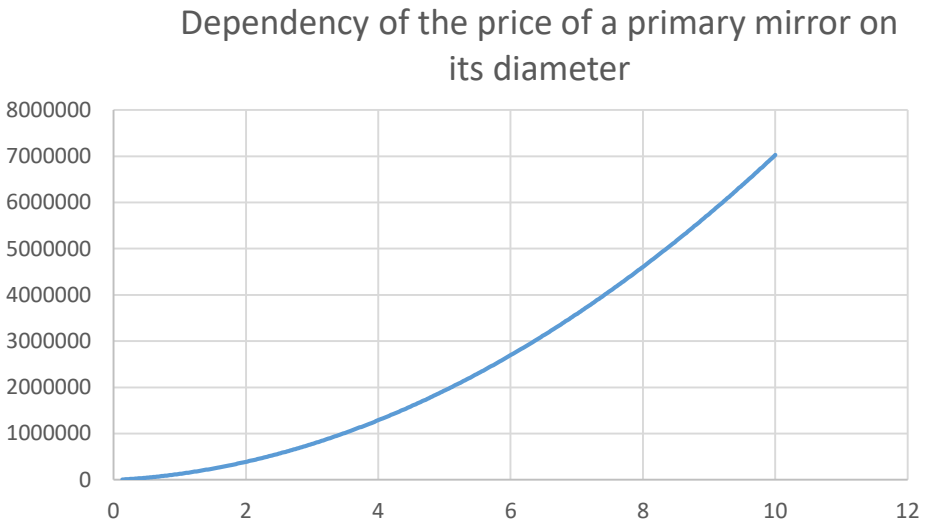
WORKSHEETS FOR PUPILS

Activity name	Expected duration	Difficulty of the activity	Age of children for which the activity is suitable	Tools and material used	Objective of the activity
Practical Exercise 1:	1 lesson	medium	14 – 15 years	drawing supplies	Deepening the knowledge of geometrical optics.
Practical Exercise 2:	1 lesson	higher	12 – 14 years	small and large magnifying glass, ruler, tube for drawings, saw, scissors, glue gun, calculator	Deepening the knowledge of geometrical optics and the principle of telescope construction.
Practical Exercise 3:	1 lesson	higher	12 – 14 years	small and large magnifying glass, ruler, tube for drawings, quarter sheet of paper, saw, scissors, glue gun, calculator	Deepening the knowledge of geometrical optics and the principle of telescope construction.
Practical Exercise 4:	1 lesson	medium	12 – 14 years	scissors, ruler, calculator	Understanding the principle of mirror construction from segments.
Practical Exercise 5:	1 lesson	medium	12 – 14 years	two quarter sheets of paper, aluminium foil, pin, drawing supplies, scissors, adhesive tape	The principle of a pinhole camera.

Practical Exercise 4: SEGMENTED MIRROR

Really large astronomical mirrors are expensive. A mirror with a diameter of 10 metres costs 7 million dollars. Your task is to design a cheaper mirror. The dependency of the price of the mirror on its diameter is shown in the following graph:



The *x* axis is the diameter of the mirror, the *y* axis its price in dollars. You can cut the last part of the worksheet and try out how the ten-metre mirror can be replaced with smaller mirrors. A smaller mirror will certainly be cheaper, but more mirrors will be needed so that the sum of their areas is again 10 metres.

The total price can be calculated as

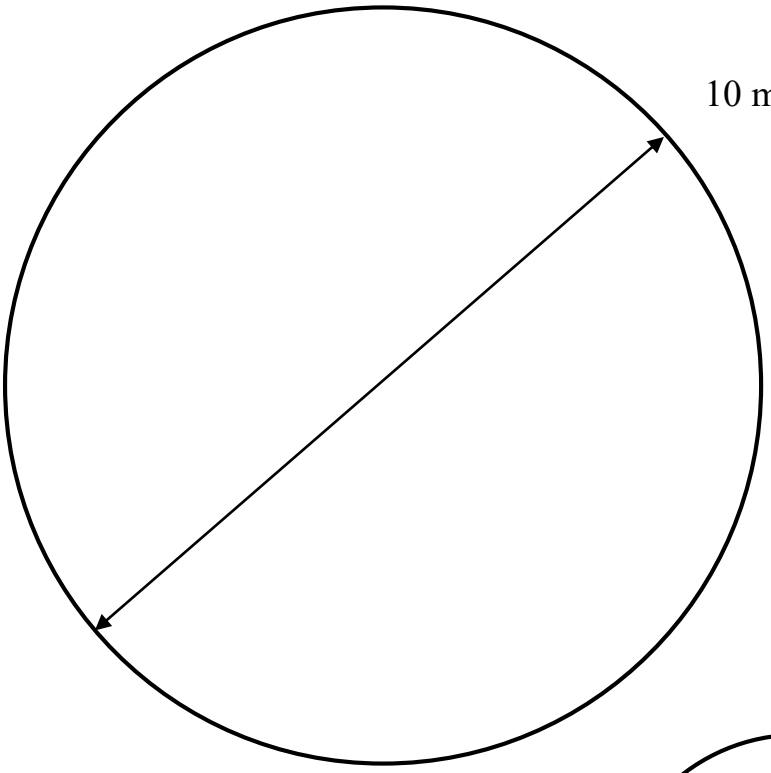
$$C_{\text{total}} = \text{number of mirrors} \cdot \text{price of one mirror.}$$

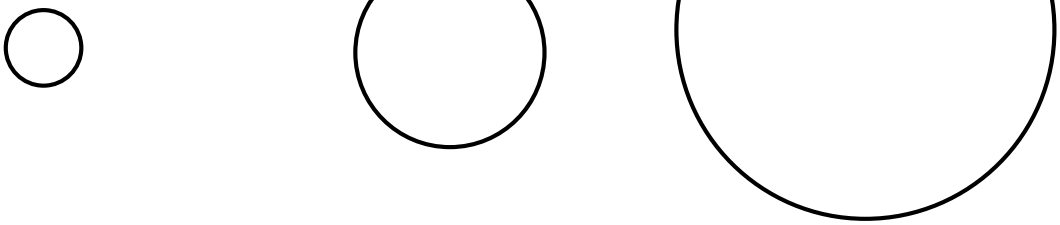
The number of mirrors (segments) can be determined as a ratio of the required diameter (10 metres) and the diameter of one segment. Then

$$C_{\text{total}} = \frac{\frac{\pi D^2}{4}}{\frac{\pi d^2}{4}} c = \frac{D^2}{d^2} c = \frac{100\ \text{m}^2}{d^2} c,$$

where D = 10 m is the diameter of the required mirror, d the diameter of a segment and c the price of one segment according to the graph.

Try different options with the mirror diameters that you have available after cutting the last part of the worksheet, or you can calculate with other segment diameters. At the end of this activity, you will present your solution to the class.





Diameter of 1 metre

Diameter of 2.5 metres

Diameter of 5 metres