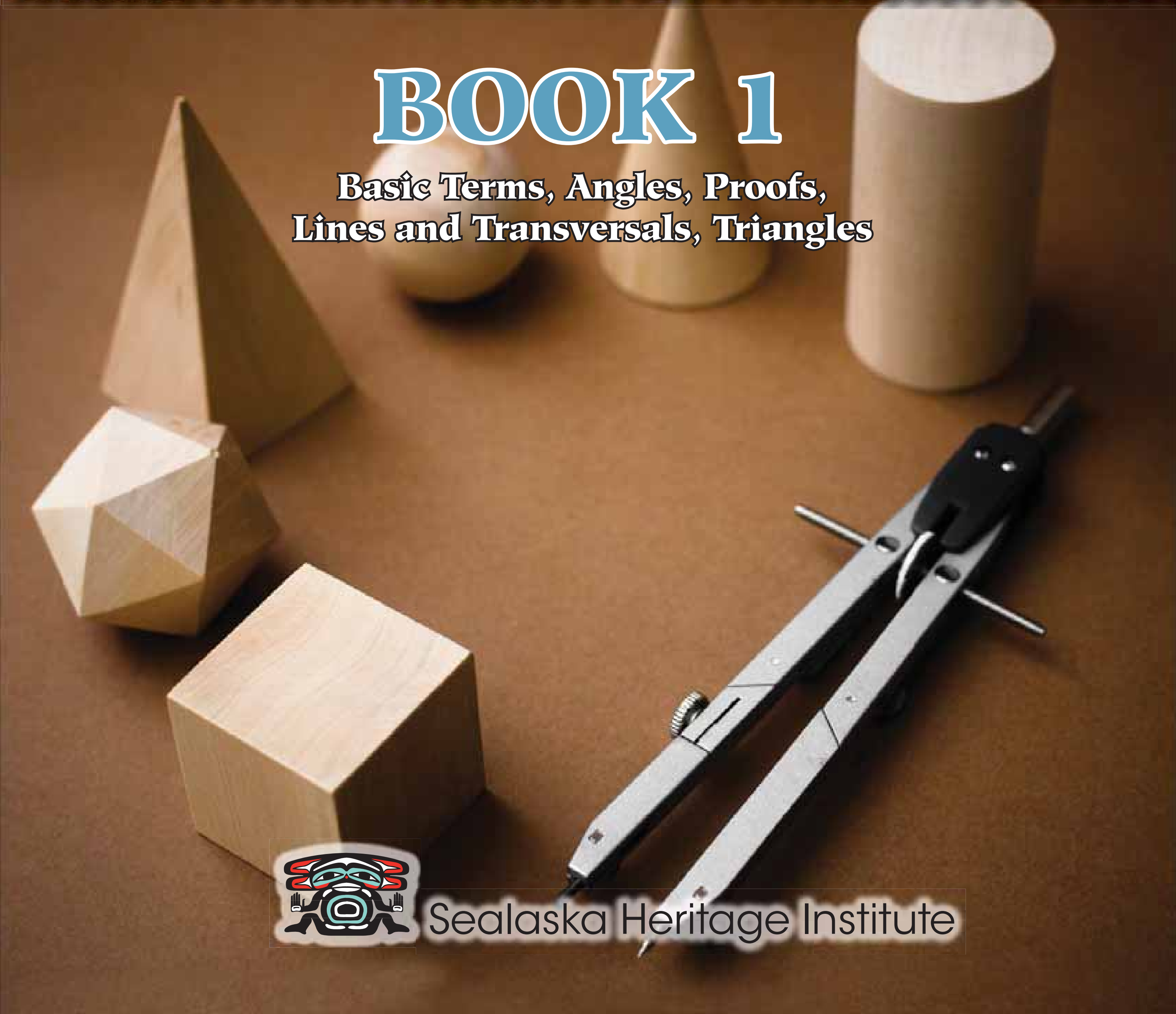
Grades 9–11

High School Geometry

Language Development for Success

BOOK 1

Basic Terms, Angles, Proofs, Lines and Transversals, Triangles



Sealaska Heritage Institute

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2009

Integrating Culturally Responsive, Place-Based Content with Language Skills Development for Curriculum Enrichment

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BOOK 1

INTRODUCTION

Over the years, much has been written about the successes and failures of students in schools. There is no end to the solutions offered, particularly for those students who are struggling with academics. There have been efforts to bring local cultures into the classroom, thus providing the students with familiar points of departure for learning. However, most often such instruction has been limited to segregated activities such as arts and crafts or Native dancing rather than integrating Native culture into the overall learning process. Two core cultural values, *Haa Aaní,* the reference for and usage of the land, and *Haa Shagóon,* the tying of the present with the past and future, are known by both students and parents, and can be included in a curriculum that simultaneously provides a basis for self-identity and cultural pride, within the educational setting. This will provide a valuable foundation for improved academic achievement.

While the inclusion of Native concepts, values, and traditions into a curriculum provides a valuable foundation for self-identity and cultural pride, it may not, on its own, fully address improved *academic* achievement.

This program is designed to meet the academic realities, faced by high school students every day, using a developmental process that integrates *culture* with *skills* development. The values of *Haa Aaní* and *Haa Shagóon* are reinforced through the various activities in the program.

During math lessons, students are exposed to math information and to key vocabulary that represent that information. While the students may acquire, through various processes, the mathematical information, the vocabulary is often left at an exposure level and is not internalized by them. Over time, this leads to *language-delay* that impacts negatively on a student's on-going academic achievement.

Due to *language delay*, many Native Alaskan high school students struggle with texts that are beyond their comprehension levels and writing assignments that call for language they do not have. To this end, in this resource program each key vocabulary word in math is viewed as a *concept*. The words are introduced concretely, using place-based information and contexts. Using this approach, the students have the opportunity to acquire new information in manageable chunks; the sum total of which represent the body of information to be learned in the math program. In many high school math classes it is assumed that the academic vocabulary is being internalized during the learning process, which is most often an erroneous assumption.

