imagine plus math

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# Fluency Activities

## Geometry

imagine learning

# Geometry Fluency Activities

Math fluency activities in Imagine+ Math help students develop accuracy, efficiency, and flexibility in mathematical thinking. They provide structured practice to strengthen number sense, reinforce foundational skills, and build automaticity with key math concepts. Fluency activities increase student confidence by engaging them in problem-solving, developing a deeper understanding of mathematical relationships, and preparing them for more complex tasks.

Some activities require materials found in your classroom.

## Contents

## Activity 1 Solve and Match: Geometry Formulas

### Topic/Concept

Applying Area and Volume Formulas

### Objective

Students will select the correct geometry formula and substitute given dimensions to calculate area, surface area, or volume for a variety of figures.

### Materials

- Sets of diagram cards (labeled dimensions)
- Formula cards
- Sticky notes

### Steps

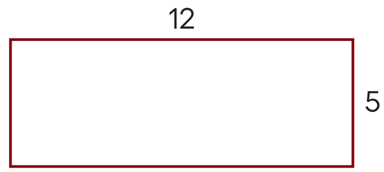
1. Distribute diagram cards and matching formula cards separately.
2. In pairs, students pick a diagram, identify the correct formula, and plug in values.
3. They place a sticky note with the numeric answer on the diagram; partners verify or revise.
4. Rotate pairs and repeat with mixed figures (including composite shapes).

### Resource List

- Diagram Cards: Area and Volume
- Formula Cards

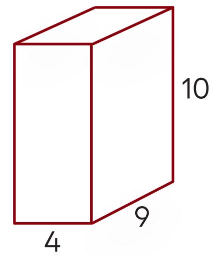
# Diagram Cards: Area and Volume

### RECTANGLE (Area)




not to scale

### RECTANGULAR PRISM (Volume)

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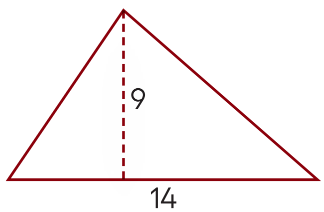
### TRIANGLE (Area)

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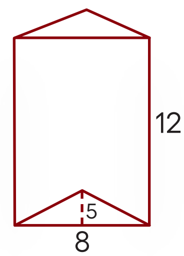
### TRIANGULAR PRISM (Volume)

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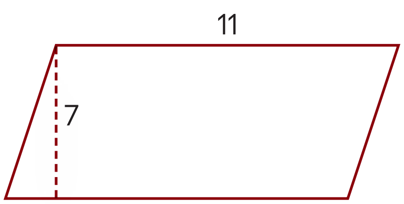
### PARALLELOGRAM (Area)

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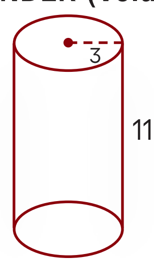
### CYLINDER (Volume)

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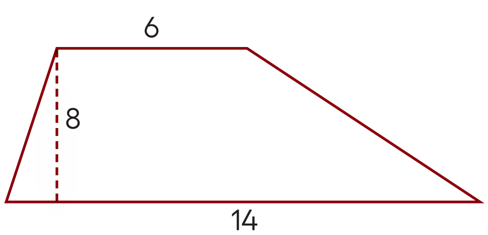
### TRAPEZOID (Area)

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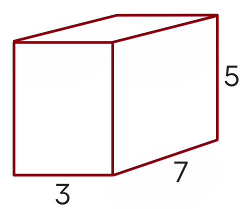
### RECTANGULAR PRISM (Surface Area)

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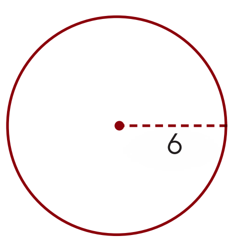
### CIRCLE (Area)

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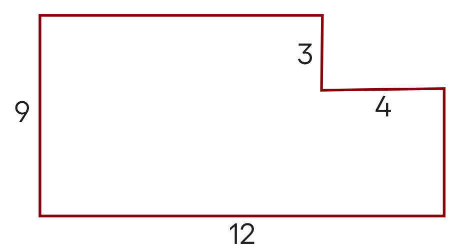
### COMPOSITE SHAPE (Area)




not to scale

## Formula Cards

| | |
|---|---|
| $A = lw$ | $V = lwh$ |
| $A = \frac{1}{2}bh$ | $V = (\frac{1}{2}bh)L$ |
| $A = bh$ | $V = \pi r^2 h$ |
| $A = \frac{1}{2}(b_1 + b_2)h$ | $SA = 2(lw + lh + wh)$ |
| $A = \pi r^2$ | $A = A_{big} - A_{cut\text{-}out}$ |

# Activity 2 Net-to-Solid Relay

## Topic/Concept

Building 3D Models

## Objective

Students will use nets to build 3D solids, label dimensions, and calculate surface area and volume to verify their results.

## Materials

- Printed nets of prisms, pyramids, cylinders, and cones
- Scissors
- Tape
- Index cards with dimensions

