Rolling parabolas

Teacher notes

This resource asks students to find the locus of the focus of a parabola if the parabola is rolled along the x-axis. Students will find it helpful to know the standard parametric form of a parabola. The task is structured via a series of mini-questions to help students reach the interesting conclusion that the focus follows the path of a catenary curve ($y = a\cosh\frac{x}{a}$). As the problem involves arc length, this resource could be used after How long is a piece of string?

Preparation

To encourage students to approach each mini-question in turn, a set of question cards for each group could be useful, or a printout of the sheet containing all 6 questions.

Access to devices on which the applet could be used could be helpful.

If students have not studied conics then some prior discussion of what the focus is would be helpful.

Possible approaches

Students could be shown the applet as a whole class before working in small groups on the problem, either with a sheet of mini-questions, or having the questions issued as each one is answered.

Some think-pair-share time could be used, especially if students have devices on which they can explore the applet, before a whole class plenary which could include some revision of work on parabolas.

Key questions

- Can you think of any alternative ways to express a general point on a parabola?
- What do you already know?
- Can you find an expression for the x-co-ordinate?

Possible extension

Creating the applet as suggested!