When the key vocabulary/concepts have been introduced, the students are then taken through a sequence of listening, speaking, reading, and writing activities, designed to instill the vocabulary into their long term memories - see the **Developmental Language Process**, which follows.

It should be understood that these materials are not a *curriculum* - rather, they are resource materials designed to encourage academic achievement through intensive language development in the content areas.These resource materials are *culturally responsive* in that they utilize teaching and learning styles effective with Native students. As the students progress through the steps of the Process, they move from a concrete introduction of the key vocabulary, to a symbolic representation of the vocabulary, and finally, to their abstract forms - reading and writing. This provides a format for the students to develop language and skills that ultimately lead to improved academic performance.

The Integration of Place-Based, Culturally Responsive Math Content and Language Development

Introduction of Key Math Vocabulary

↓

Math, Vocabulary Development

Listening, speaking, reading & writing

↓

Math Application

Reinforcement Activities

The Developmental Language Process

The Developmental Language Process (DLP)is designed to instill language into long term memory. The origin of the Process is rooted in the struggles faced by language-delayed students, particularly when they first enter school.

The Process takes the students/children through developmental steps that reflect the natural acquisition of language in the home and community. Initially, once key language items have been introduced concretely to the students, the vocabulary are used in the first of the language skills, Basic Listening. This stage in the process represents *input* and is a critical venue for language acquisition and retention. A baby hears many different things in the home, gradually the baby begins to *listen* to what he/she hears. As a result of the *input* provided through Basic Listening, the baby tries to repeat some of the language heard – this is represented by the second phase of the Process, Basic Speaking - the oral *output* stage of language acquisition.

As more language goes into a child's long-term memory, he/she begins to understand simple commands and phrases. This is a higher level of listening represented by the stage, Listening Comprehension. With the increase in vocabulary and sentence development, the child begins to explore the use of language through the next stage in the Process, Creative Speaking. All of these steps in the Process reflect the natural sequence of language development.

The listening and speaking skill areas represent *true* language skills; most cultures, including Alaska Native cultures, never went beyond them to develop written forms. Oral traditions are inherent in the listening and speaking skills.

However, English does have abstract forms of language in reading and writing. Many Native children entering kindergarten come from homes where language is used differently than in classic Western homes. This is not a value judgment of child rearing practices but a definite cross-cultural reality. Therefore, it is critical that the Native child be introduced to the concepts of reading and writing before ever dealing with them as skills areas. It is vital for the children to understand that reading and writing are *talk in print*.

The Developmental Language Process integrates the *real* language skills of listening and speaking with the related skills of reading and writing. At this stage in the Process, the students are introduced to the printed words for the first time. These abstract representations are now familiar, through the listening and speaking activities, and the relationship is formed between the words and language, beginning with Basic Reading.

As more language goes into the children's long-term memories, they begin to comprehend more of what they read, in Reading Comprehension.

Many Alaskan school attics are filled with reading programs that didn’t work – in reality, any of the programs would have worked had they been implemented through a language development process. For many Native children, the printed word creates angst, particularly if they are struggling with the reading process. Often, children are asked to read language they have never heard.

Next in the Process is Basic Writing, where the students are asked to write the key words. Finally, the most difficult of all the language skills, Creative Writing, has the students writing sentences of their own, using the key words and language from their long-term memories. This high level skill area calls upon the students to not only retrieve language, but to put the words in their correct order within the sentences, to spell the words correctly and to sequence their thoughts in the narrative.

The Developmental Language Process is represented in this chart:

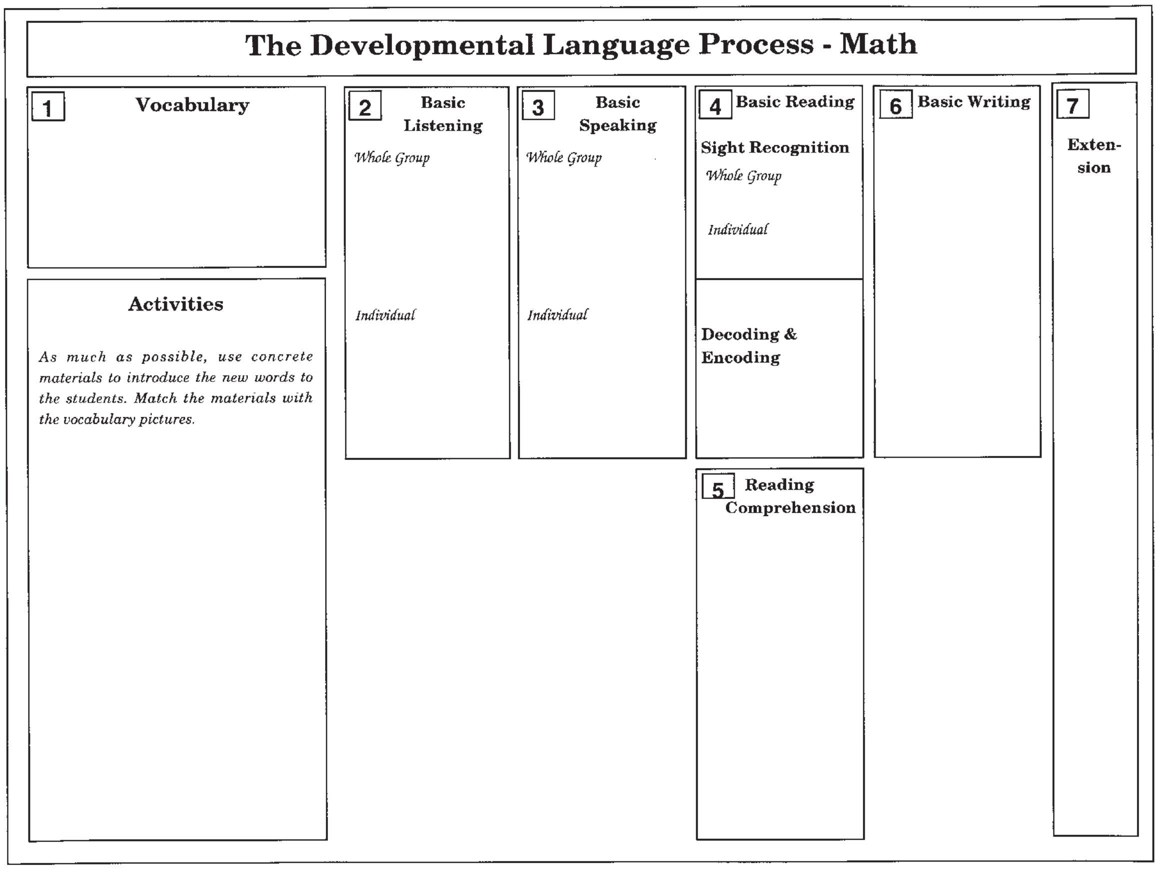
At the end of the Process, the students participate in enrichment activities based on recognized and reasearch-based *best practices*. By this time the information and vocabulary will be familiar, adding to the students’feelings of confidence and success.

