Answer on Question #43786, Math, Algebra

Andrew has been doing archery for a number of years. While training, he noticed that when he draws the arrow, the bow is in the shape of a conic section. Determine the equation of this conic section given that the distance between his hands when he draws the arrow is 0.5 m and that the cor is attached to the bow at points (-2,-) and (-2,4). In addition, in a Cartesian coordinate system, his bow is open to the right.

Remark. The part of statement is missed ("attached to the bow at points (-2,-?) and (-2,4)"). We suppose that the y-coordinate of the first vertex equals y_0. We also suppose the length unit vector in this Cartesian coordinate system has length 0.1 m.

Solution.

The conic section of the bow due to Euler Bernoulli beam theory will be parabola (simply supported beam with central load). The midpoint of segment which connects $(-2, y_0)$ and $(-2,4)$ is the location of the first hand. The first hand coordinates are $\left(\frac{-2-2}{2}, \frac{y_0+4}{2}\right) = (-2, \frac{y_0+4}{2})$. The second hand is located in the vertex of the parabola and has coordinates $\left(-2+5, \frac{y_0+4}{2}\right) = \left(3, \frac{y_0+4}{2}\right)$, as the distance between two hands is 0.5 m and bow is open to the right. Then the equation of the parabola is

$$x = k\left(y - \frac{y_0+4}{2}\right)^2 + 3.$$

If substitute point $(-2,4)$ in it, we will obtain

$$-2 = k\left(\frac{y_0-4}{2}\right)^2 + 3$$

or

$$k = -\frac{20}{(y_0-4)^2}.$$

Therefore the equation is

$$x = -\frac{20}{(y_0-4)^2}\left(y - \frac{y_0+4}{2}\right)^2 + 3.$$

Answer: $x = -\frac{20}{(y_0-4)^2}\left(y - \frac{y_0+4}{2}\right)^2 + 3.$