Standard #: MAFS.912.G-GMD.2.4

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Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

Grade: 912

Cluster: Visualize relationships between two-dimensional and three-dimensional objects. (Geometry - Additional Cluster) -
Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

Date Adopted or Revised: 02/14

Content Complexity Rating: Level 2: Basic Application of Skills & Concepts - More Information

Date of Last Rating: 02/14

Status: State Board Approved

Assessed: Yes

TEST ITEM SPECIFICATIONS

Item Type(s): This benchmark may be assessed using: MC item(s)

N/A
Assessment Limits :
Items may include vertical, horizontal, or other cross-sections.

Items may include more than one three-dimensional shape.

Calculator :
Neutral

Clarification :
Students will identify the shape of a two-dimensional cross-section of a three-dimensional object.

Students will identify a three-dimensional object generated by a rotation of a two-dimensional object

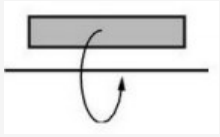
Stimulus Attributes :
Items may be set in a real-world or mathematical context.

A verbal description of a cross-section or a three-dimensional shape may be used.

Response Attributes :
Items may require the student to draw a line that shows the location of a cross-section.

SAMPLE TEST ITEMS (1)

Test Item #: Sample Item 1
Question:
A rectangle and a horizontal line segment are shown.



What is the resulting object when the rectangle is rotated about the horizontal line segment?

Difficulty: N/A

Type: MC: Multiple Choice

Related Courses

Course Number	Course Title
1200400:	Intensive Mathematics (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1206300:	Informal Geometry (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1206310:	Geometry (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1206320:	Geometry Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
7912060:	Access Informal Geometry (Specifically in versions: 2014 - 2015 (course terminated))
7912070:	Access Liberal Arts Mathematics (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 - 2019, 2019 and beyond (current))
1206315:	Geometry for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1207300:	Liberal Arts Mathematics 1 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
7912065:	Access Geometry (Specifically in versions: 2015 and beyond (current))

Related Access Points

Access Point

Access Points Number	Access Points Title
MAFS.912.G-GMD.2.AP.4a:	Identify shapes created by cross sections of two-dimensional and three-dimensional figures.

Related Resources

Lesson Plan

Name	Description
2D Representations of 3D Objects:	This lesson is intended to help you assess how well students are able to visualize two-dimensional cross-sections of representations of three-dimensional objects. In particular, the lesson will help you identify and help students who have difficulties recognizing and drawing two-dimensional cross-sections at different points along a plane of a representation of a three-dimensional object.
Modeling: Rolling Cups:	This lesson unit is intended to help you assess how well students are able to choose appropriate mathematics to solve a non-routine problem, generate useful data by systematically controlling variables and develop experimental and analytical models of a physical situation.
Representing and Combining Transformations:	This lesson unit is intended to help you assess how well students are able to recognize and visualize transformations of 2D shapes, translate, reflect and rotate shapes, and combine these transformations. It also aims to encourage discussion on some common misconceptions about transformations.

Formative Assessment

Name	Description
2D Rotations of Rectangles:	Students are given the coordinates of the vertices of a rectangle and asked to describe the solid formed by rotating the rectangle about a given axis.
2D Rotations of Triangles:	Students are given the coordinates of the vertices of a right triangle and asked to describe the solid formed by rotating the triangle about a given axis.
Inside the Box:	Students are asked to identify and draw cross sections of a rectangular prism and to describe their dimensions.
Slice It:	Students are asked to identify and describe two-dimensional cross sections of three-dimensional solids.
Slice of a Cone:	Students are asked to sketch, describe, and compare three horizontal cross sections of a cone.
Working Backwards – 2D Rotations:	Students are given a solid and asked to determine the two-dimensional shape that will create the solid when rotated about the *y*-axis.

Virtual Manipulative

Name	Description
3-D Conic Section Explorer:	Using this resource, students can manipulate the measurements of a 3-D hourglass figure (double-napped cone) and its intersecting plane to see how the graph of a conic section changes. Students will see the impact of changing the *height* and *slant* of the cone and the *m* and *b* values of the plane on the shape of the graph. Students can also rotate and re-size the cone and graph to view from different angles.
A Plethora of Polyhedra:	This program allows users to explore spatial geometry in a dynamic and interactive way. The tool allows users to rotate, zoom out, zoom in, and translate a plethora of polyhedra. The program is able to compute topological and geometrical duals of each polyhedron. Geometrical operations include unfolding, plane sections, truncation, and stellation.
	With this online Java applet, students use slider bars to move a cross section of a cone, cylinder, prism, or pyramid.

Cross Section Flyer - Shodor:	This activity allows students to explore conic sections and the 3-dimensional shapes from which they are derived. This activity includes supplemental materials, including background information about the topics covered, a description of how to use the application, and exploration questions for use with the java applet.
Space Blocks:	This virtual manipulative allows students to manipulate blocks, add or remove blocks, and connect them together to form solids. They can also experiment with counting the number of exposed faces, seeing what happens to the surface area when blocks are added or removed, and "unfolding" a block to create a net .

Problem-Solving Task

Name	Description
Global Positioning System I:	This question examines the algebraic equations for three different spheres. The intersections of each pair of spheres are then studied, both using the equations and thinking about the geometry of the spheres.
Global Positioning System II:	Reflective of the modernness of the technology involved, this is a challenging geometric modeling task in which students discover from scratch the geometric principles underlying the software used by GPS systems.
Tennis Balls in a Can:	This task is inspired by the derivation of the volume formula for the sphere. If a sphere of radius 1 is enclosed in a cylinder of radius 1 and height 2, then the volume not occupied by the sphere is equal to the volume of a "double-naped cone" with vertex at the center of the sphere and bases equal to the bases of the cylinder

Original Student Tutorial

Name	Description
Ninja Nancy Slices:	Learn how to determine the shape of a cross section created by the intersection of a slicing plane with a pyramid or prism. This task is vital to those that work to create three dimensional objects. Whether it is the inventor of a new toy or the architect of your next house, they must be able to convey their design on paper. The drawings they make represent various cross sections of the finished product. Can you visualize the relationships between two-dimensional and three-dimensional objects? Imagine that Ninja Nancy will slice through this pyramid with her sword. What two-dimensional figures will she reveal?

Assessment

Name	Description
Sample 2 - High School Geometry State Interim Assessment:	This is a State Interim Assessment for 9th-12th grade.

Student Resources

Name	Description
3-D Conic Section Explorer:	Using this resource, students can manipulate the measurements of a 3-D hourglass figure (double-napped cone) and its intersecting plane to see how the graph of a conic section changes. Students will see the impact of changing the *height* and *slant* of the cone and the *m* and *b* values of the plane on the shape of the graph. Students can also rotate and re-size the cone and graph to view from different angles.
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Cross Section Flyer - Shodor:	With this online Java applet, students use slider bars to move a cross section of a cone, cylinder, prism, or pyramid. This activity allows students to explore conic sections and the 3-dimensional shapes from which they are derived. This activity includes supplemental materials, including background information about the topics covered, a description of how to use the application, and exploration questions for use with the java applet.
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Ninja Nancy Slices:	Learn how to determine the shape of a cross section created by the intersection of a slicing plane with a pyramid or prism. This task is vital to those that work to create three dimensional objects. Whether it is the inventor of a new toy or the architect of your next house, they must be able to convey their design on paper. The drawings they make represent various cross sections of the finished product. Can you visualize the relationships between two-dimensional and three-dimensional objects? Imagine that Ninja Nancy will slice through this pyramid with her sword. What two-dimensional figures will she reveal?
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Parent Resources

Name	Description
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