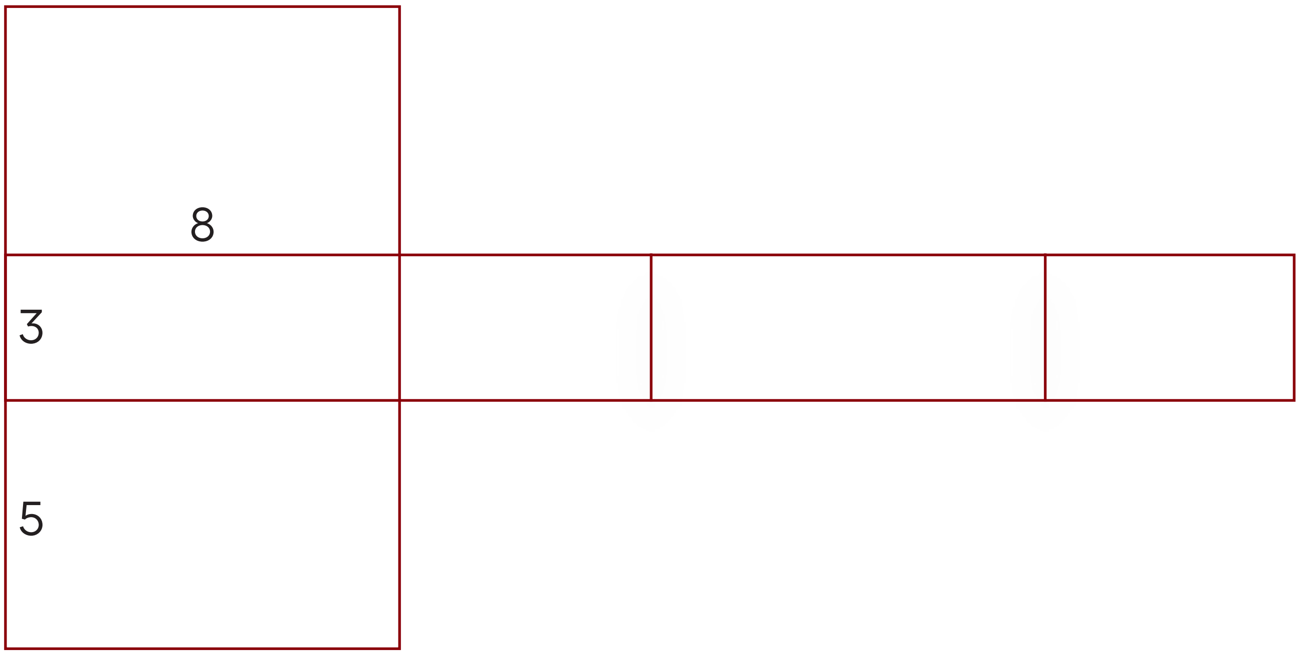
## Steps

1. Teams choose a net, label the given dimensions from an index card, and assemble quickly.
2. Students then compute the surface area and volume and write the results on a team whiteboard.
3. They rotate to a new solid and repeat; the quickest, most accurate team wins.

