

Non- Euclidean Worksheet

Name _____

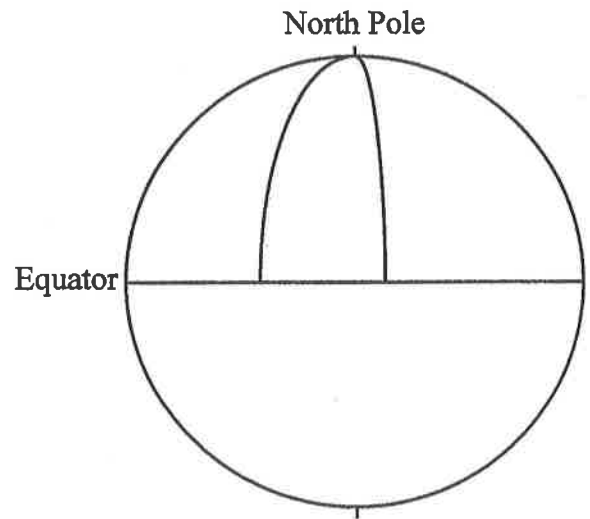
Date _____

Class/Grade _____

1 Earth is nearly spherical in shape. Because of this, it makes sense that our movements along the Earth's surface should follow the rules of spherical geometry. However, Euclidean geometry seems more applicable in our day-to-day lives. Why is this true?

- Ⓐ Spherical geometry is useful only for theoretical purposes.
- Ⓑ Relatively small regions of the Earth's surface are approximately planar.
- Ⓒ Euclidean geometry was created when many people believed that the Earth was flat.
- Ⓓ Earth is not exactly spherical.

2 Spherical geometry is a non-Euclidean geometry in which lines are defined as great circles of a sphere. Spherical geometry applies to navigation over long distances on Earth's approximately spherical surface.

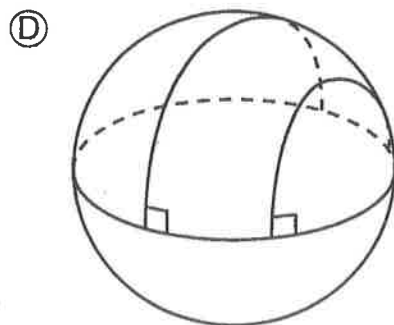
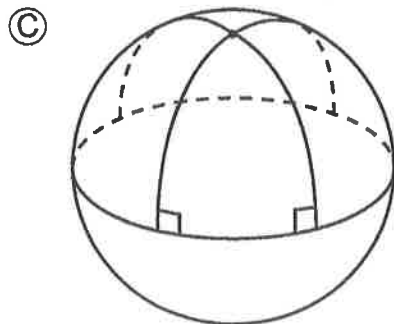
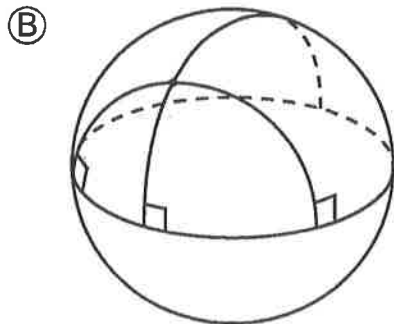
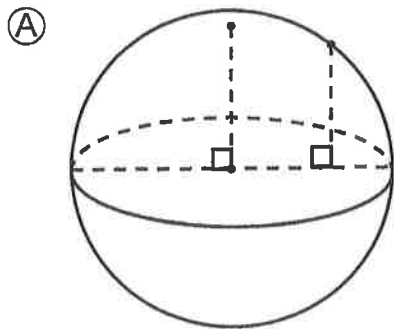


Suppose two airplanes at different points on the equator both fly due north and meet at the North Pole. How does the triangle formed by the equator and the flight paths of the two airplanes differ from any triangle in Euclidean planar geometry?

- Ⓕ The triangle only has two vertices.
- Ⓖ The triangle has six sides.
- Ⓗ The triangle has two right interior angles.
- Ⓙ The triangle has no interior angles.

Non-Euclidean Worksheet

- 3 In Euclidean geometry it is true that two lines that are perpendicular to the same line do not intersect. Which of the following diagrams shows that this is not true in spherical geometry?