The Unit’s Assessment is also administered during the Extension Activities section of the Process. This test provides the teacher with a clear indication of the students’ progress based on the objectives for basic listening, basic reading, reading comprehension, basic writing and creative writing.

Since the DLP is a *process* and not a program, it can be implemented with any materials and at any grade or readiness level. A student’s ability to comprehend well in *listening* and *reading*, and to be creatively expressive in *speaking* and *writing*, is dependent upon how much language he/she has in long-term memory.

Math & The Developmental Language Process

The Developmental Language Process can be applied effectively in the development of math concepts and their vocabulary. Not all math vocabulary lend themselves well to listening comprehension, creative speaking, and creative writing activities and therefore the Process can be adapted to create a *fast track* in math. This schema represents the use of the Process in math:



Activities for listening comprehension, creative speaking, and creative writing can be used, depending upon the vocabulary being developed.

This resource book is designed to be used approximately once per month for a sixty to ninety minute lesson. During this time, the development of ***math vocabulary*** is the principle endeavor, not the teaching of the math concepts. However, the math concepts form the bases for language development.

Increased vocabulary development in math will ultimately lead to improved academic achievement, increased self-esteem, and to a higher success rate on academic assessments.

UNIT 1
Basic Terms

Sealaska Heritage Institute

Grade Level Expectations for Unit 1

Unit 1 Basic Terms

Alaska State Mathematics Standard C
A student should understand and be able to form and use appropriate methods to define and explain mathematical relationships.

A student who meets the content standard should:

C1) express and represent mathematical ideas using oral and written presentations, physical materials, pictures, graphs, charts, and algebraic expressions;

C2) relate mathematical terms to everyday language;

GLEs
The student communicates his or her mathematical thinking by

[9] PS-3 representing mathematical problems numerically, graphically, and/or symbolically, translating among these alternative representations; or using appropriate vocabulary, symbols, or technology to explain, justify, and defend strategies and solutions

[10] PS-3 representing mathematical problems numerically, graphically, and/or symbolically, communicating math ideas in writing; or using appropriate vocabulary, symbols, or technology to explain, justify, and defend strategies and solutions

Vocabulary & Definitions

Introduction of Math Vocabulary

Infinite

Infinite means unlimited or unending. When something is infinite it cannot be measured or counted. It goes on forever. Space, as shown in the photo, is infinite; it has no boundaries. Times, and numbers, are also infinite.

Dimension

Dimensions are directions of extension. Length, width, and height are dimensions. A stretched string models a line, which has one dimension (length). A wall or floor models a plane, which has two dimensions (length and width). Space, a box, or a house has three dimensions (length, width, and height). In this photo of a long hallway, you can see one-dimensional, two-dimensional, and three- dimensional objects represented. Lines and planes have no thickness, but in the real world, any model of a line or a plane has some thickness. We say that telephone wires or lines on the pavement **model or represent** one-dimensional objects, and that the ice on a pond **models** a two-dimensional object.

Space

Space is the set of all points. It is the 3-dimensional place in which an object can exist or events can take place. Space is infinite. We can't measure all of space, and we can't measure the infinite number of points in any given space. We use cubic centimeters, cubic feet, cubic meters, or other measures for the amounts of space contained in inside of jars, rooms, or other boundaries.

Introduction of Math Vocabulary

Point

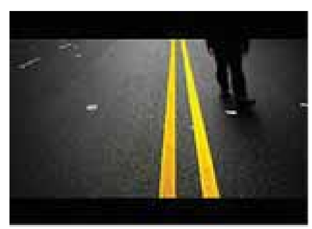
A point is a position in space. It has no size and no dimensions and is infinitely small. A dot can be used to represent a point, but a point is smaller than the smallest dot you can make. The picture shows the symbol that is used by Google Maps to indicate a point.

Some other models of points might be the very tip of a pencil, or the corner of a box.

Line

A line is the straight path that connects two points and goes on forever beyond the points in both directions. It is made up of infinitely many points in a straight arrangement. A line has no thickness; it has one dimension.

The yellow lines in the photo might help to give us a mental picture of a line, even though in reality they do have thickness and they don't really go on forever!



The symbol for line has an arrow on each end. ▯

Segment_

A segment is a piece or section of a line. It has two endpoints and contains all the points in between. It can be measured.

A_______________B This is a picture of a line segment with endpoints A and B. It is called segment AB or segment BA.

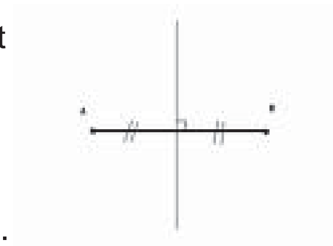
The edges of the box in the photo are line segments. Other things in our environment that represent line segments are poles wires, and edges of buildings.

Introduction of Math Vocabulary

Midpoint

A midpoint is the point in the middle of a line segment. It divides a line segment in half.

In the photo, you can see a segment represented by the horizontal pole on the fish rack. The midpoint is located where the center support comes in contact with that pole.