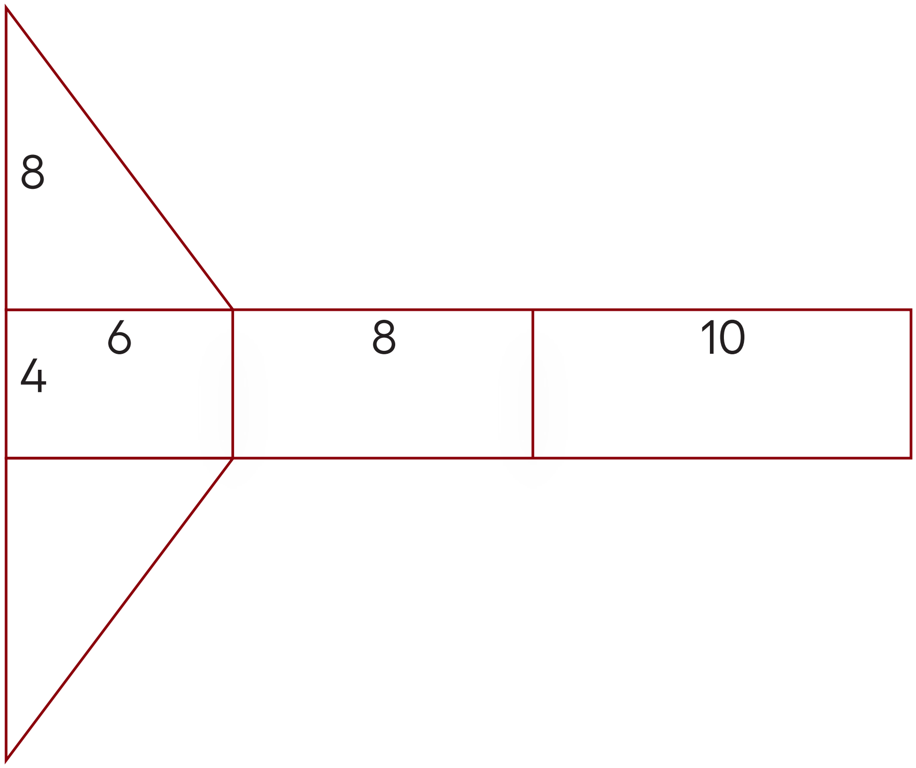
## Resource List

- Printed nets

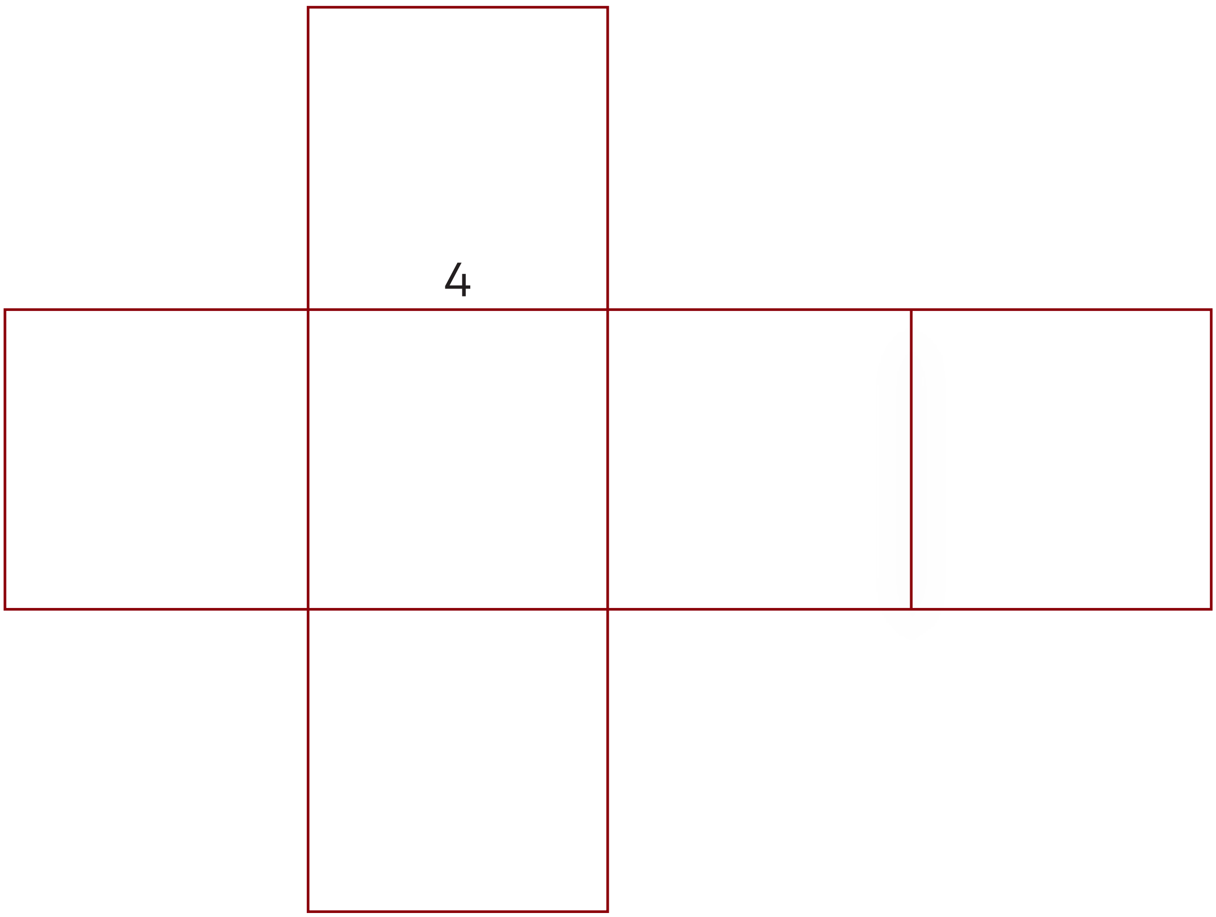
## Net 1 — Rectangular Prism



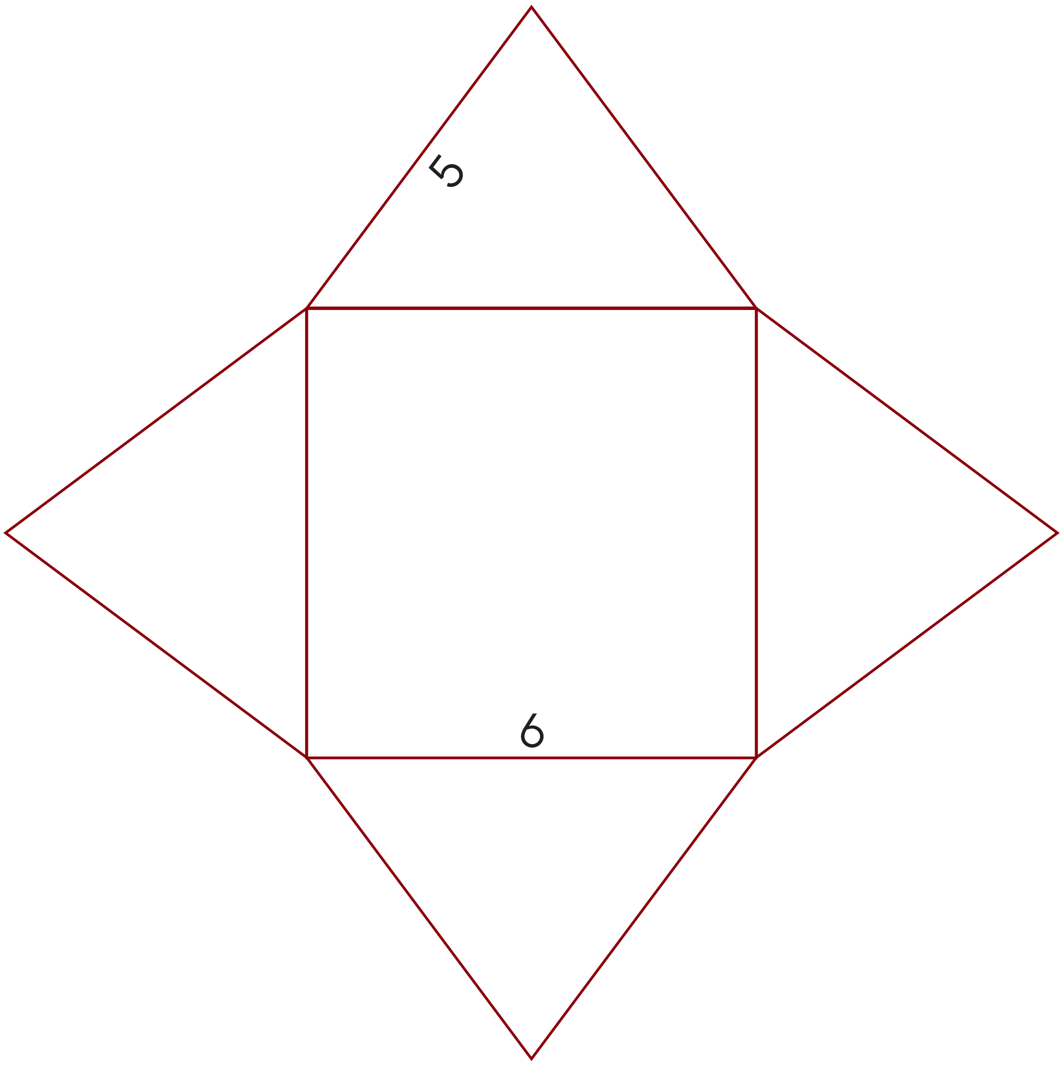

## Net 2 — Triangular Prism



## Net 3 — Cube



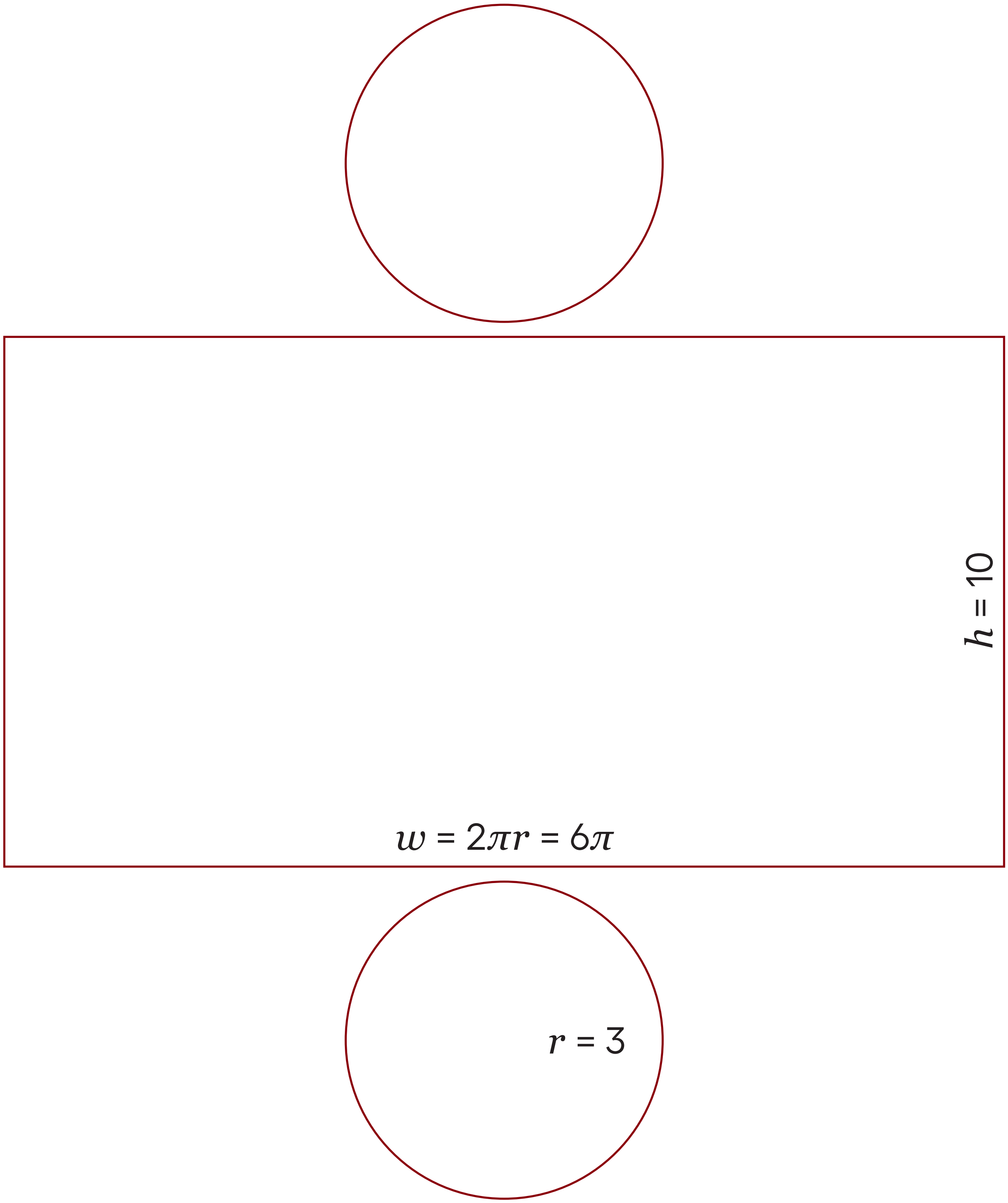
## Net 4 — Square Pyramid



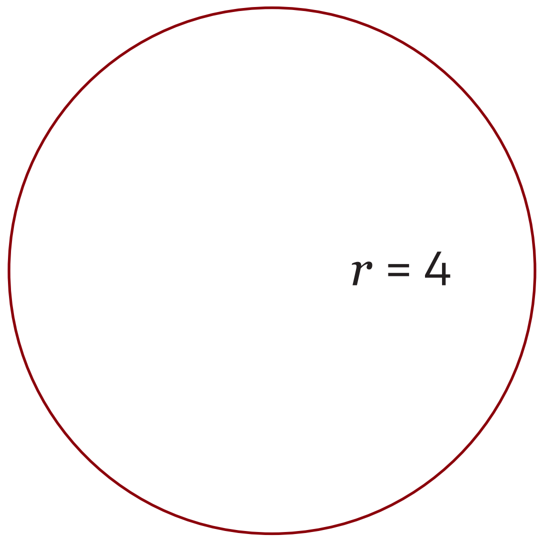
## Printed Nets

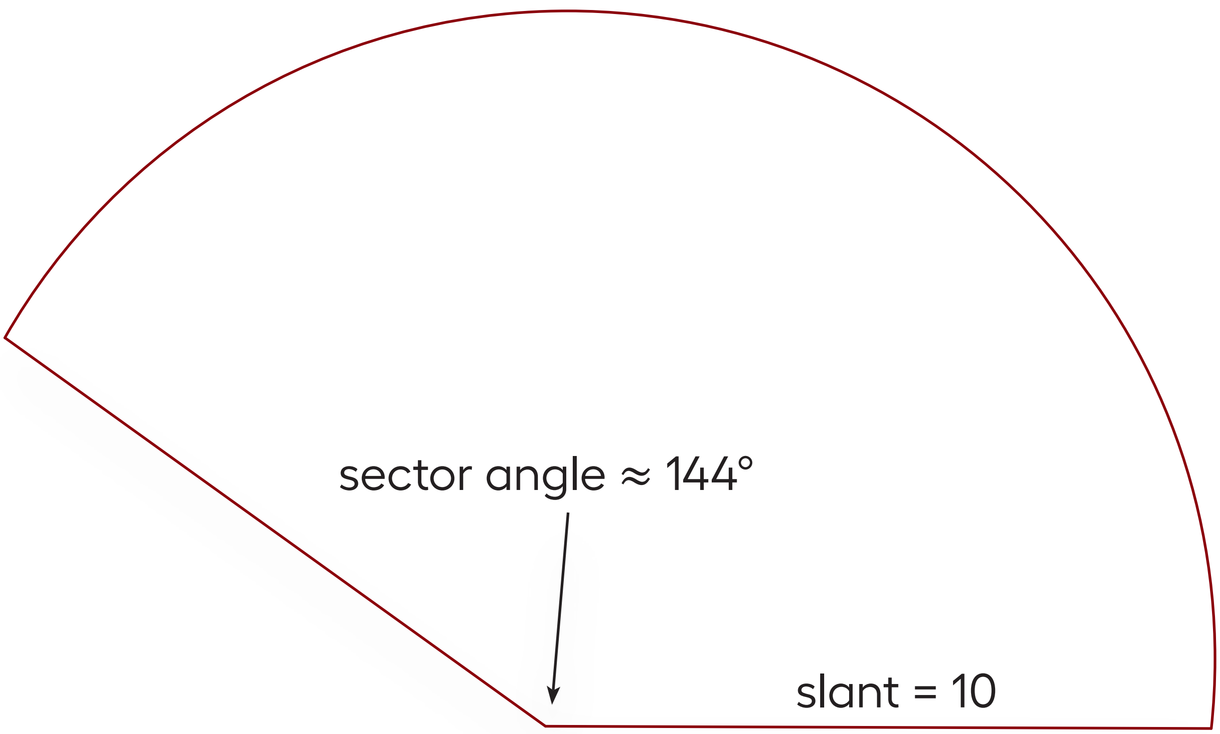


### Net 5 — Cylinder



## Net 6 — Cone



## Activity 3 — Logic Sort and Fix

### Topic/Concept

Determining Conditionals and Logical Equivalence

### Objective

Students will identify a conditional statement and write its converse, inverse, and contrapositive, then determine truth values using examples or counterexamples.

### Materials

- Card sets with statements, converses, inverses, and contrapositives *(include a few incorrect pairings)*
- Compass
- Straightedge

### Steps

1. In teams, sort each conditional with its related forms and label truth values.
2. Identify incorrect pairings and correct them, giving a counterexample if false.
3. Finish with a quick construction (e.g., construct the perpendicular bi-sector) to connect logic to a guaranteed outcome.
4. **Extend:** Choose one true conditional from your set and test its converse.

### Resource List

- Four card sets (each includes conditional, converse, inverse, and contrapositive)
  *Print each set on 4 separate cards and mix them up.*

# Card Sets



**Instructions for teacher:** Print each set on 4 separate cards and mix them up.

| Card Set 1: Even Numbers | Card Set 2: Right angles and perpendicular lines |
