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Geometry Journey Video Series

Program #15

Non-Euclidean Geometry

**Satellite Broadcasting
VHS
and Internet/Intranet Streaming**



Topic

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Geometry Journey Series

Program #15 - Non-Euclidean Geometry

Program Description

Although Euclidean geometry has helped us for thousands of years, as mankind questions and discovers the universe, other branches of geometry have been developed. This video is an attempt to introduce these difficult subjects -- hyperbolic geometry, elliptic geometry and fractal geometry -- using the visual approach. The goal is to spark an interest into exploring many unknown worlds ahead.

This program is the #15 episode in the fifteen 15-minute Geometry Journey Series.

Synopsis

This program will cover the following topics:

1. Introduction to Non-Euclidean Geometry
2. Hyperbolic Geometry
3. Elliptic Geometry
4. Fractal Geometry

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Program #15 - Non-Euclidean Geometry

Student Worksheet

Name _____

1) The assumption that "through a given point not on a given line there passes more than one line parallel to the given line" led us to a new non-Euclidean geometry called _____.

2) The assumption that "through a given point not on a given line there passes no lines parallel to the given line" helped us discovered a new non-Euclidean geometry called _____.

3) Why did we introduce a new Non-Euclidean geometry called fractal geometry?

Question: Figure 1 represents a model for hyperbolic geometry, which includes all the points located at the interior of a circle. The open-ended chords of the circle are the geometric lines in this new model. Figure 1 shows a point P and a line m that does not contain P. Although we are saying that there are two or more lines through P that are parallel to line m. Actually, none of the lines through P look like parallel to m. Are they really parallel to line m at the same time? As shown in Figure 2, they actually intersect line m once they are extended.

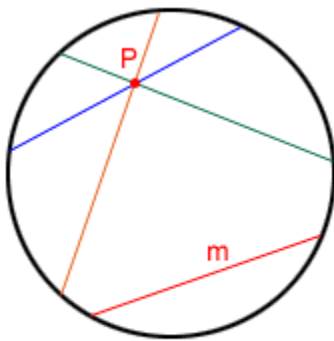


Figure 1

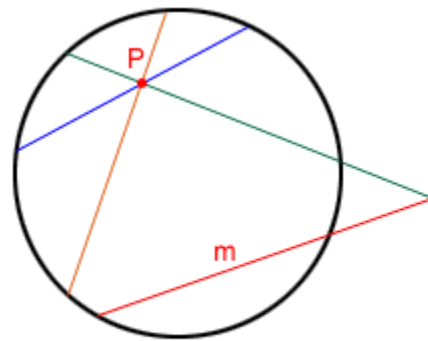


Figure 2

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Answers to the Student Worksheet

1) The assumption that "through a given point not on a given line there passes more than one line parallel to the given line" led us to a new non-Euclidean geometry called hyperbolic geometry.

2) The assumption that "through a given point not on a given line there passes no lines parallel to the given line" helped us discovered a new non-Euclidean geometry called elliptic geometry.

3) Why did we introduce a new Non-Euclidean geometry called fractal geometry?

Many everyday objects such as clouds, coastlines, mountain ranges, rivers and trees seem to be easy to describe because they are so familiar to us. However, Euclidean geometry simply cannot describe them. These natural objects can only be explained by a modern, non-Euclidean geometry called fractal geometry, introduced by the mathematician Mandelbrot. A fractal is a geometric shape that consists of an identical motif repeating itself on an ever-reduced scale.

Hints to Discussion Questions

Question: Figure 1 represents a model for hyperbolic geometry, which includes all the points located at the interior of a circle. The open-ended chords of the circle are the geometric lines in this new model. Figure 1 shows a point P and a line m that does not contain P. Although we are saying that there are two or more lines through P that are parallel to line m. Actually, none of the lines through P look like parallel to m. Are they really parallel to line m at the same time? As shown in Figure 2, they actually intersect line m once they are extended.

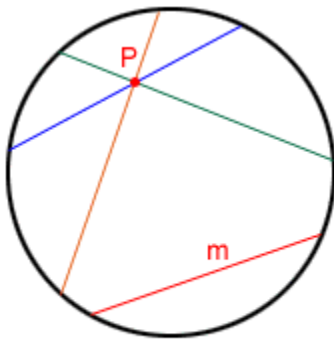


Figure 1

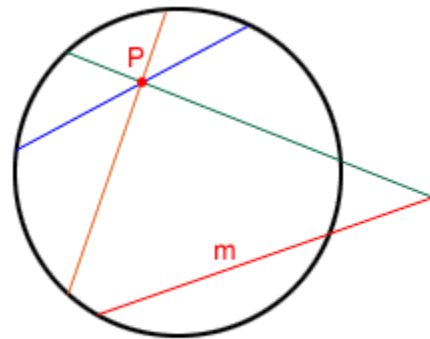


Figure 2

Hint: In geometry, "parallel" really means "no intersection." It is only true in Euclidean geometry that "parallel" is equivalent to "equidistant."

In addition, the new model includes only those points located at the interior of a circle. Our playing ground is inside the circle. Consequently, the geometric lines are the open-ended chords of the circle in this new model. They cannot be extended outside the circle. Because none of the lines through P intersects line m, this means that they are all parallel to m.