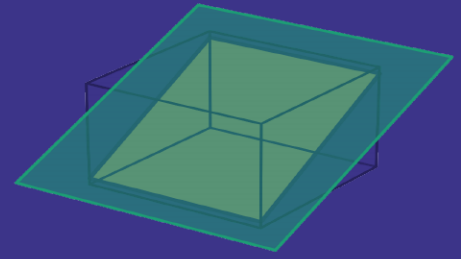


DISCOVERY LAB

Cross Sections Discovery Lab



Slice It! See It! Draw It!

A hands-on + digital exploration of plane sections of right rectangular prisms and right rectangular pyramids.

GRADE 7

CCSS 7.G.A.3

HANDS-ON + DIGITAL

4

ACTIVITIES

12

PHOTO CARDS

12

PRACTICE PROBLEMS

10

QUIZ Q's

CONTENTS

Table of Contents

Teacher Guide — Overview & Standards	3
Three Implementation Options	5
Vocabulary Foldable	7
Foundations: Cross-Section & Plane	9
Figure Types: Prisms & Pyramids	10
Slice Orientations: Parallel, Perpendicular, Diagonal	11
Activity 1: Real-Food Slicing	12
Real-Food Slicing Cards (1-12)	13
Activity 1 — Recording Sheet	19
Activity 2: Play-Doh Lab (Instruction Sheet)	20
Play-Doh Lab — Recording Sheet	22
Activity 3: Digital Drag-the-Plane	24
Digital Exploration — Recording Sheet	26
Activity 4: Cross-Section Practice Problems	27
Activity 4 — Detailed Answer Key	33
Cross-Sections Quiz	38
Quiz — Answer Key & Explanations	40

How to use this resource: Each section is designed to be modular. Use the Teacher Guide (pp. 3-5) to choose the implementation option that best fits your classroom. Print the Play-Doh Lab sheet and the 12 food cards front-to-back for hands-on stations. The vocabulary foldable prints across pp. 7-11 (assembly instructions on pp. 7-8, then the 7 panels on pp. 9-11) — students cut and accordion-fold along the dashed teal lines.

Teacher Guide — Overview & Standards

Welcome to the **Cross Sections Discovery Lab** — a premium, multi-modal resource designed to make CCSS 7.G.A.3 come alive in your Grade 7 mathematics classroom. This standard asks students to *"describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids."* While most existing resources reduce this rich, visual standard to a single worksheet, this Discovery Lab treats it as a multi-day investigation that builds genuine spatial reasoning through physical, photographic, and digital experiences.

The lab is organized around a simple but powerful learning progression: students first encounter cross-sections in familiar real-world foods (Activity 1), then construct and slice their own three-dimensional figures from Play-Doh (Activity 2), then explore dynamic plane-section relationships in a digital environment (Activity 3), and finally consolidate their understanding through twelve carefully-scaffolded practice problems (Activity 4). A vocabulary foldable, a 10-question quiz, and this teacher guide complete the package. Every component is classroom-ready and aligned to the Common Core State Standards for Mathematics.

STANDARD ALIGNMENT

CCSS.MATH.CONTENT.7.G.A.3 — Geometry

Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.

Learning Objectives

By the end of this Discovery Lab, students will be able to:

- **Define** the terms *cross-section*, *plane*, *prism*, *pyramid*, *parallel slice*, *perpendicular slice*, and *diagonal slice* using precise mathematical language.
- **Identify** the three-dimensional figure (right rectangular prism, right rectangular pyramid, triangular prism, cylinder, cone, or sphere) represented by a real-world object.
- **Predict** the two-dimensional shape that will result from a given slicing plane through a given three-dimensional figure, including horizontal, vertical, and diagonal cuts.
- **Verify** predictions through hands-on slicing (Play-Doh lab) and digital simulation, reconciling any discrepancies between prediction and observation.
- **Justify** cross-section results by reasoning about how a plane intersects each face of a polyhedron or each lateral surface of a curved solid.
- **Generalize** the rule that any slice parallel to a face of a right rectangular prism produces a congruent rectangle, and any slice parallel to the base of a pyramid produces a similar (smaller) polygon.

Materials Checklist

Three Implementation Options

Choose the option that best fits your schedule, materials, and student needs. Each option delivers the full learning progression but varies in depth, modalities, and time investment. All three options culminate with the same 10-question quiz so you can compare results across class periods.

