STRAND 7: CONIC SECTIONS

TOPIC 7.1: INTERSECTION OF A PLANE AND A CONE

Topic Notes

Mathematical focus

The mathematical focus of this topic is to describe each conic section as the intersection of a plane and a cone.

Topic focus

The goal of this topic is for participants and students to understand how the relative position of the intersecting plane to the cone influences the conic that is found in the intersection. Two opportunities are planned to do this. One is a simple task that allows participants and students to model the intersections with cones and planes. The other task involves generating the equation of a conic algebraically. The equation of a cone is developed and the intersections with various planes are considered.

This topic includes two tasks:

Task 7.1.1: Slicing the Cone—Student Activity
Task 7.1.2: The Cone and the Intersecting Plane

TExES standards focus

TExES Standard III.014 Geometry and measurement. The teacher understands coordinate, transformational, and vector geometry and their connections. The beginning teacher:
(F) Uses coordinate geometry to derive and explore the equations, properties, and applications of conic sections (i.e., lines, circles, hyperbolas, ellipses, parabolas).

TExES Standard VI.020 Mathematical learning, instruction and assessment. The teacher understands how children learn mathematics and plans, organizes and implements instruction using knowledge of students, subject matter, and statewide curriculum (Texas Essential Knowledge and Skills [TEKS]). The beginning teacher:
(D) Understands a variety of instructional strategies and tasks that promote students' abilities to do the mathematics described in the TEKS.

TEKS/TAKS focus

TEKS 2A.5 Algebra and geometry. The student knows the relationship between the geometric and algebraic descriptions of conic sections. The student is expected to:
(A) describe a conic section as the intersection of a plane and a cone.

Materials

	Task 7.1.1	Task 7.1.2
Scissors	*	
Tape	*	
Template run on cardstock	*	
Transparencies1-4		*
Chart paper		*
Markers		*

Procedure

Participants should complete Task 7.1.1. Allow time to build the models and experiment with them. Keep the models to use during Task 7.1.2.

Task 7.1.2 should be done as a guided discovery. Its purpose is for participants to make the connection between the plane/cone intersection description of a conic section and its algebraic equation. The algebraic equation of the conic is derived by solving a system of equations containing the equation of a cone and the equation of an intersecting plane. If 3-d graphing technology is available, its use will enhance the presentation. Take the time to graph each system used in finding the intersection of a plane and cone. Rotate the graph to examine the conic in the intersection from several views. If graphing technology is not available, pictures showing the results of graphing are provided on Transparency 2.

Summary

If a plane intersects a cone parallel to the base of the cone, their intersection forms a(n) __circle__.

If a plane intersecting a cone is not parallel to the base of a cone and the plane does not intersect the base of the cone, the intersection of the plane and the cone forms a(n) __ellipse____ .

If a plane intersects a cone perpendicular to the base of the cone and parallel to the axis of the cone, their intersection forms a(n) __hyperbola__.

If a plane intersects a cone parallel to the line generating the cone, their intersection forms a(n) __parabola__.

Assessments

Ask participants to complete a Student Journal for Task 7.1.1 and a Teacher Journal for Task 7.1.2.

	Teacher use only	Modify for students	Ready for students
Task 7.1.1			*
Task 7.1.2		*	