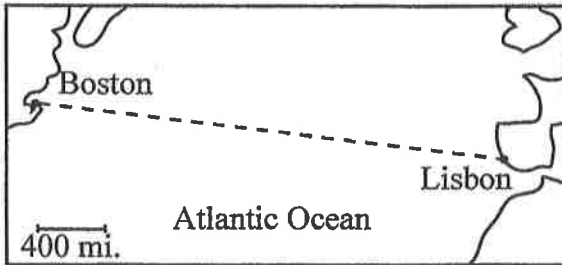


- 4 Euclidean and non-Euclidean geometries share a core of common axioms but differ in a few respects. For instance, Euclidean geometry largely concerns lines on two-dimensional planes, whereas non-Euclidean geometries, such as elliptical geometry and hyperbolic geometry, concern lines —

- (F) on the surfaces of polyhedra.
(G) that intersect conic sections.
(H) in three-dimensional space.
(J) on curved surfaces.
- 5 Which of the following conjectures is true in both Euclidean geometry and spherical geometry?
- (A) For every line, there is another line parallel to that line.
(B) Triangles are similar if each has interior angles with measures x° and y° .
(C) Vertical angles are congruent.
(D) The sum of the measures of the interior angles of a triangle is 180° .

Non- Euclidean Worksheet

- 6 Christopher planned to sail from Boston, Massachusetts, to Lisbon, Portugal. On the map shown below, he determined the distance between the cities to be approximately 2,800 miles.



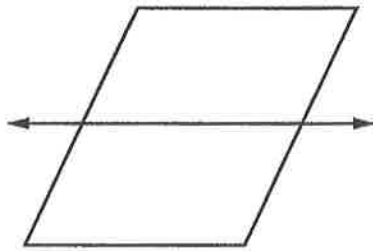
Much to Christopher's surprise, the actual journey from Boston to Lisbon was about 3,200 miles long. How can Christopher account for the inaccuracy of his estimate?

- Ⓕ His route on the map was drawn based on non-Euclidean geometry rather than Euclidean geometry.
- Ⓖ The map did not account for ocean currents that pushed his ship off course.
- Ⓗ He incorrectly used the map scale to measure his route.
- Ⓙ His route on the map was drawn based on Euclidean geometry rather than non-Euclidean geometry.

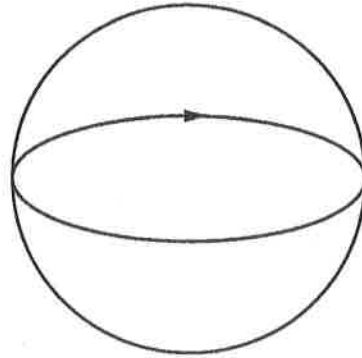
Non- Euclidean Worksheet

- 7 Euclidean geometry is based on a set of axioms concerning figures on a plane. However, other non-Euclidean geometries exist that are based on different sets of axioms. One example of a non-Euclidean geometry is spherical geometry. In spherical geometry, lines are defined as great circles of a sphere.

Lines in Different Geometries



Euclidean (planar)



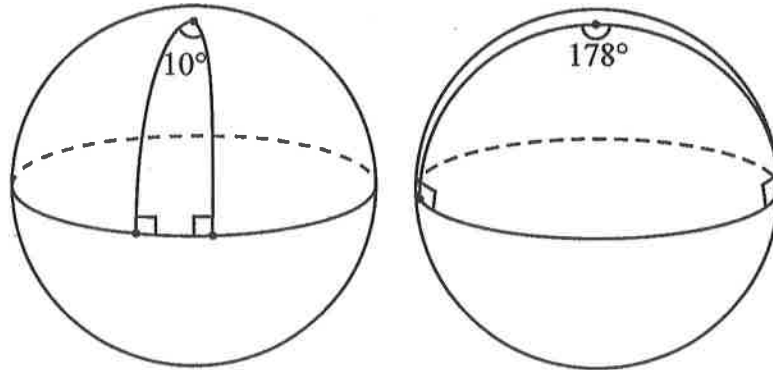
Non-Euclidean (spherical)

In Euclidean geometry, non-parallel lines intersect at exactly one point. At how many points do non-parallel lines intersect in spherical geometry?