	Option 1: Full Lab	Option 2: Digital Only	Option 3: Paper Only
Time required	90-120 minutes (2 periods or 1 block)	45-60 minutes (1 period)	60-75 minutes (1 period)
Activities used	1, 2, 3, 4 (all four)	1, 3, 4 (skip Play-Doh)	1, 2, 4 (skip digital)
Materials	Play-Doh, floss, devices, photo cards	Devices only + photo cards	Play-Doh, floss, photo cards
Best for	Conceptual depth, hands-on learners, full inquiry	Tech-rich classrooms, quick review, 1:1 schools	Low-tech settings, focus on physical modeling
Grouping	Pairs for Activities 2-3; individual for 1 & 4	Pairs for Activity 3; individual for 1 & 4	Pairs for Activity 2; individual for 1 & 4
Assessment	Quiz + Activity 4 problems	Quiz + Activity 4 problems	Quiz + Activity 4 problems

Option 1: Full Lab (90-120 minutes)

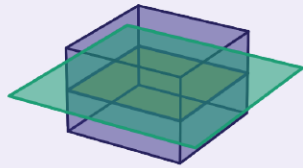
The complete inquiry experience. Begin with the vocabulary foldable as a 10-minute warm-up so every student enters Activity 1 with shared language. Run Activity 1 (food cards) as a whole-class launch — project a few photo cards and model the thinking. Then split into pairs and rotate through Activity 2 (Play-Doh) and Activity 3 (Digital) as stations, 15-20 minutes per station. Close with Activity 4 practice problems done individually, then administer the quiz on a second day. This option maximizes conceptual depth and is the recommended path whenever time allows.

Option 2: Digital Only (45-60 minutes)

A streamlined path for 1:1 classrooms or quick review. Skip the Play-Doh station and compensate by giving students extra time on the digital drag-the-plane tool (Activity 3), which dynamically simulates the slicing that Play-Doh provides physically. Use Activity 1 food cards as projected warm-up prompts rather than printed stations. Assign Activity 4 as homework and use the quiz as an in-class exit ticket. This option trades tactile experience for efficiency and is excellent for review days or for classes where Play-Doh is impractical.

Option 3: Paper Only (60-75 minutes)

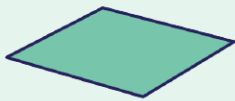
Foundations: Cross-Section & Plane



1. Cross-Section

Definition: The two-dimensional shape formed when a flat surface (a plane) cuts through a three-dimensional figure. Imagine slicing a loaf of bread — the freshly exposed face of each slice *is* a cross-section. Every cross-section is always a flat, 2-D shape.

Real-World Example: A slice of bread reveals a rectangular cross-section. A slice of an orange reveals a circular cross-section.



2. Plane

Definition: A perfectly flat surface that extends forever in every direction, with no thickness at all. In geometry we use a plane as the "knife" that slices a 3-D figure. A plane has length and width but zero depth, and any two points on a plane can be connected by a straight line that stays entirely inside the plane.

Real-World Example: A sheet of glass, the surface of a calm lake, or the flat top of a desk all model portions of a geometric plane.

PREVIEW

ACTIVITY 1

Real-Food Slicing — Photo Analysis

Activity 1: Real-Food Slicing

In this opening activity, students examine twelve full-color photographs of common foods that have been sliced open. For each food, they identify the underlying three-dimensional figure (rectangular prism, cylinder, sphere, triangular prism, cone) and the two-dimensional shape of the freshly exposed cross-section. This activity bridges everyday intuition with formal geometric language — students already "know" that a slice of bread is rectangular; the activity asks them to articulate *why* in terms of geometric figures.

The twelve foods were chosen to span the full range of figure types students will encounter in the lab: rectangular prisms (bread, butter), cylinders (cheese wheel, cucumber, cake, pineapple), spheres (watermelon, orange), a triangular prism (sandwich, Toblerone), and a cone (ice cream cone). One unusual case — celery — is included to remind students that not every cross-section is a "textbook" shape, and that real-world geometry is messier than the idealized figures in our diagrams.

STUDENT DIRECTIONS

1. Look at the photo card. Notice the food, the cut, and the arrow showing the direction of the slice.
2. In the blank under "3D figure," write the name of the three-dimensional figure the food most closely resembles (rectangular prism, cylinder, sphere, triangular prism, or cone).
3. In the blank under "2D cross-section," write the name of the two-dimensional shape of the exposed slice (rectangle, circle, triangle, or other).
4. Compare your answers with a partner. If you disagree, look closely at the cross-section thumbnail in the corner of the card — it shows the actual shape.
5. Record your final answers on the recording sheet (next page).

