4 Modeling the real world

Try this worksheet after you have completed section 4.7

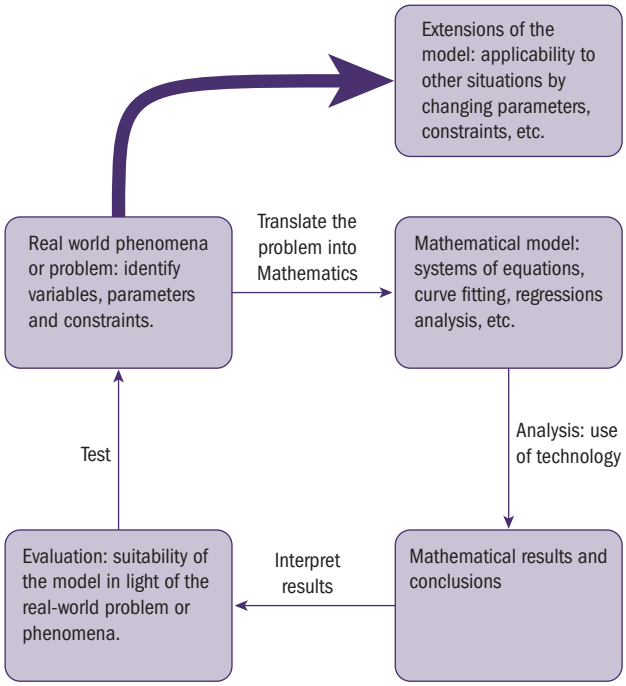
More optimization and modeling

Mathematical modeling is the application of mathematics to solving real-life problems, explaining real-life phenomena, and making predictions about the world.

In designing a model, the mathematician needs to identify variables, parameters, and constraints of the problem. Once the model is established, results should have a reasonable level of numerical accuracy.

The modeler then considers any limitations of the model, and the usefulness of the model in other situations.

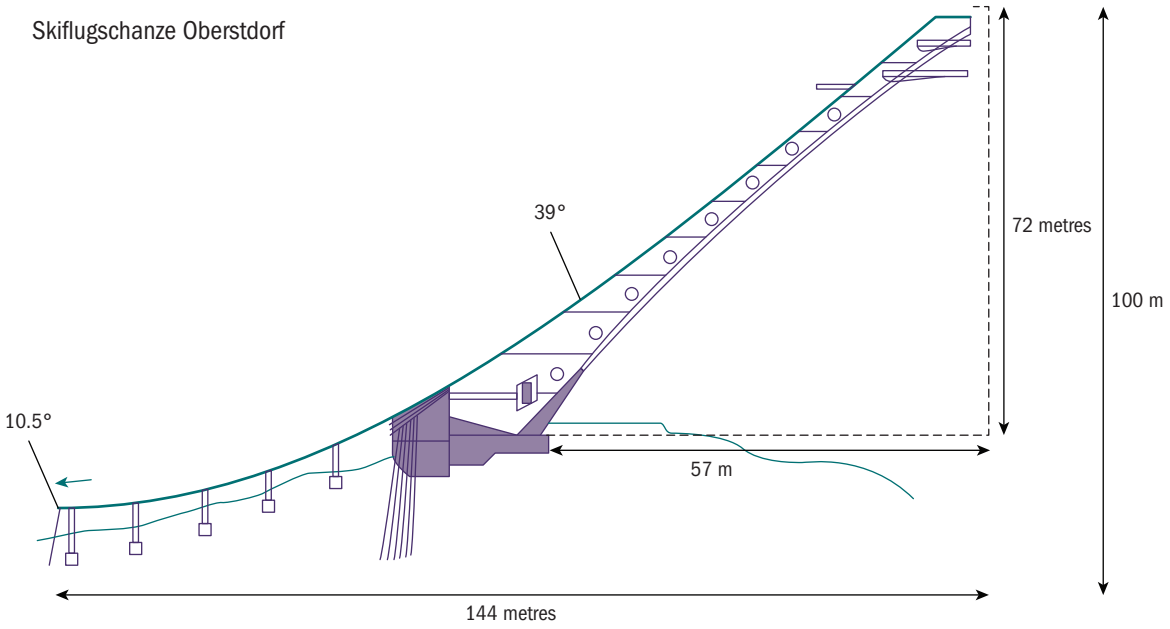
The process of mathematical modeling



Skiflugschanze oberstdorf

The **Heinl-Klopfer** ski-jump ramp in Oberstdorf, Germany, provides one of the most sensational and unforgettable ski-jumping experiences.

The specifications of this thrilling and famous construction are on the next page.



Specifications

The tower – hollow body with inclined elevation (dotted area)

- Height of the tower (dotted line) 72 m
- Inclination 39°
- Length from base of vertical tower (dotted line) 57 m

The ski-jump ramp

- Inclination at end of the ramp (depression) 10.5°
- Entire length from end of ramp to base of tower 144 m
- Entire height from end of ramp to top of tower 100 m

The hill and landing area

- You can research this yourself

Modeling the ski jump

Use piecewise functions to model the ramp from the top of the tower to the jump off point. Clearly indicate the data you used, and comment on the appropriateness and/or limitations of the functions you found to model the ramp. In order for there to be a smooth connection at the endpoints of the piecewise functions, the 1st (and 2nd derivative if it exists) at these points must be the same.

Then model the hill and the landing area, and incorporate this model with the model for the ski ramp. Evaluate the entire model for its appropriateness and/or limitations.