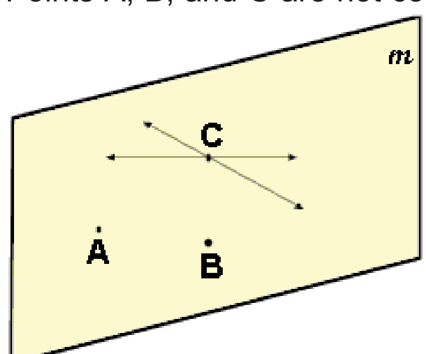


Collinear

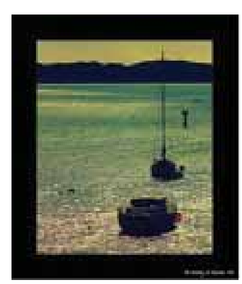
Collinear means "on the same line".   Collinear points are three or more points that lie on the same line. (If you only have two points, there is always one line that can contain them both.)

Points A, B, and C are collinear:

Points A, B, and C are not collinear:



In the photo, the two boats and the buoy are all in a straight line, so they are collinear.



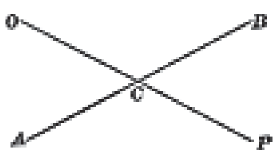
Introduction of Math Vocabulary

Intersect

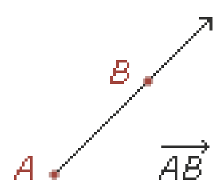
Lines, line segments, rays, and other figures are said to intersect if they meet, or in other words, if they share a common point. That point is called the point of intersection.

In the photo, the crossing of the two ropes or lines represents an intersection. You can find intersections represented at road crossings, on fishnets, on fences, and many other locations.

In the picture below, Segment AB intersects segment OP at point C.



Ray



A ray is half a line, or part of a line that has a starting point and extends infinitely in one direction. Think of the sun's rays – they start at the sun but do not end.

A ray is represented by an arrow that goes in one direction.

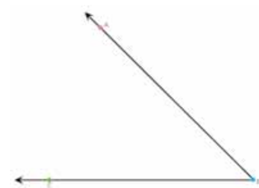
This is a picture of ray AB:

In the picture, you can see the sun's rays. Flashlight beams and searchlights also represent rays.

Introduction of Math Vocabulary

Angle

An angle is made up of two rays with a common starting point. We also think of an angle as the amount of “turning” or space between the two rays. Angles are measured in degrees or radians. This is the symbol for angle.



The picture shows a representation of an angle drawn on the pavement. The hands of a clock also form angles, and angles can be seen commonly on buildings and other structures.

Congruent

$\cong$

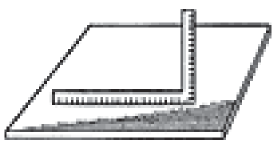
Congruent means exactly equal in size and shape. Line segments can be congruent, and so can two-dimensional and three-dimensional figures and objects.
This is the symbol for congruent:

The chairs in the picture are congruent since they have the same size and shape. Other congruent objects around you might be sheets of notebook paper, or textbooks.

Introduction of Math Vocabulary

Plane

A plane is a flat surface extending infinitely in all directions. It is two- dimensional; it has length and width but no thickness. Roofs, walls, ceilings, and frozen ponds are all models of planes, but a plane is thinner than anything you could touch or see, and it goes on forever.

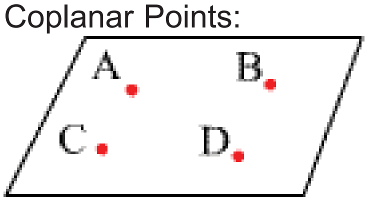


The floor shown in the picture represents a plane surface.

Coplanar

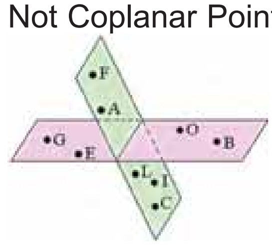
Coplanar means “on the same plane”. When points, lines, or figures are coplanar, it means they are on the same plane.

Coplanar Points:



A, B, C, and D are coplanar.

Not Coplanar Points:



A, B, and C are not coplanar

Introduction of Math Vocabulary

The tiles on the floor in the photo are coplanar, and all of the lines and points represented by their edges and intersections are coplanar.

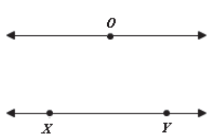
Other examples that represent coplanar objects might be pictures on a wall or windows on the side of a building.

Parallel lines

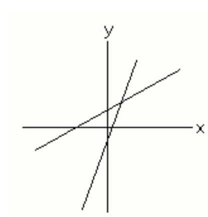
Parallel lines are lines that are on the same plane (coplanar) but that do not intersect. You can think of them as going in the same direction and staying the same distance apart.

The wires in the photo represent parallel lines. Other common representations might be the edges of the boards along a boardwalk, or the opposite edges of a sheet of paper.

Parallel Lines:

