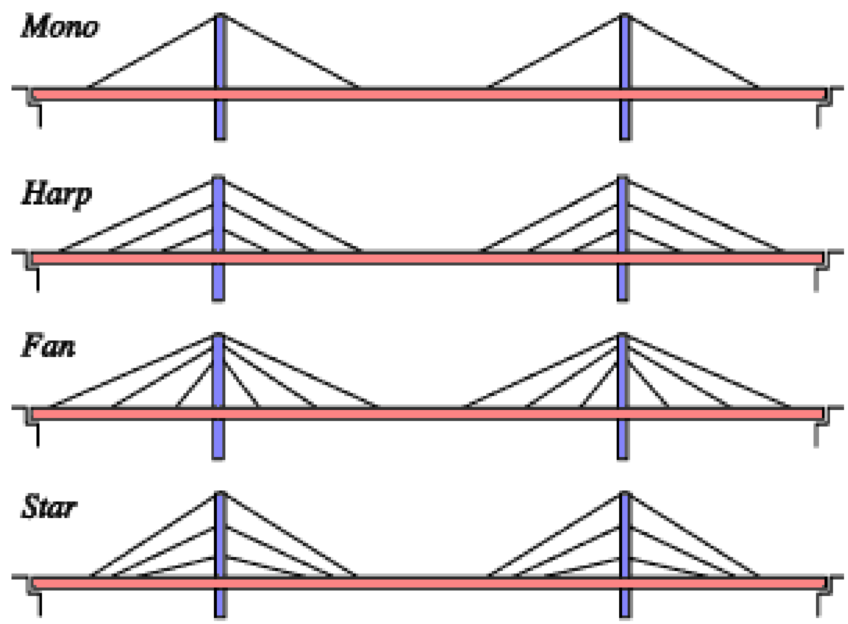
George Washington Bridge

Golden Gate bridge

Mackinac Bridge

Rhein bridge,Germany

Verazanno Narrows bridge



Mono
Harp
Fan
Star

Normandie bride , France

Higashi bridge Kobe

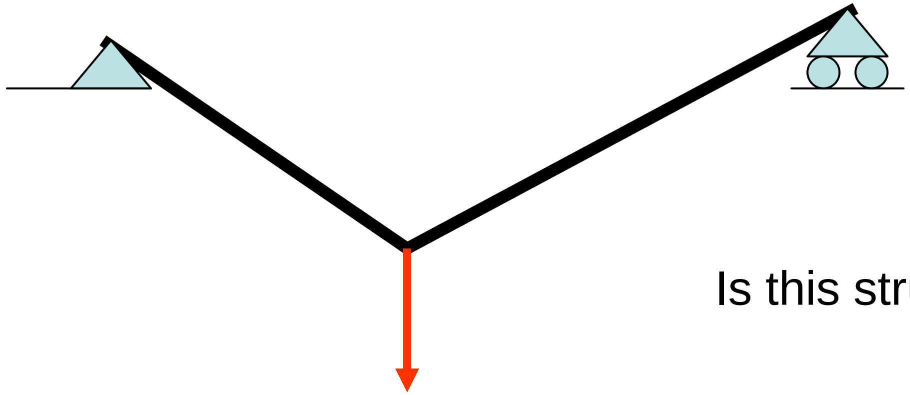
Neckar bridge, Germany

Knie bridge, Germany

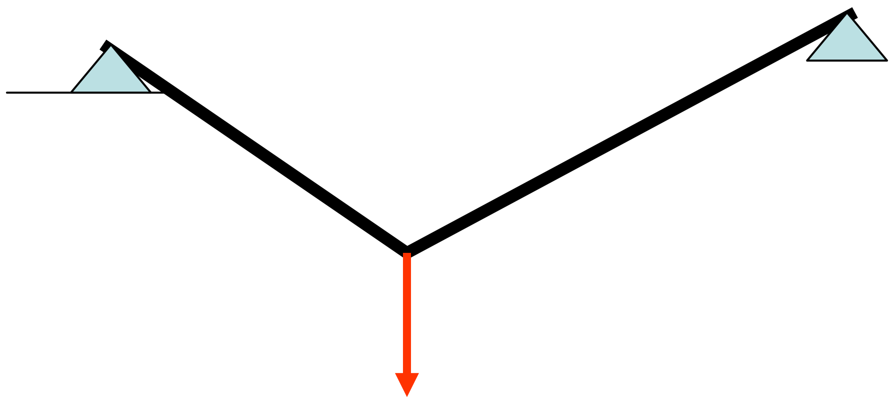