|---|---|
| **Conditional:** If a number is divisible by 4, then it is even. | **Conditional:** If two lines are perpendicular, then they form a right angle. |
| **Converse:** If a number is even, then it is divisible by 4. | **Converse:** If two lines form a right angle, then they are perpendicular. |
| **Inverse:** If a number is not divisible by 4, then it is not even. | **Inverse:** If two lines are not perpendicular, then they do not form a right angle. |
| **Contrapositive:** If a number is not even, then it is not divisible by 4. | **Contrapositive:** If two lines do not form a right angle, then they are not perpendicular. |

# Card Sets



**Instructions for teacher:** Print each set on 4 separate cards and mix them up.

| Card Set 3: Squares and rectangles | Card Set 4: Midpoints and congruent segments |
|---|---|
| **Conditional:** If a quadrilateral is a square, then it is a rectangle. | **Conditional:** If a point is the midpoint of a segment, then it divides the segment into two congruent segments. |
| **Converse:** If a quadrilateral is a rectangle, then it is a square. | **Converse:** If a point divides a segment into two congruent segments, then it is the midpoint. |
| **Inverse:** If a quadrilateral is not a square, then it is not a rectangle. | **Inverse:** If a point is not the midpoint of a segment, then it does not divide the segment into two congruent segments. |
| **Contrapositive:** If a quadrilateral is not a rectangle, then it is not a square. | **Contrapositive:** If a point does not divide a segment into two congruent segments, then it is not the midpoint. |