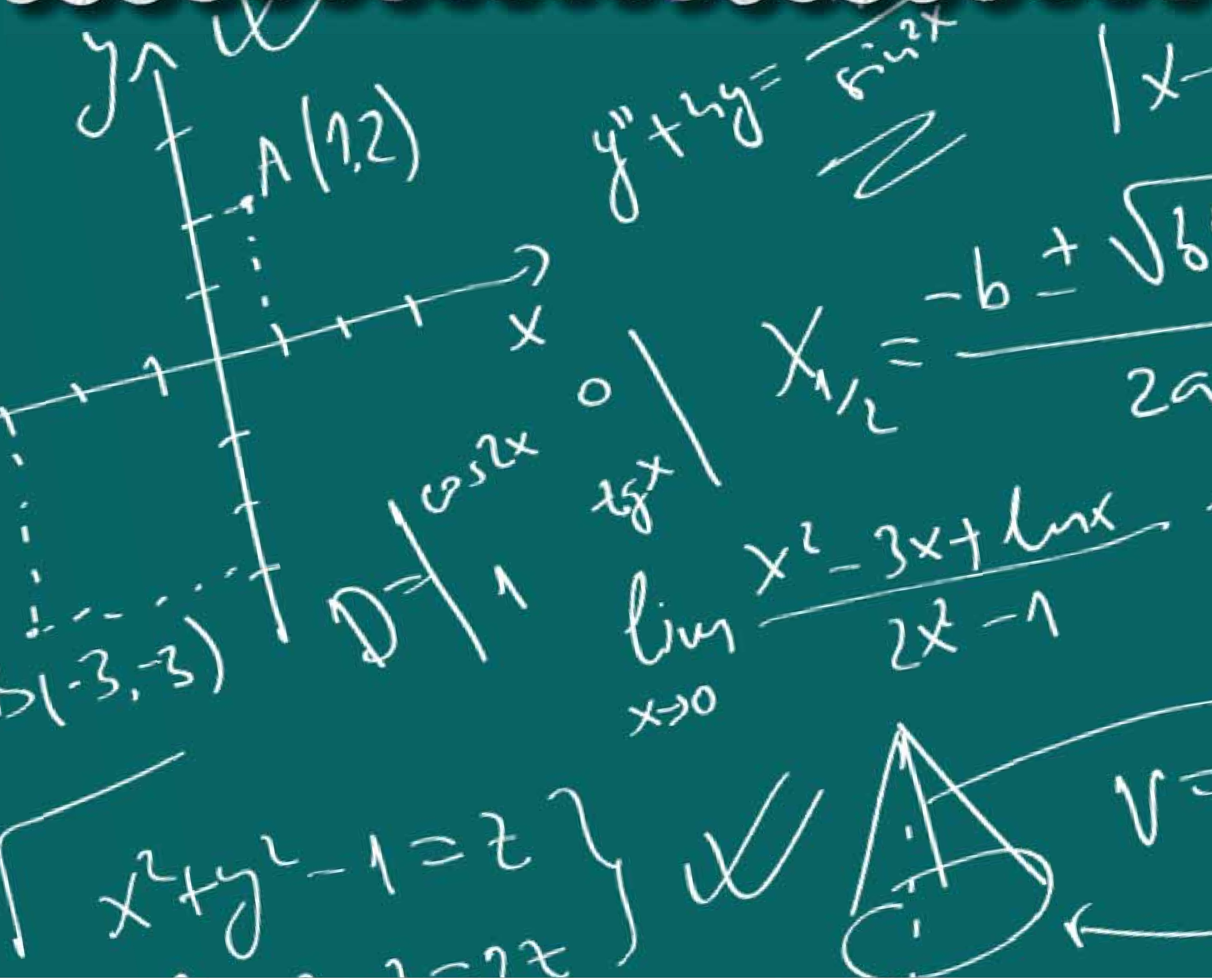


Not Parallel Lines:



Language and Skills Development

Using the Math Vocabulary Terms



Language & Skills Development

LISTENING

Use the activity pages from the Student Support Materials.

Illustration Bingo

Provide each student with a copy of the mini-illustration activity page from the student support materials. The students should cut out the illustrations. Each student should turn his/her illustrations face-down on the desk. Then, each student should turn ONE illustration face up. Say a vocabulary word. Any student or students who have the illustration for the vocabulary word you said face up on their desks, should show their illustrations. Those illustrations should then be put to the side and the students should turn over another illustration. The first student or students to have no illustrations left on their desks, win the round. The illustrations may be collected, mixed, and re-distributed to the students for the different rounds of the activity.

SPEAKING

One to Six

Provide each student with two blank flashcards. Each student should then write a number on each of his flashcards, between one and six - one number per card. When the students' number cards are ready, toss two dice and call the numbers showing. Any student or students who have those two numbers must then identify a vocabulary illustration you show. The students may exchange number cards periodically during this activity.

READING

Use the activity pages from the Student Support Materials.

Right or Wrong

Mount the sight words on the chalkboard. Point to one of the sight words and name it. The students should repeat the sight word. However, when you point to a sight word and say the wrong word for it, the students should remain silent. Repeat this process until the students have responded accurately to all of the sight words a number of times.