Pasco Kennewick bridge, England

Stuttgart Bridge, Germany

Meiwa Bridge, Japan – a piece of art



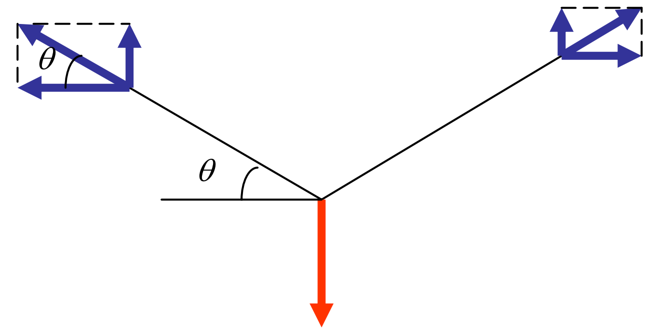
Is this structure stable?

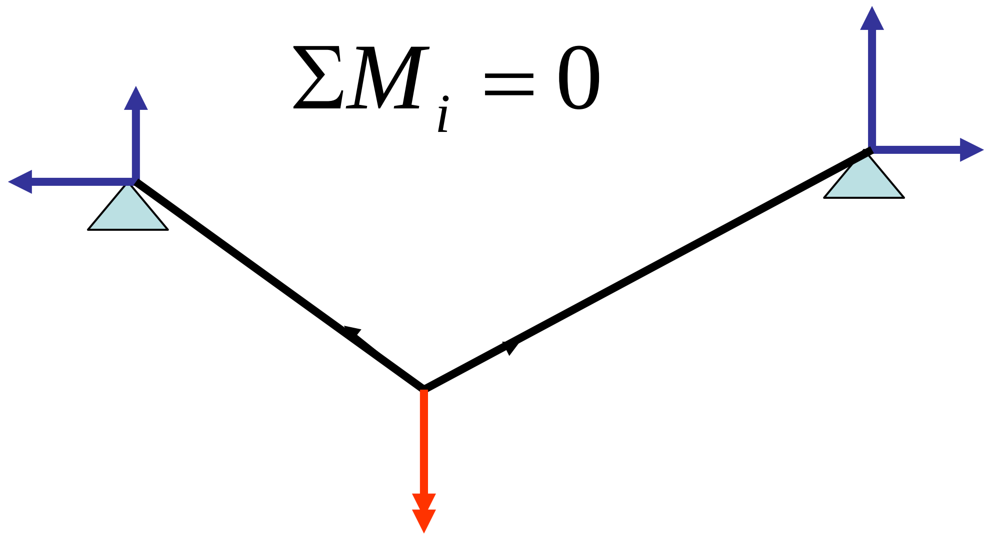


$$\Sigma F_x = 0$$

$$\Sigma F_y = 0$$

$$\Sigma M_i = 0$$





Is this System a

A Particle

or

A Rigid Body?

