

TELESCOPE #2

Teaching Guidelines

Subject: Mathematics

Topics: Algebra--Quadratic Equations and Functions

Grades: 8 - 12

Knowledge and Skills:

- Can graph a quadratic function
- Can relate the coefficients of a quadratic function to their influence on the shape and position of the parabolic graph of that function

Procedure: This project should be done by students working individually or in teams of two. Distribute the handout and discuss it. Ensure that students understand the questions they are being asked to answer.

To determine the diameter, students will need to realize that in order for telescope #2 to have twice the light-gathering power of telescope #1, it will need to have twice the area:

Area of telescope #1 = 7.06 square meters (radius is 1.5 meters).

Area of telescope #2 must be 14.12 square meters, which gives a radius of 2.12 meters, or diameter of 4.24 meters. (As an alternative approach, for the area of #2 to be twice the area of #1, then the diameter of #2 must be equal to the diameter of #1 multiplied by the square root of 2 (1.414...), which gives the same result.

In order to graph the curve, students will need to know the value of the coefficient, a . They should have learned that, for a parabola, this equation holds true:

$$F = 1/(4a), \text{ where } F \text{ is the focal length of the parabola.}$$

Using a focal length of 8 meters in this equation gives a value for a of .03125 meters.

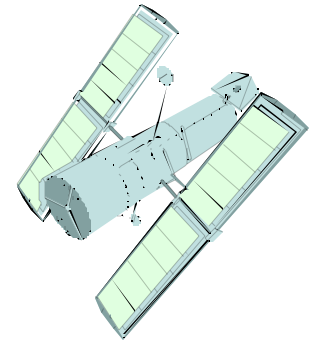
To graph the parabola, students should place the vertex at (2.12,0), and use the vertex form of the parabola equation:

$$(y - 0) = .03125(x - 2.12)^2$$

which simplifies to

$$y = .03125x^2 - 0.1325x + .14045$$

Thus the y intercept is +.14045.



From: Chief Astronomer
To: Mirror Design Team
Regarding: Telescope #2

Here are the specifications for the mirror for telescope #2, which we are hoping to have up and running within 18 months:

- 1) Light gathering power: Telescope #2 should have twice the light-gathering power of telescope #1, which, as you know, has a 3-meter diameter. Knowing this will enable you to determine the diameter of the main mirror for telescope #2.

- 2) Focal Length: Telescope #2 should have a focal length of 8 meters.

Based on this data, please sketch the cross-sectional curve of the mirror for telescope #2 below. Be sure to state the value of the depth and radius of the new mirror.

Then determine the specific equation which describes that curve, in quadratic function format ($y = ax^2 + bx + c$).

I need this right away.

Ed

EH: jk