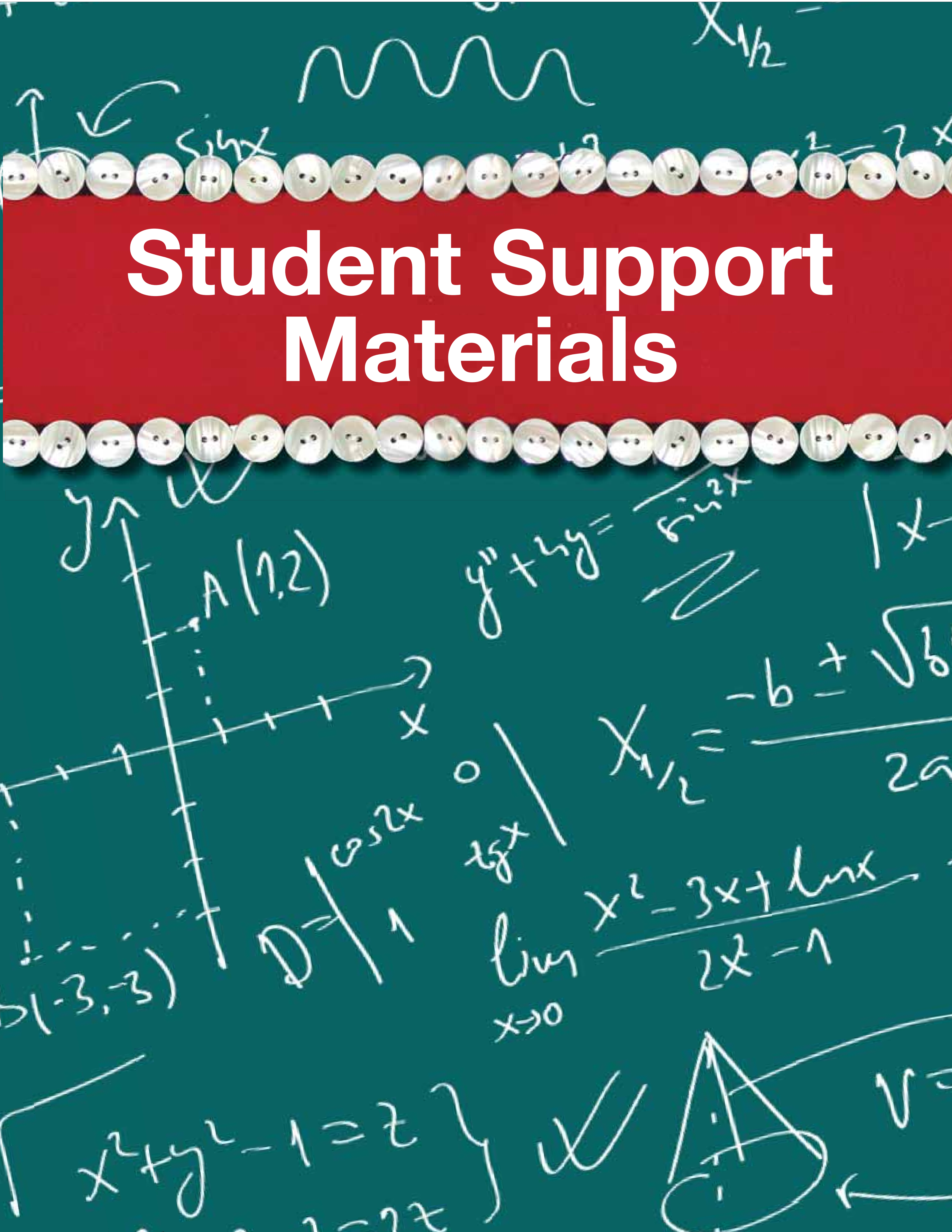
WRITING

Use the activity pages from the Student Support Materials.

