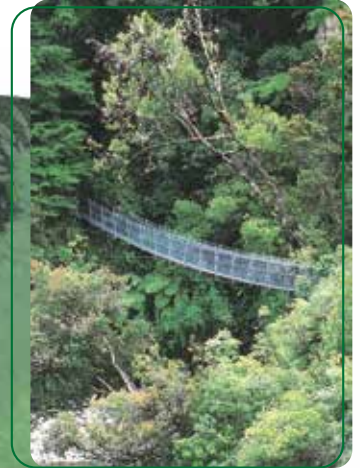
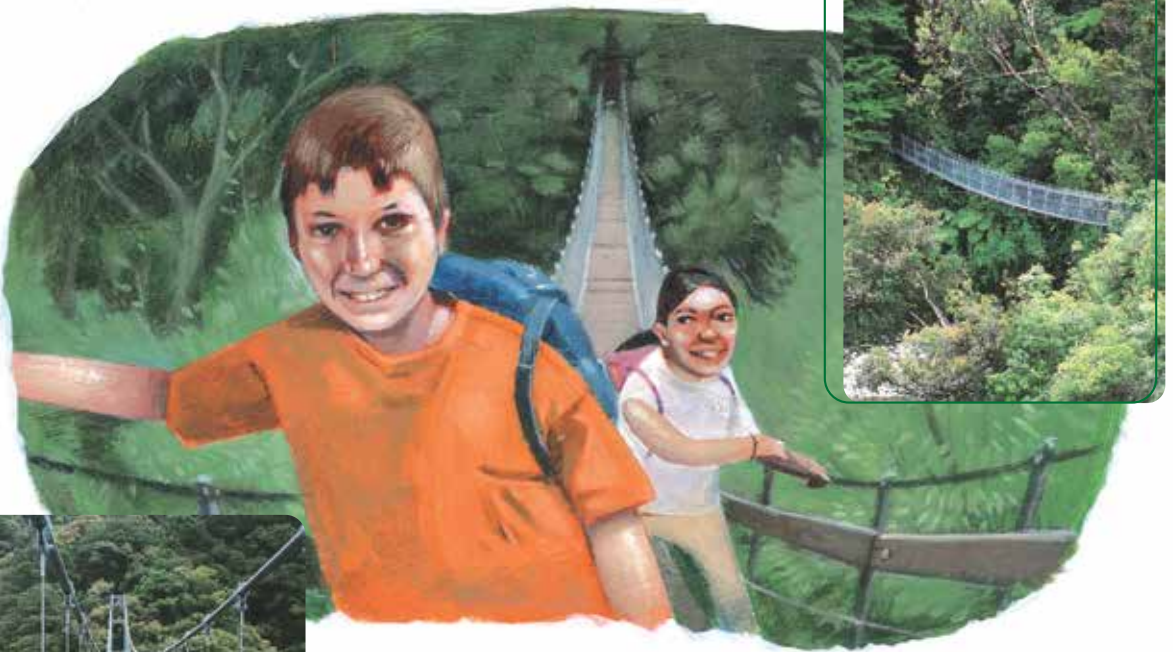


Suspended Thought

You need: metre rulers, a skipping rope, heavy books or bricks, graph paper, a computer spreadsheet (optional)

ACTIVITY

Trampers often use swing bridges to cross rivers. The sag towards the middle, known as a catenary curve, is the curve you always get when you hang a flexible rope, cable, or chain across a gap.



Suspension bridges are constructed in a different way. Cables are strung between pairs of towers, each one forming a catenary curve. The flat road deck is then suspended, or hung, from these cables.

Engineers often build scale models to help them as they design structures. Imagine that you have to build a suspension bridge 80 metres long. The support towers are 30 metres high.

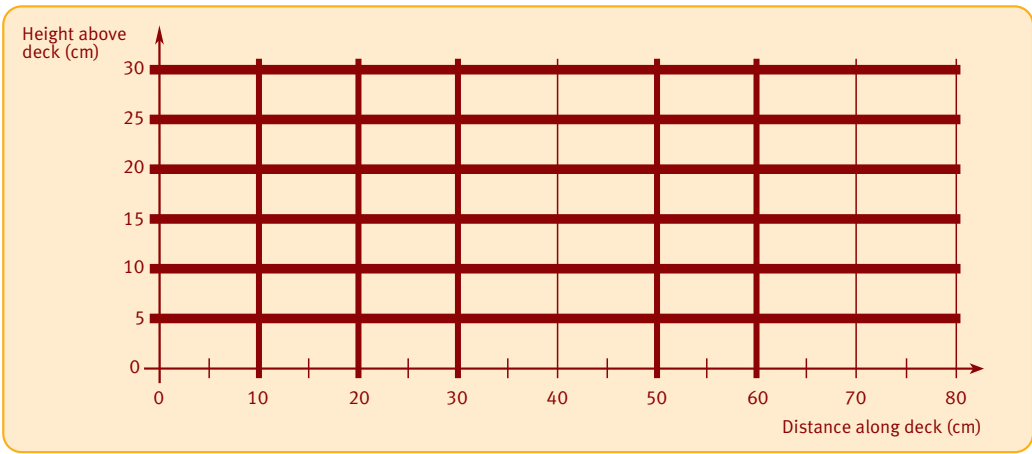
1. a. Model the sag of the cable in this way, using the scale 1 cm : 1 m.
 - i. Place two desks 80 centimetres apart.
 - ii. Suspend a length of skipping rope between the desks so that it sags about 20 centimetres in the middle.
 - iii. Place a metre ruler between the desks and anchor both the ruler and the rope with bricks or heavy books.
- b. Measure the depth or sag of the catenary curve at 5 centimetre intervals along the metre ruler.



c. Record your results in a table like this. Look carefully at the photo to see why you need to do a subtraction in the third column:

Distance along bridge (cm)	Depth of sag (cm)	Height of cable above deck (cm)
0	0	$30 - 0 = 30$
5	⋮	⋮
10		
⋮		

2. Graph the data from your table on a set of axes like the ones below. So that you can see the shape of the curve, use the same scale on both axes.



- How might an engineer work out the length of each vertical suspender cable needed for a real bridge, using a diagram like this?
- How does the catenary curve change as the length of the cable is increased?

INVESTIGATION

- Find out why the sides of a suspended rope or chain hang more steeply than the centre.
- The Golden Gate Bridge in San Francisco is possibly the most famous suspension bridge in the world. Find out about it and present your findings to the class.