## Activity 4 — Proof Scramble: Congruence

### Topic/Concept

Constructing Proofs

### Objective

Students will construct a logical proof to show two triangles are congruent using valid congruence criteria and then use CPCTC to justify additional corresponding parts.

### Materials

- Proof strips in three colors: givens (one color), statements (second), and reasons (third) *(Include 1–2 distractor strips [e.g., "AAA," "SSA," or a wrong reason] per set.)*
- Triangle diagram that matches the intended criterion (SAS/SSS/ASA/AAS/HL) with some marks intentionally missing so students must annotate
- Theorem bank handout or on the board: definitions, properties (reflexive, vertical angles), and congruence criteria (SSS, SAS, ASA, AAS, HL), plus CPCTC

### Steps

1. Teacher provides a scrambled proof targeting a specific criterion (e.g., SAS).
2. In teams, students arrange statements and reasons logically, then annotate the diagram by (a) labeling vertices to show correspondence, (b) marking the diagram as they place each line, and (c) crossing out any distractors with a brief "why not" note.
3. Once the triangles are proven congruent (e.g., "$\triangle ABC \cong \triangle DEF$ by SAS"), students add one or two CPCTC statements (e.g., "$\angle C \cong \angle F$," "$AC \cong DF$") and write a justification of how the congruence allowed those conclusions.
4. **Extend:** Have students convert the solved two-column proof into a flow proof or a short paragraph proof, keeping the same logical sequence and diagram marks.