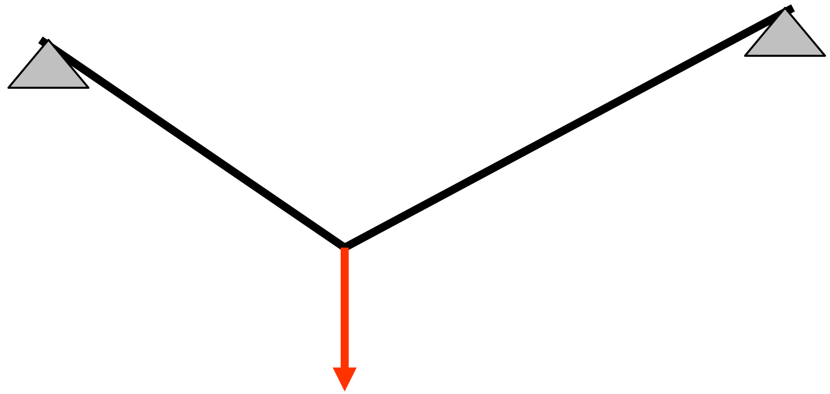
$$\Sigma M = 0$$

Left subassembly

OR

Right subassembly

1



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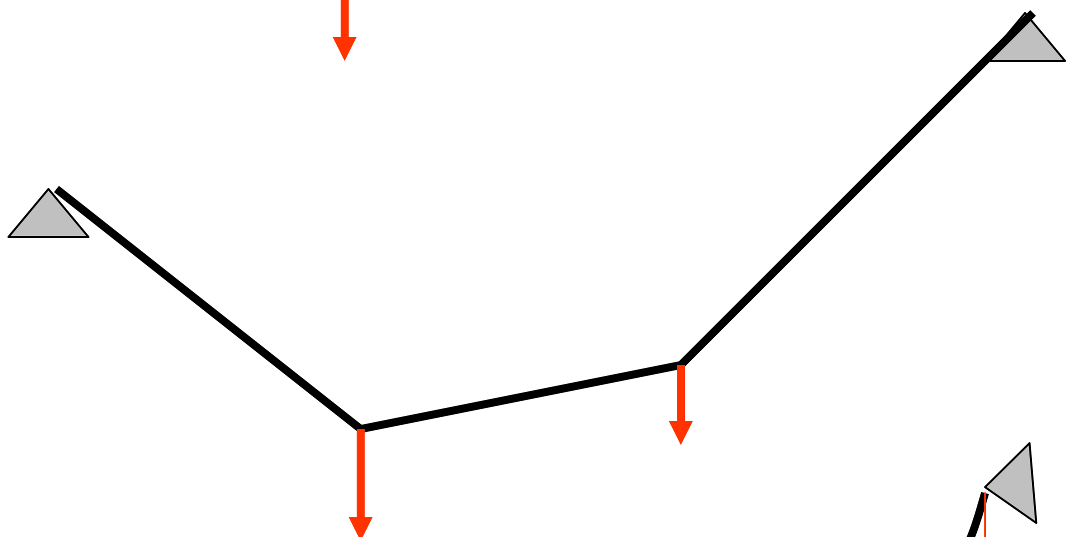