Discussion Questions (after the activity)

- Q1.** Which 3D figure produced the most surprising cross-section? Why was it surprising?
- Q2.** The watermelon and the orange are both spheres, and both produce circular cross-sections. Is this a coincidence, or does it have to be true? Justify your answer.
- Q3.** The cucumber and the cake layer are both cylinders, but their cross-sections look very different in size. What is the same about the cross-sections? What is different?
- Q4.** The celery stalk produces a crescent-shaped cross-section that is not in our vocabulary list. What does this tell you about the limits of using "ideal" geometric figures to describe real-world objects?
- Q5.** If you sliced each food in a different direction (perpendicular instead of parallel, or diagonal), would the cross-section change? Predict one example and explain.

ACTIVITY 2

Play-Doh Lab — Build & Slice

Activity 2: Play-Doh Lab (Instruction Sheet)

In this hands-on station, students build their own three-dimensional figures from Play-Doh and slice them with dental floss at three different angles — horizontal, vertical, and diagonal. This is the heart of the discovery lab: there is no substitute for the moment when a student pulls two halves of a Play-Doh pyramid apart and sees a trapezoid staring back at them. The physical experience creates a lasting mental image that students will retrieve weeks later when they encounter cross-section questions on a quiz or standardized test.

Print this instruction sheet single-sided. Each pair of students needs one sheet, one can of Play-Doh, two 12-inch pieces of unwaxed dental floss, and one blunt plastic knife for shaping. Plan for 30-40 minutes at this station. The recording sheet on the next page guides students through six slicing trials: two figures (rectangular prism and square pyramid) cut at three angles each.

MATERIALS (per pair)

- **Play-Doh** (any color; one can per pair)
- **Unwaxed dental floss**, cut into two 12-inch pieces per pair
- **Plastic knife** (blunt, for shaping the figure)
- **Ruler** (for sketching rectangles on the recording sheet)
- **Wet wipes or paper towels** for cleanup
- **This instruction sheet + recording sheet** (pp. 20-23)

SAFETY TIPS

- Play-Doh is non-toxic, but students should **not eat** it. Students with gluten sensitivity should wear gloves (Play-Doh contains wheat).
- Dental floss can cut skin if pulled too hard. Wrap each end around two fingers and pull gently — let the floss do the work, not your hands.
- Use only the **blunt plastic knife** for shaping. Never substitute a metal knife.
- Wash hands before and after the activity. Wipe down the work surface with a disinfecting wipe when finished.
- Keep Play-Doh away from carpets and fabrics. Work on a hard, washable surface (desk, tray, or paper plate).
- **Allergy check:** Verify no students in the class have a wheat or gluten allergy before distributing Play-Doh. Substitute modeling clay if needed.

Step-by-Step Procedure

Part A: Build a Right Rectangular Prism

- **Step 1.** Roll half the Play-Doh into a ball, then press it firmly against the desk to flatten the bottom. Use the plastic knife to shape it into a clean rectangular block about 2 inches long, 1.5 inches wide, and 1.5 inches tall.
- **Step 2.** Check your work: are all angles 90° ? Are the top and bottom faces parallel rectangles of the same size? If not, reshape.

ACTIVITY 4

Practice Problems (1-12)

Activity 4: Cross-Section Practice Problems

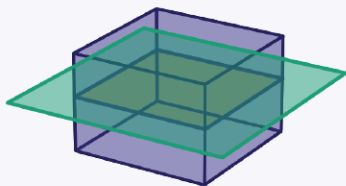
Twelve practice problems follow, two per page. Each problem shows a labeled diagram of a 3-D figure with the cutting plane drawn in teal and the cross-section highlighted in gold. For each problem, name the cross-section shape and briefly explain your reasoning. Detailed solutions begin on the page after Problem 12 — check your work and read the explanations for any problems you found tricky.

1

Problem 1

Figure: Right Rectangular Prism (Cube)

Slice: Horizontal (parallel to base)



A horizontal plane slices through the center of the cube shown. What is the shape of the cross-section?

Your answer:

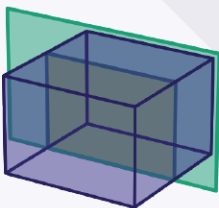
Why?