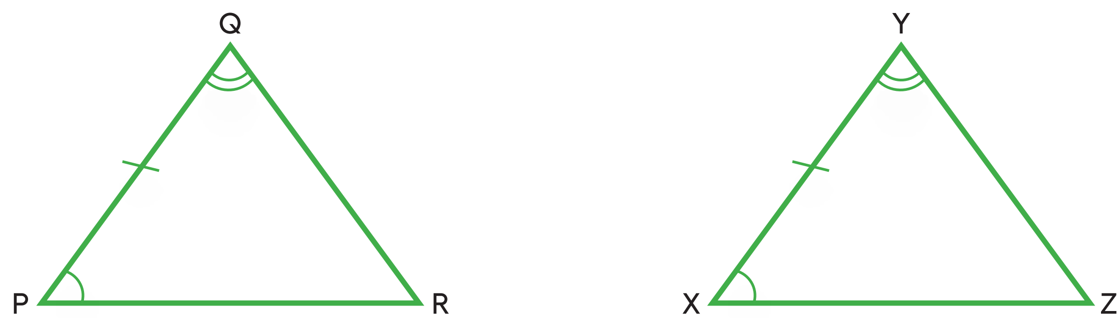
### Resource List

- Diagram Cards: Triangles
- Theorem Bank (handout)

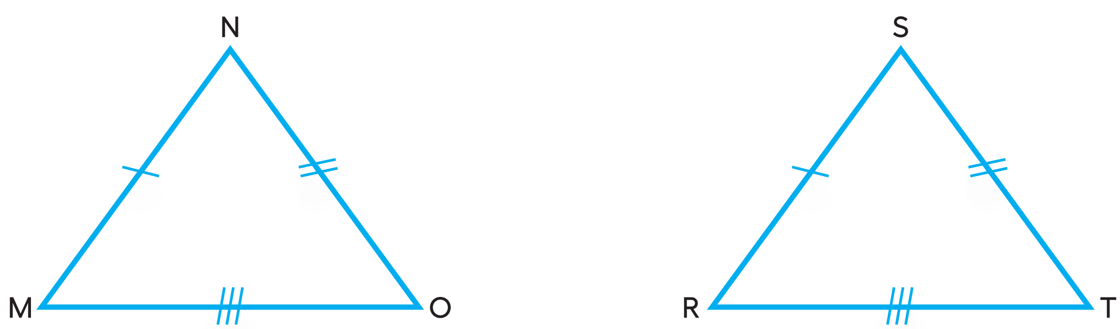
# Diagram Cards: Triangles

## SAS

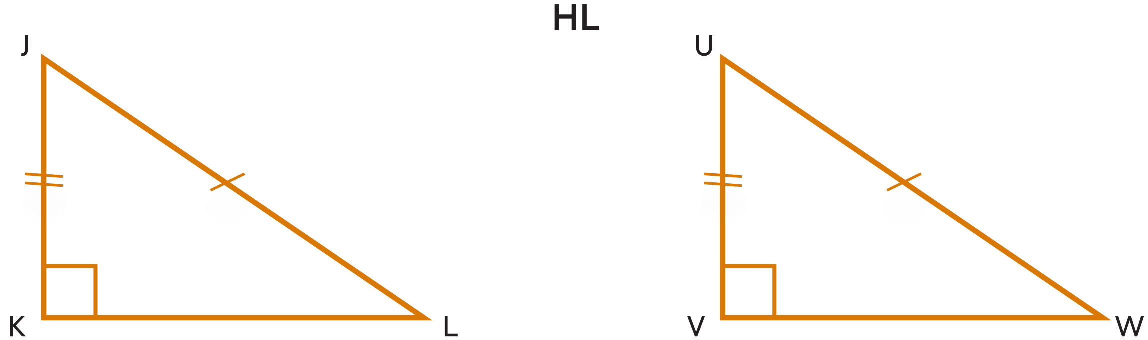

## ASA




## SSS




## HL



# Theorem Bank

### Core Definitions

- **Congruent segments:** Segments with the same length.
- **Congruent angles:** Angles with the same measure.
- **Midpoint:** A point that divides a segment into two congruent segments.
- **Angle bisector:** A ray/segment that divides an angle into two congruent angles.
- **Perpendicular lines:** Lines that intersect to form right angles (90°).
- **Parallel lines:** Lines in a plane that never intersect.
- **Right triangle:** A triangle with one 90° angle.
- **Hypotenuse:** The side opposite the right angle in a right triangle (longest side).
- **Legs (right triangle):** The two sides that form the right angle.

### Angle Facts

- **Vertical angles are congruent.**
- **Linear pair:** Two adjacent angles that form a straight line.
- **Supplementary angles:** Two angles whose measures add to 180°.
- **Complementary angles:** Two angles whose measures add to 90°.
- If lines are parallel, then:
  - **Alternate interior angles are congruent.**
  - **Corresponding angles are congruent.**

### Properties Used in Proofs

- **Reflexive Property:** A segment or angle is congruent to itself.
- **Symmetric Property of Congruence:** If $A \cong B$, then $B \cong A$.
- **Transitive Property of Congruence:** If $A \cong B$ and $B \cong C$, then $A \cong C$.
- **Substitution:** If two expressions are equal, one can replace the other.

### Triangle Congruence Criteria

- **SSS:** If three sides of one triangle are congruent to three sides of another, then the triangles are congruent.
- **SAS:** If two sides and the included angle are congruent, then the triangles are congruent.
- **ASA:** If two angles and the included side are congruent, then the triangles are congruent.
- **AAS:** If two angles and a non-included side are congruent, then the triangles are congruent.
- **HL:** If two right triangles have congruent hypotenuses and one pair of congruent legs, then the triangles are congruent.