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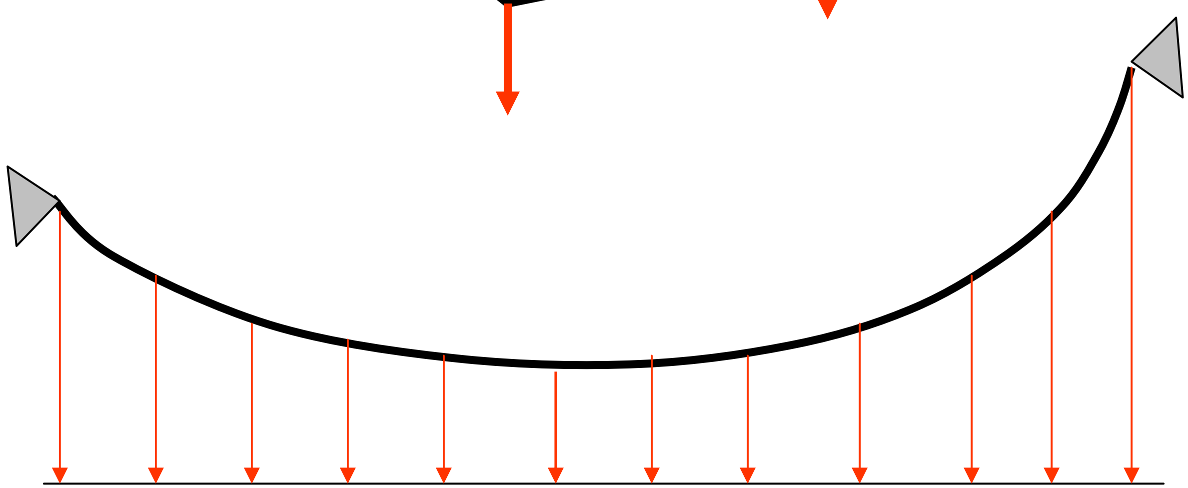
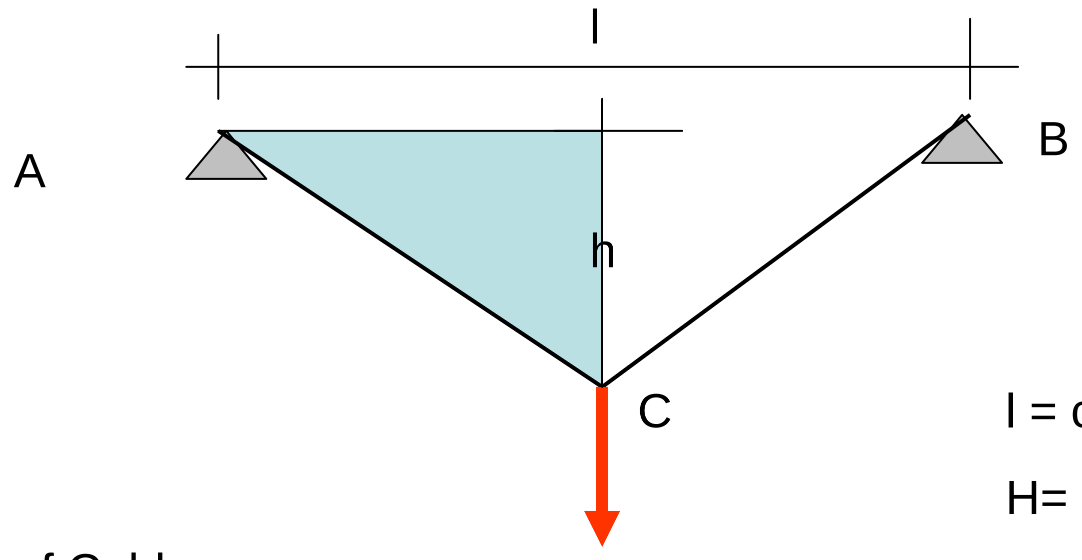