2

Problem 2

Figure: Right Rectangular Prism (Cube)

Slice: Vertical (perpendicular to base)



A vertical plane slices through the cube, parallel to one pair of lateral faces. What is the shape of the cross-section?

Your answer:

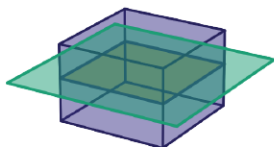
Why?

Activity 4 — Detailed Answer Key

Each solution below restates the problem, gives the answer, and then explains **why** the cross-section has that shape. The reasoning is the most important part — students who can articulate *why* will transfer their understanding to quiz questions, standardized tests, and future geometry courses. Encourage students to read the explanation for every problem, not just the ones they got wrong.

1 Solution 1 — Right Rectangular Prism (Cube)

Slice: Horizontal (parallel to base)

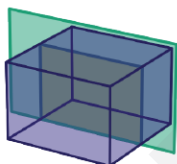


Answer: Rectangle (specifically a square, since the cube has equal side lengths).

Why: A horizontal plane is parallel to the top and bottom faces of the cube. When a plane is parallel to a face of a right rectangular prism, the cross-section is congruent to that face. Because this is a cube, all faces are squares, so the cross-section is a square — which is a special rectangle. **Key rule:** Parallel slice → congruent cross-section.

2 Solution 2 — Right Rectangular Prism (Cube)

Slice: Vertical (perpendicular to base)

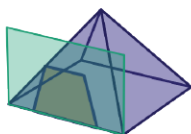


Answer: Rectangle (square, if the cube has equal sides).

Why: A vertical plane perpendicular to the base and parallel to a pair of lateral faces cuts through the top face, the bottom face, and two lateral faces. The intersection with each face is a straight line segment, and together these four segments form a rectangle. Because the figure is a cube, the cross-section is a square. **Key rule:** A plane parallel to any face of a right rectangular prism produces a cross-section congruent to that face.

12 Solution 12 — Square Pyramid

Slice: Vertical (parallel to base edge, NOT through apex)



Answer: Trapezoid.

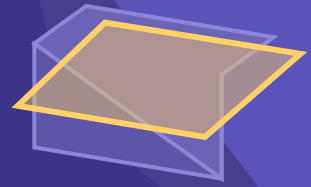
Why: Because the plane is vertical and parallel to a pair of base edges, it intersects the square base along a line segment parallel to those edges (the bottom side of the cross-section). It also intersects the two lateral faces on either side of the apex (two slanted sides of the cross-section). Finally, because the plane is offset from the center, it intersects exactly one of the remaining two lateral faces (the face on the side toward which the plane is offset) — this forms the top side of the cross-section. The cross-section therefore has four sides: one on the base, two on the slanted lateral faces, and one on the far lateral face. Two of these sides (the bottom segment on the base and the top segment on the far lateral face) are parallel, making the cross-section a trapezoid. **Key rule:** A vertical slice of a pyramid that misses the apex and is parallel to a base edge produces a trapezoid; a slice that passes through the apex produces a triangle.

PREVIEW

Cross Sections

Discovery Lab

Grade 7 • CCSS 7.G.A.3 • Hands-On + Digital



WHAT'S INSIDE THE FULL RESOURCE

01 Teacher Guide

Overview & standards, materials, pacing, differentiation, and three implementation options.

pp. 3-6

02 Vocabulary Foldable

A 7-term cut-and-fold reference covering cross-section, plane, prism, pyramid, and slice orientations.

pp. 7-10

03 Activity 1: Real-Food Slicing

12 illustrated food cards, a recording sheet, and discussion questions connecting real objects to cross-sections.

pp. 11-19

04 Activity 2: Play-Doh Lab

Instruction sheet, materials and safety guidance, plus a student recording sheet for hands-on slicing.

pp. 20-23

05 Activity 3: Digital Drag-the-Plane

Digital exploration guide with a student recording sheet for investigating plane-section relationships.

pp. 24-26

06 Activity 4: Practice Problems

12 cross-section problems with labeled diagrams followed by detailed teacher solutions.

pp. 27-38

07 Cross-Sections Quiz

10-question student quiz covering multiple-choice, short-answer, and diagram-based understanding, with answer key and rubric.

pp. 39-40

08 Review / Thank-You Page

A branded closing page for UM Printables with a general feedback and resource-discovery message.

p. 41

41

TOTAL PAGES

4

ACTIVITIES

12

PRACTICE PROBLEMS

10

GRADE 7 • CCSS 7.G.A.3