### After Triangles are Proven Congruent

- **CPCTC:** Corresponding Parts of Congruent Triangles are Congruent.

### Common Non-Examples (Good for Distractors)

- **AAA:** Shows similarity, not congruence.
- **SSA:** Not a valid congruence test (ambiguous case).

# Activity 5 — Transform-It Stations

## Topic/Concept

Describing Transformations

## Objective

Students will apply and describe transformations on a coordinate grid by recording pre-image and image coordinates, writing mapping rules, and identifying symmetry in the results.

## Materials

- Coordinate grids
- Tracing paper/patty paper
- Rulers
- Protractors

## Steps

1. At stations, students carry out a specified transformation and record pre-/image coordinates.
2. They describe the mapping rule and identify lines/centers of symmetry.
3. Students then rotate and compose two transformations, noting which compositions yield the same result.

## Resource List

- Station Cards (a set of six)

# Station Cards



## Station 1 — Translation

Pre-image (triangle ABC): A(–4, 1), B(–2, 4), C(–1, 1)

**Task:** Translate the figure **right 5** and **down 2**.

1. Record A′, B′, C′.
2. Write the rule: $(x, y) \rightarrow (x + \_\_\_, y + \_\_\_)$.
3. Describe what changed (position? orientation? size?).

## Station 2 — Reflection

Pre-image (quadrilateral PQRS): P(–3, 2), Q(–1, 5), R(2, 4), S(1, 1)

**Task:** Reflect the figure over the **$y$-axis**.

1. Record P′, Q′, R′, S′.
2. Write the rule.
3. Identify the **line of symmetry** used.

## Station 3 — Rotation

Pre-image (triangle JKL): J(1, 2), K(4, 1), L(3, 4)

**Task:** Rotate the figure **90° counterclockwise about the origin**.

1. Record J′, K′, L′.
2. Write the rule.
3. State whether the transformation is **rigid** (yes/no) and why.

### Station 4 — Dilation

Pre-image (rectangle WXYZ): W(–2, –1), X(2, –1), Y(2, 1), Z(–2, 1)

**Task:** Dilate the figure by a factor of $\frac{1}{2}$ about the **origin**.

1. Record W′, X′, Y′, Z′.
2. Write the rule.
3. What happens to side lengths? What happens to angles?

### Station 5 — Composition Order Test (Do they match?)

Pre-image (triangle DEF): D(–3, –1), E(–1, 2), F(1, 0)

**Task A:** Reflect over the $x$**-axis**, then translate **left 2** and **up 1**.
**Task B:** Translate **left 2** and **up 1**, then reflect over the $x$**-axis**.

1. Compute the final image for **Task A** and **Task B**.
2. Do they end at the same coordinates? **Yes/No**
3. One sentence: What does this tell you about the order of transformations?

### Station 6 — Symmetry + Rule

Pre-image (segment AB): A(–4, 3), B(4, 3)

**Task:**

1. Find the **midpoint** of the segment and write it as a coordinate.
2. Name the **line of symmetry** for the segment.
3. Reflect the segment over that line and describe what happens (does it change?).

*(Extension if you want it: "Create your own segment with a different line of symmetry and swap with a partner.")*

# Activity 6 Trig Ratio Sprint

## Topic/Concept

Finding the Missing Sides of Right Triangles

## Objective

Students will identify opposite, adjacent, and hypotenuse and use sine, cosine, or tangent to find a missing side or angle in a right triangle.

## Materials

- Right-triangle task cards with varied orientations/scales
- Calculators (optional)

## Steps

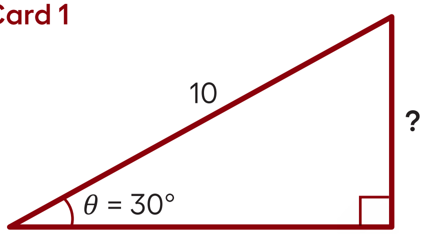
1. Students pick a card, label "opposite," "adjacent," and "hypotenuse" relative to a marked angle.
2. They choose and compute the correct trig ratio to find a missing side or angle.
3. Then, they can trade cards and repeat.
4. **Alternative:** If students are struggling, instead of trading cards, have them discuss which ratio they used and why.

## Resource List

- Right Triangle Task Cards (a set of 10)

# Right Triangle Task Cards

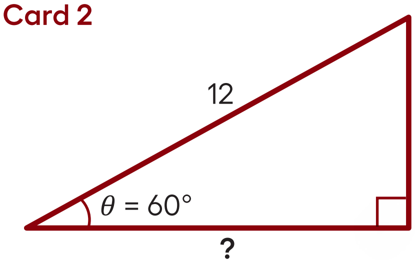
### Task Card 1




*Round to the nearest tenth.*

not to scale

### Task Card 2




*Round to the nearest tenth.*

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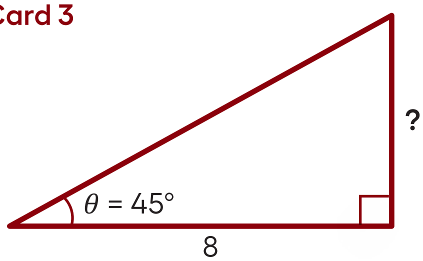
### Task Card 3




*Round to the nearest tenth.*

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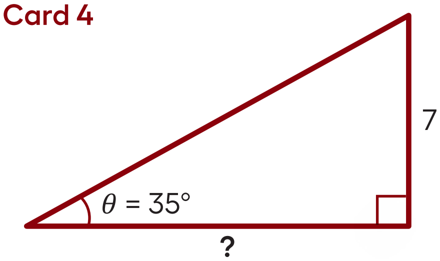
### Task Card 4




