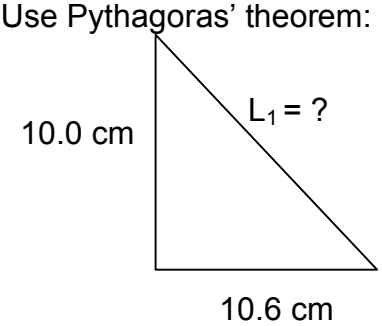
Bridges: Cable-Stayed Bridges in Action

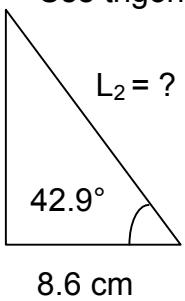
Design and Build

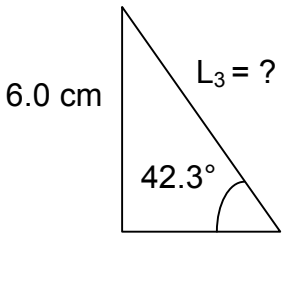
You are in charge of calculating the required lengths of cable for a harp style cable-stayed bridge so the manufacturers know what to make. Use **Pythagoras' theorem** and **trigonometry** to find out the lengths of the cables on your bridge. Give your answers to **one decimal place**.

Use Pythagoras' theorem:

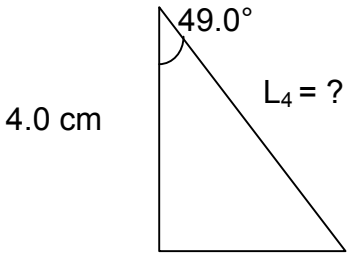


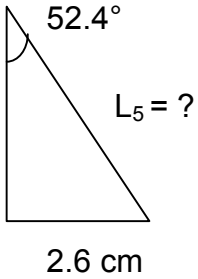
Use trigonometry:





Use trigonometry:





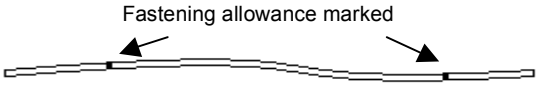
For construction purposes it is necessary to add on 2 cm to each end of the cable in order to fasten them to the supports. Complete the table below.

Cable number	Length previously calculated	Length plus fastening allowance
1		
2		
3		
4		
5		

Now:

1. Measure and cut the correct lengths of string you calculated for the length of cable plus the fastening allowance.

2. Mark on each piece of string the 2 cm fastening allowance at each end with a pen.

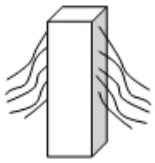


3. Collect your bridge cut-out sheets from your teacher.

4. Cut out the two towers (parts **A** and **B**), cutting along the solid lines and fold along the long, dashed lines. Label the base on both sides of the card.

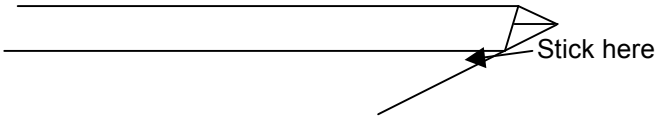
5. Make the holes (shown as circles) and push the string through the holes. Fasten the string at the 2cm allowance on the dotted lines so most of the string is hanging through the other side of the card.

6. Use sellotape to stick each tower together making sure the lines are on the **inside** and most of the string on the **outside**. It should look like this:

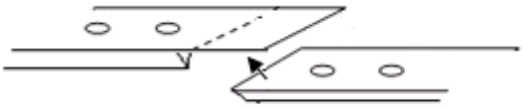


7. Cut out the two deck parts (**C** and **D**) and the square holes for the towers. Cut along the solid lines and fold along the dashed ones. The hatched part is waste. Make the holes (shown as circles).

8. Fold along the dotted line on the edge of the deck to make a triangular prism shape. Stick in place.

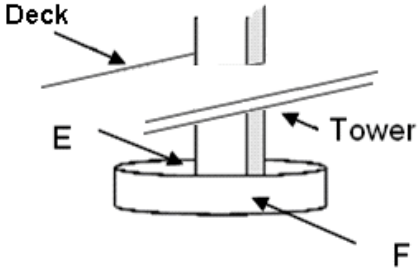


9. Stick the decks end to end with a 3cm overlap as marked on the deck. Make sure the triangular prisms are facing **downwards**.



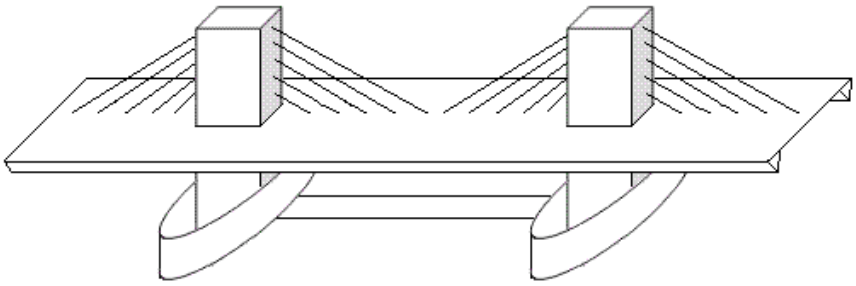
10. Mark around the towers 6 cm from the base. Insert the towers into the square holes in the deck, pushing them from above. Make sure that the strings face along the deck. Stick the towers in place where you have marked them. Take care to get them the right way up!

11. Stick two bottom supports together, end to end (**E** and **F**), and then place them over the bottom of the towers as shown below. Stick them in place at the sides. Repeat this for the other ends (**G** and **H**).



12. Stick part I so it spans from the bottom of one tower to the other.

13. Now thread the strings through the holes in the deck and stick them in place on the underside of the deck. For the harp style bridge: start with the smallest cable and work upwards.



Scaling

a) The deck of the model bridge is about 438 times the width of the actual Millau Viaduct. How wide is the real bridge?

b) The model bridge is only 1/3650 the length of the real bridge. How long is the full-size bridge?