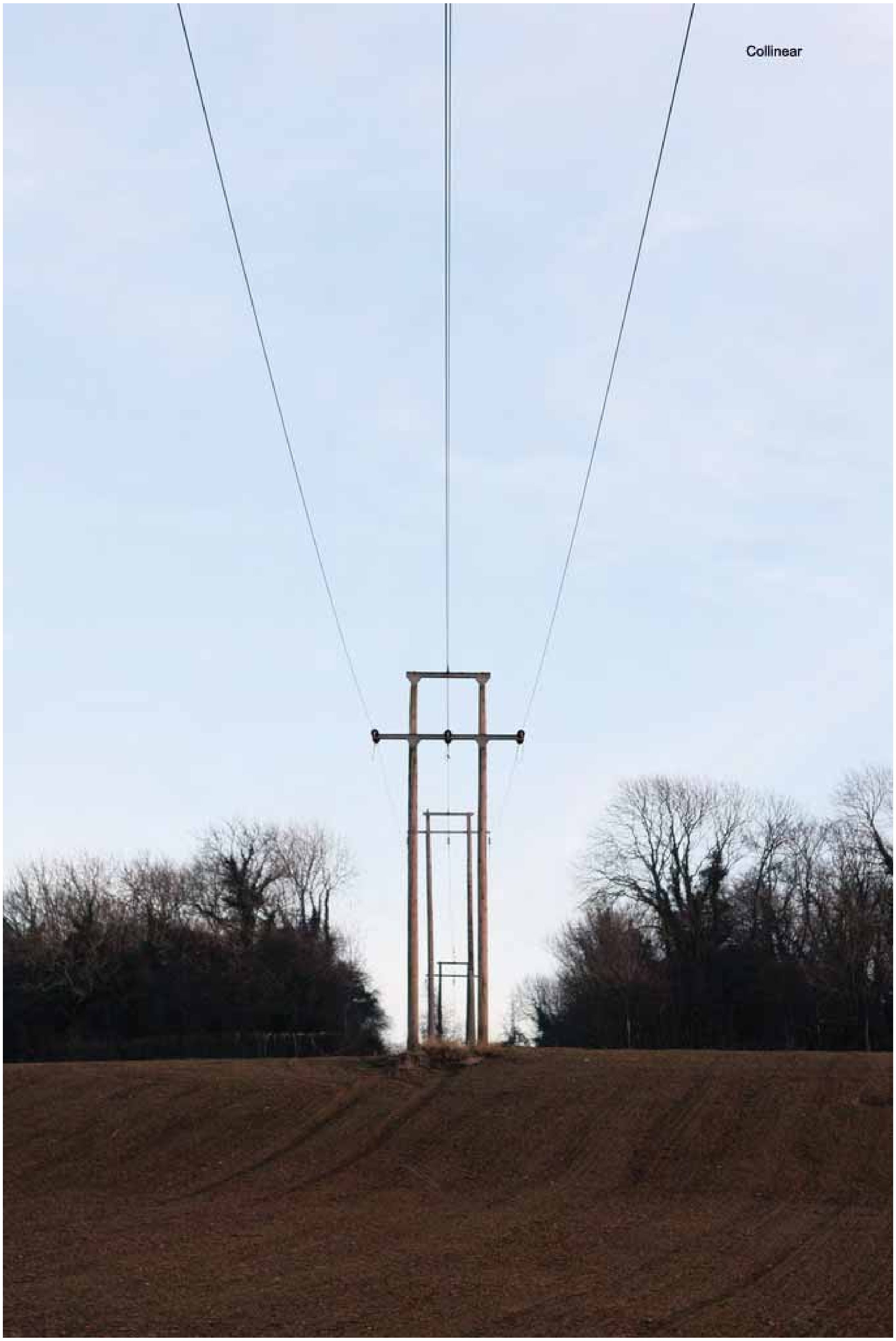
Mirror Writing

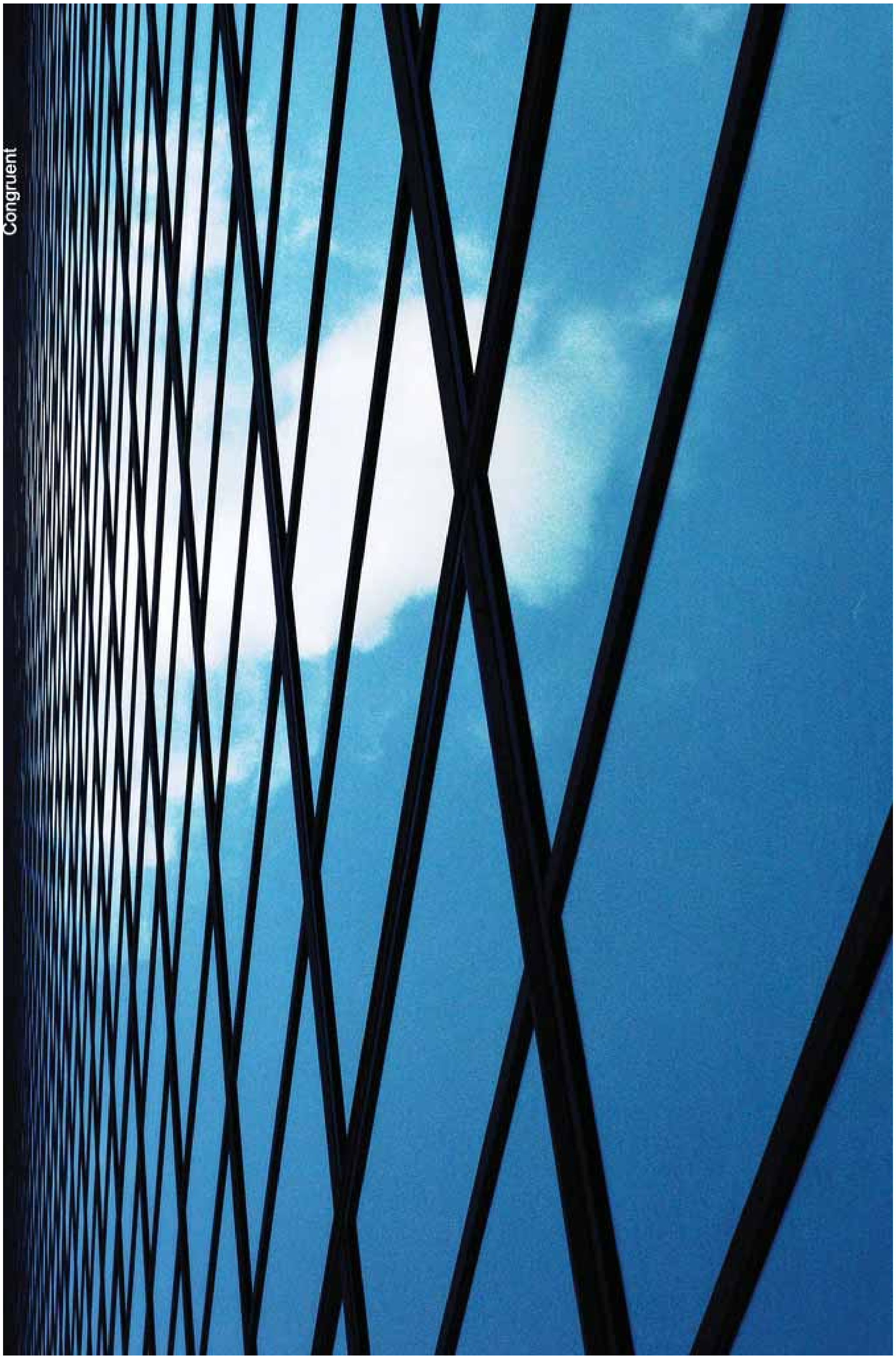
Group the students into two teams. Have the first player from each team stand in front of the chalkboard. Give each of the two players a small, unbreakable mirror. Stand some distance behind the two players with illustrations for the sight words. Hold up one of the illustrations. When you say "Go," the players with the mirrors must look over their shoulders to see the illustration you are holding. When a player sees the illustration, he/she must write the sight word for that illustration on the chalkboard. The first player to do this correctly wins the round. Repeat this process until all players in each team have ha an opportunity to respond.

