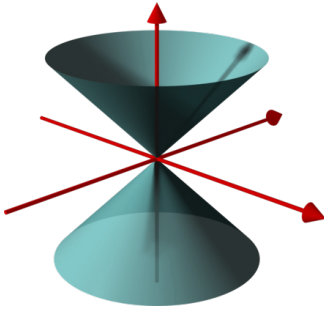


INTERNATIONAL
STEM OLYMPIAD
GRAND FINAL GERMANY

GRADES 9-10-11

MATHEMATICS

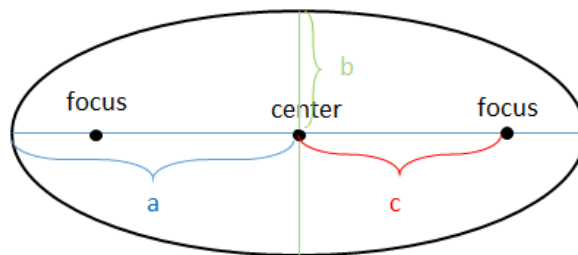
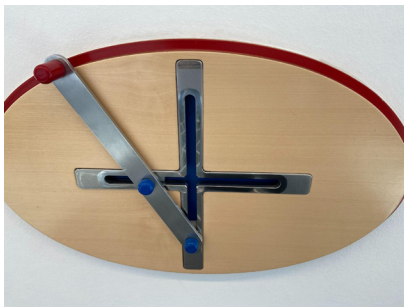
1 -



A shape would be formed if you cut the above conic sections with a vertical plane, given that the plane does not pass through the vertices. What is the equation for this shape?

- A) B) C) D)

2 -



The trammel of Archimedes is an ancient instrument that can be used to draw an ellipse.

Using the above image and labels, how can the distance c between the center and each foci be calculated?

- A) B) C) D)

3 -

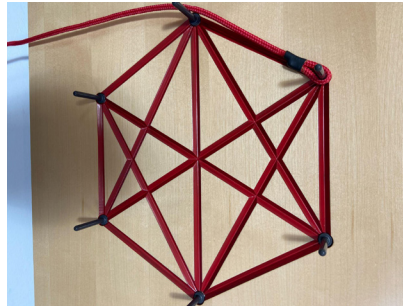
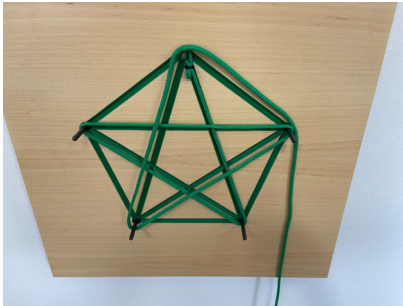
The Fibonacci sequence starts with the numbers 1 and 1, and then each successive number is the sum of the two previous numbers, so it starts 1, 1, 2, 3, 5, 8, 13...

As we take the ratio of each number to its preceding number, the ratios start to approach the Golden Ratio.

Which of the following is the closest approximation to the Golden Ratio?

- A) B) C) D)

4 -



Leonhard Euler was an 18th century mathematician who made many discoveries in many fields of math, and even has a special number named after him.

An Euler pattern is a circuit or path that uses every edge of a graph exactly once. The difference is that an Euler circuit starts and ends at the same vertex while an Euler path starts and ends at different vertices.

Are the two patterns above Euler circuits or paths?

- A) B) C) D)

5 -

A worker starts a new job with a yearly salary of \$60,000. She is guaranteed a 5% increase in her salary annually. What will her salary be after 5 years?

- A) B) C) D)