*Round to the nearest tenth.*

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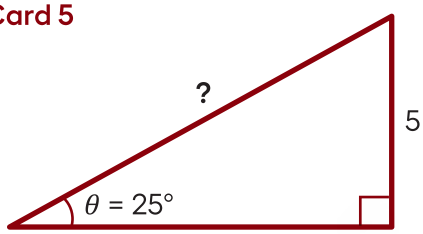
### Task Card 5




*Round to the nearest tenth.*

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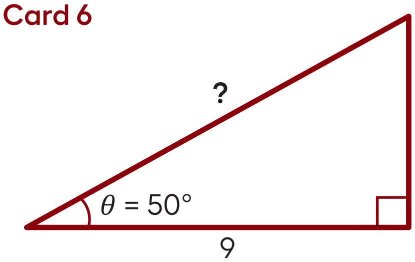
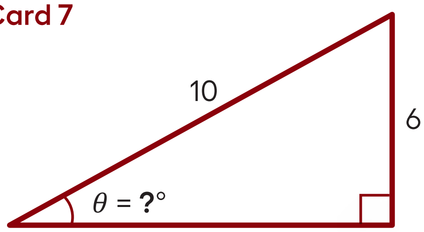
### Task Card 6




*Round to the nearest tenth.*

not to scale

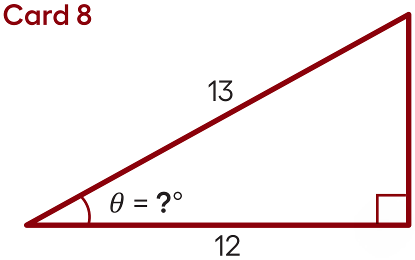
### Task Card 7




*Round to the nearest tenth.*

not to scale

### Task Card 8




*Round to the nearest tenth.*

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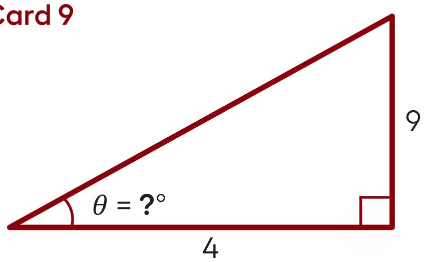
### Task Card 9




*Round to the nearest tenth.*

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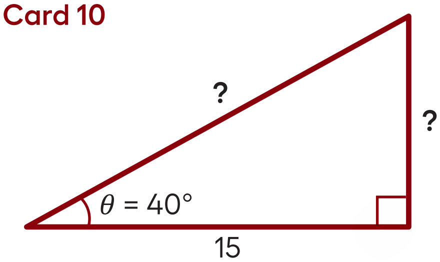
### Task Card 10




*Round to the nearest tenth.*

not to scale

## Topic/Concept

Finding the Missing Angles or Arcs of Circles

## Objective

Students will use circle angle, arc, chord, tangent, and secant relationships to find missing angle or arc measures and justify the rule they used.

## Materials

- Mini whiteboards
- Quick-draw circle diagrams with marked chords, tangents, and secants

## Steps

1. As a whole group, show a diagram and have students write the angle/arc relationship formula they will use.
2. Students then compute the requested measure, display answers, and justify the choice.
3. Be sure to mix in arc length/sector area tasks with radius/central angle given.

## Resource List

- Sample quick-draw circles for the board:
  - **Central angle ↔ arc:** Draw a circle with center $O$. Draw radii $OA$ and $OB$.
    Given: $m\angle AOB = 72°$ Find: $m\widehat{AB}$
  - **Inscribed angle:** Draw a circle. Mark points $A$, $B$, and $C$ on the circle. Draw chords $CA$ and $CB$ (inscribed angle at $C$).
    Given: $m\widehat{AB} = 110°$ Find: $m\angle ACB$
  - **Two chords intersect inside:** Draw two chords $AB$ and $CD$ intersecting at point $P$ inside the circle.
    Given: $m\widehat{AC} = 80°$ and $m\widehat{BD} = 40°$ Find: $m\angle APC$
  - **Tangent–chord angle:** Draw a circle. At point $A$, draw a tangent line. Draw chord $AB$ from $A$ into the circle.
    Given: $m\widehat{AB} = 124°$ Find: angle between the tangent at $A$ and chord $AB$
  - **Two secants intersect outside:** Draw a circle. From an external point $P$, draw two secants: $P$–$A$–$B$ and $P$–$C$–$D$ ($A$ and $C$ are the near intersection points).
    Given: $m\widehat{BD} = 150°$ and $m\widehat{AC} = 50°$ Find: $m\angle P$
  - **Sector area:** Draw a circle with center $O$. Draw radii $OA$ and $OB$ to make a central angle.
    Given: $r = 8$ and $m\angle AOB = 45°$ Find: sector area $A$

## Activity 8 — Tape-Land Geometric Probability

### Topic/Concept

Calculating Theoretical Geometric Probability

### Objective

Students will calculate theoretical geometric probability using area ratios and compare it to experimental results from repeated tosses.

### Materials

- Masking tape target on floor/desk
- Beanbags or coins
- Measuring tape
- Grid paper

### Steps

1. **Build and Measure:** Tape 3–4 non-overlapping regions (e.g., nested rectangles or a rectangle with taped sub-rectangles). Label dimensions on the floor and sketch to scale on grid paper. Compute each region's area and the total area.
2. **Theoretical Probability:** Predict landing probabilities using area ratios; record as fractions, decimals, and percents.
3. **Run the Experiment:** Set a toss line from where each team makes 30 fair tosses (underhand, object must land fully inside a region; on a line = retoss). Tally hits by region on a class chart or paper.
4. **Compare and Debrief:** Compare experimental to theoretical probabilities, and discuss error sources.
5. **Extend:** State one change to improve the model (e.g., more trials, clearer region boundaries, remeasure).

### Resource List

no additional resources needed

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