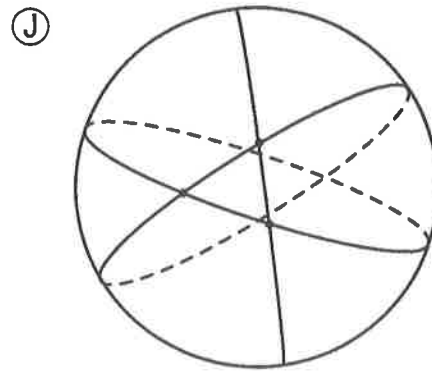
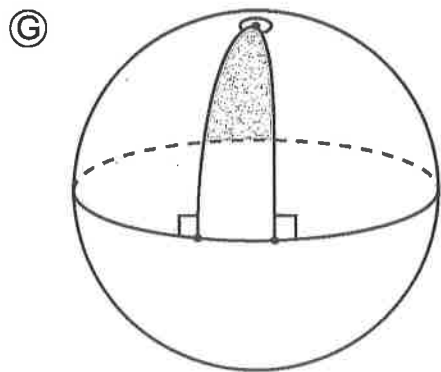
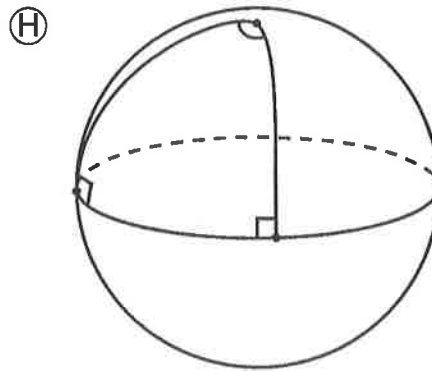
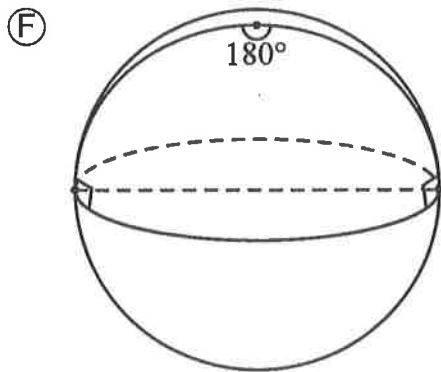
- (A) 1
- (B) 4
- (C) 0
- (D) 2

Non- Euclidean Worksheet

- 8 In spherical geometry, the sum of the measures of the interior angles of a triangle can be any value between 180° and 540° . Marta drew the following spherical triangles and incorrectly concluded that the sum of the measures of the interior angles of triangle is always between 180° and 360° .

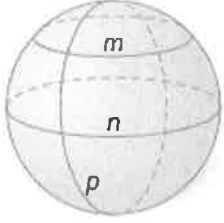
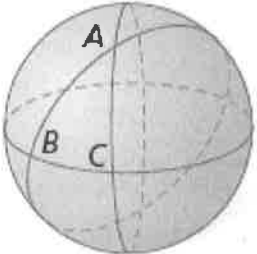



Which of the following diagrams would help Marta see that her conjecture is incorrect?



Non-Euclidean Worksheet

Name the following.

<p>_____ 9.</p>	<p>Name all lines on the sphere.</p>	
<p>_____ 10.</p>	<p>Name all lines on the sphere.</p>	
<p>_____ 11.</p>	<p>Name three line segments on the sphere.</p>	
<p>_____ 12.</p>	<p>Name a triangle on the sphere.</p>	
<p>_____ 13.</p>	<p>How much of a great circle is the distance from the North Pole to the South Pole?</p>	
<p>_____ 14.</p>	<p>How much of a great circle is the distance from the North Pole to any point on the equator?</p>	

Choose the correct answer for the following.

<p>_____ 15.</p>	<p>Which answer is not considered a line on a sphere?</p> <ul style="list-style-type: none"> A. All lines of longitude B. the equator C. all lines of latitude D. a great circle
<p>_____ 16.</p>	<p>Which of the following is the major premise that separates Euclidean geometry from spherical geometry?</p> <ul style="list-style-type: none"> A. A circle can be drawn with any given point as the center and any given radius. B. Parallel lines can be drawn given any point and a line if the point is not on the line. C. Distance can be measured by a formula. D. A straight line can be drawn through any two points.

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_____ 17.	<p>A sphere with a diameter of 18 cm is sliced through the center by a plane. Which best describes the resulting cross section?</p> <p>A. a semi-circle B. a round circle C. a great circle D. a non-circle</p>
_____ 18.	<p>The curved surface of the earth compares to which term in Euclidean geometry?</p> <p>A. Plane B. Line C. Point D. Space</p>

Determine whether each statement is true or false for each type of geometry, Spherical (S) and Euclidean (E).

S: _____ E: _____	19. Any two distinct points determine exactly one line.
S: _____ E: _____	20. A triangle can have two right angles.
S: _____ E: _____	21. Three distinct lines form at most one triangle.
S: _____ E: _____	22. Given a line and a point not on a line, there exists no line that passes through the point and is parallel to the line.
S: _____ E: _____	23. A line segment can intersect another line segment in exactly two points.