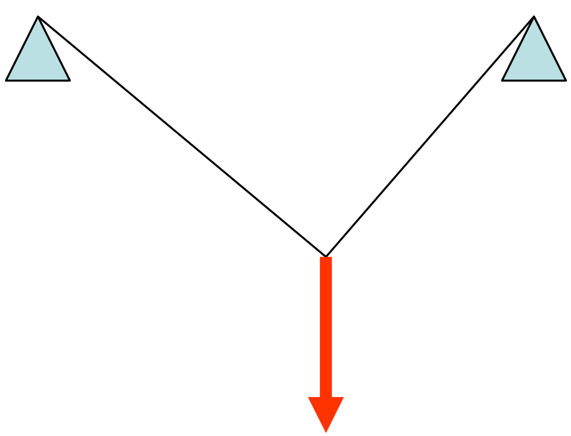
l = cable span

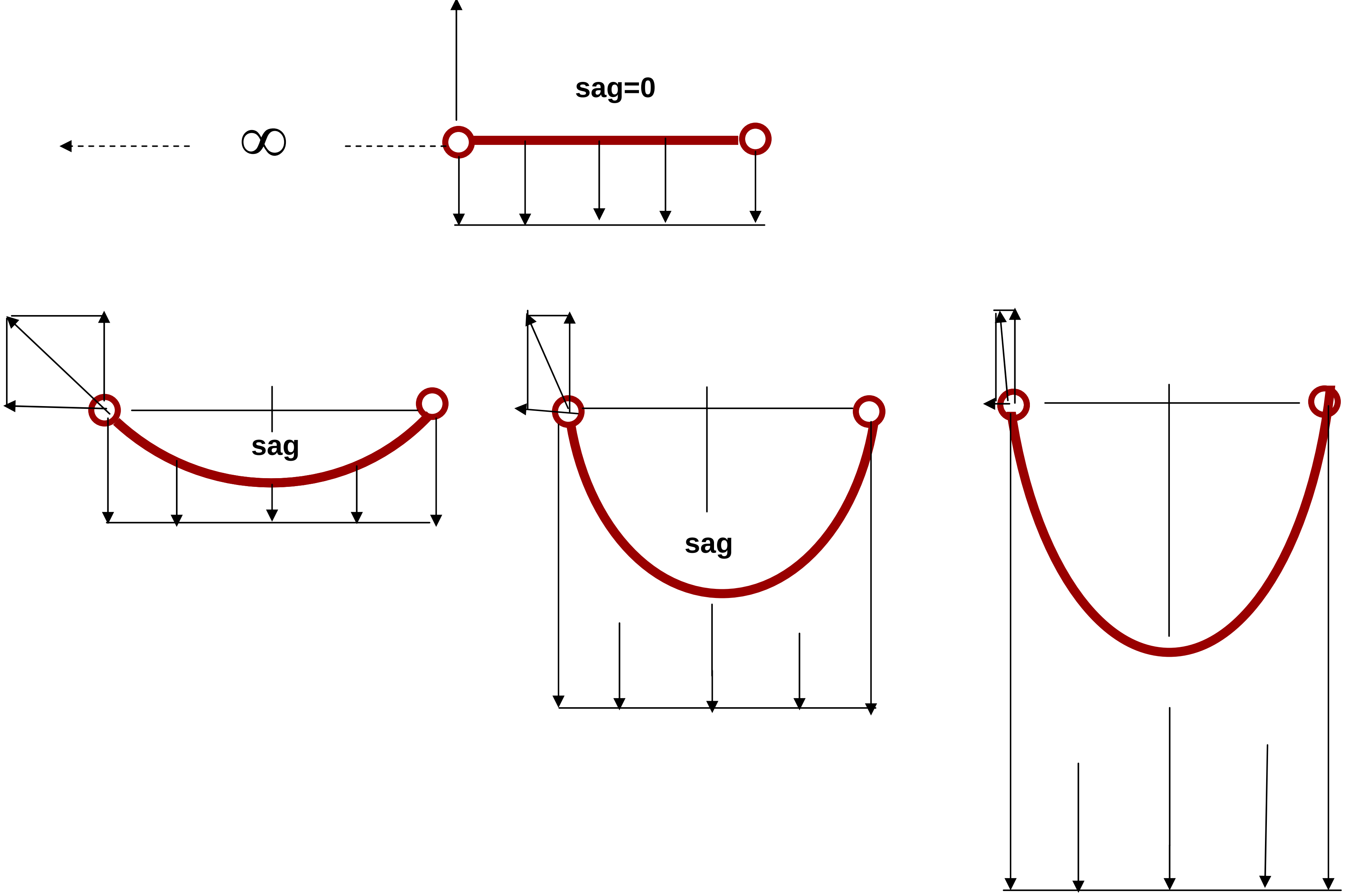
H= sag of the cable

Length of Cable

L = AC + CB

Is the following system a particle or a rigid body?




sag=0
∞
sag
sag