Invent Yourself: Curved mirrors
We use concave mirror in our experiments to heat up and then cool down metal objects. Also conducted experiments with several flat mirrors, showed that concave mirrors and showed that concave mirrors are not necessary to heat up objects with sunlight. Our physical theoretical model was compared to experiments.
Plan of presentation

• Theoretical model
  ✓ Heating objects by sun rays
• Experiments
  ✓ Without mirrors
  ✓ With parabolic mirror
• Interesting facts
  ✓ With several flat mirrors
• Comparison of Theoretical model and Experiments
• Conclusion
Theoretical model
Theoretical model

\[ cm \frac{dT}{dt} = J_0 S - \kappa (T - T_0) S \]

\[ T = T_0 + \frac{J_0}{\kappa} \]

\[ T = \frac{J_0 + \kappa T_0}{\kappa} - \frac{J_0}{\kappa} e^{-\frac{\kappa S t}{cm}} \]

- \( T_0 \) - Room temperature
- \( T \) - plate temperature
- \( t \) - Time
- \( S \) - Surface cross area
- \( m \) - Mass of plate
- \( J_0 \) - intensity of sunlight
- \( k \) - Heat conductivity
Temperature dependence on time
Comparison of Theoretical model and Experiments
Experiments

\[ Y = ax^2 \quad a = \frac{y}{x^2} \]

\[ Y = 14 \text{ cm}, \quad x = 50 \text{ cm} \]

\[ a = 0.0056 \text{ cm}^{-1} \]

\[ F = \frac{1}{4a} = \frac{x^2}{4y} \]

\[ F = 44.64 \text{ cm} \]
Experiments
Comparison of Theoretical model and Experiments
Theoretical model

\[ cm \frac{dT}{dt} = J_0 S - \kappa (T - T_0) S_0 \]

\[ L = -d \frac{\cos 2\alpha}{\cos \alpha} \]

\[ I = I_0 \frac{S}{S_0} \]
Interesting fact
Cooling method
conclusion

- We developed several devices
  - With parabolic mirror
  - With several flat mirrors
- Compared experiments with parabolic mirror and without it and saw that there is difference between them
  - Without mirror - 33°C
  - With mirror - 60°C
- We measured focus for parabolic mirror
- Find way to cool object
  - Getting it out of focus
  - Block the rays of sun
Thank you for your attention