Student Support Materials

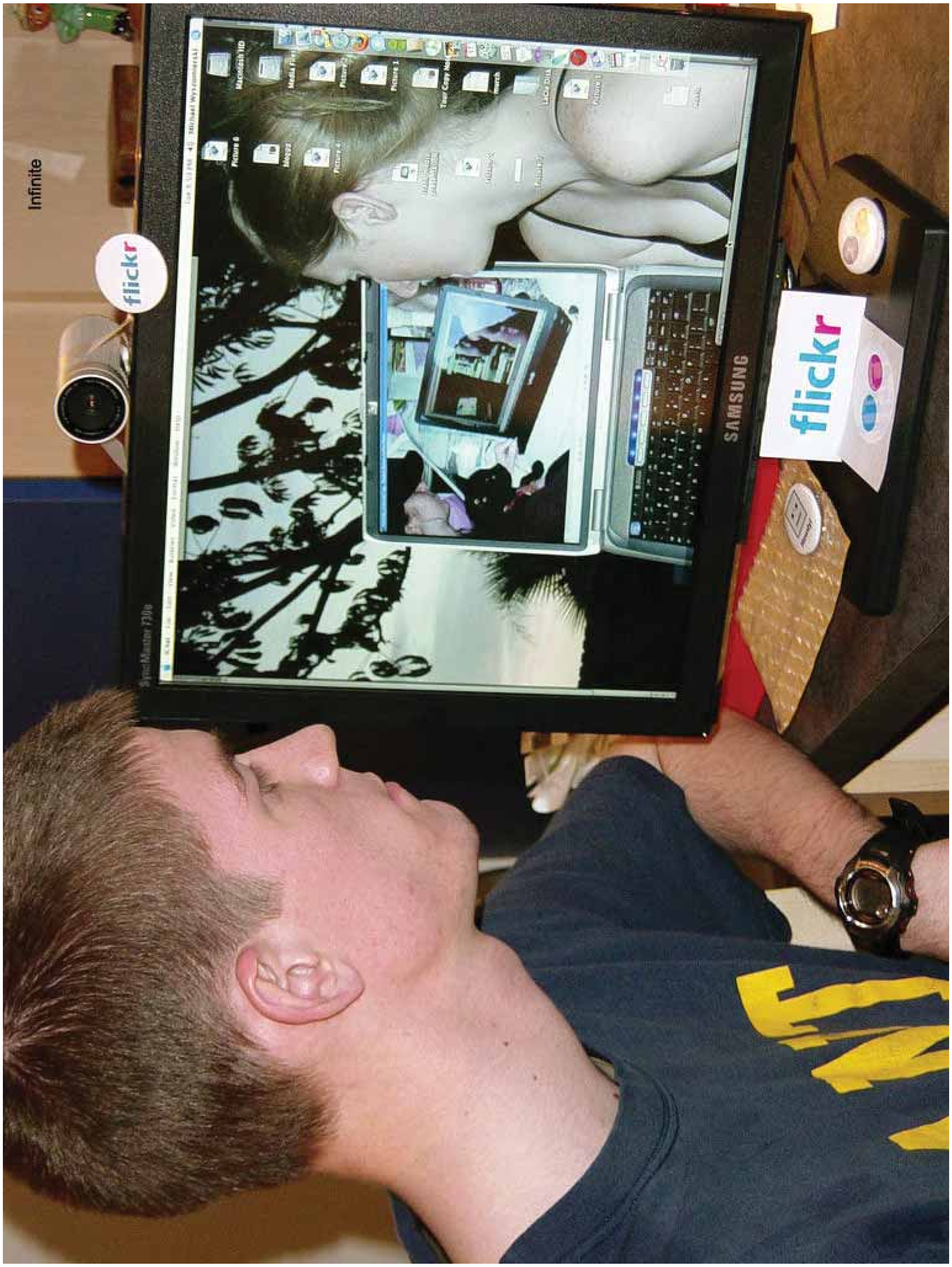



Angle


Collinear


Congruent

Coplaner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Intersect
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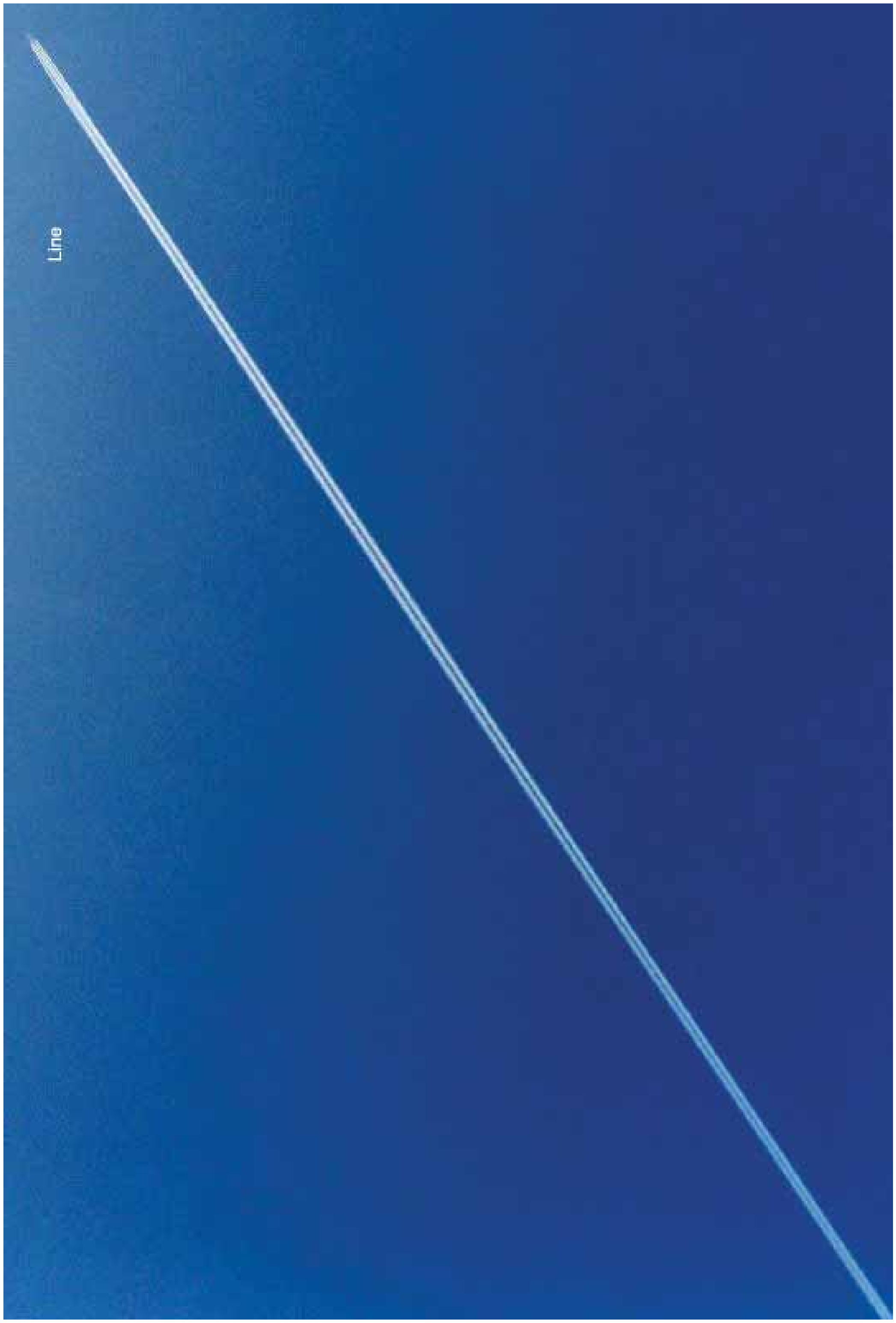
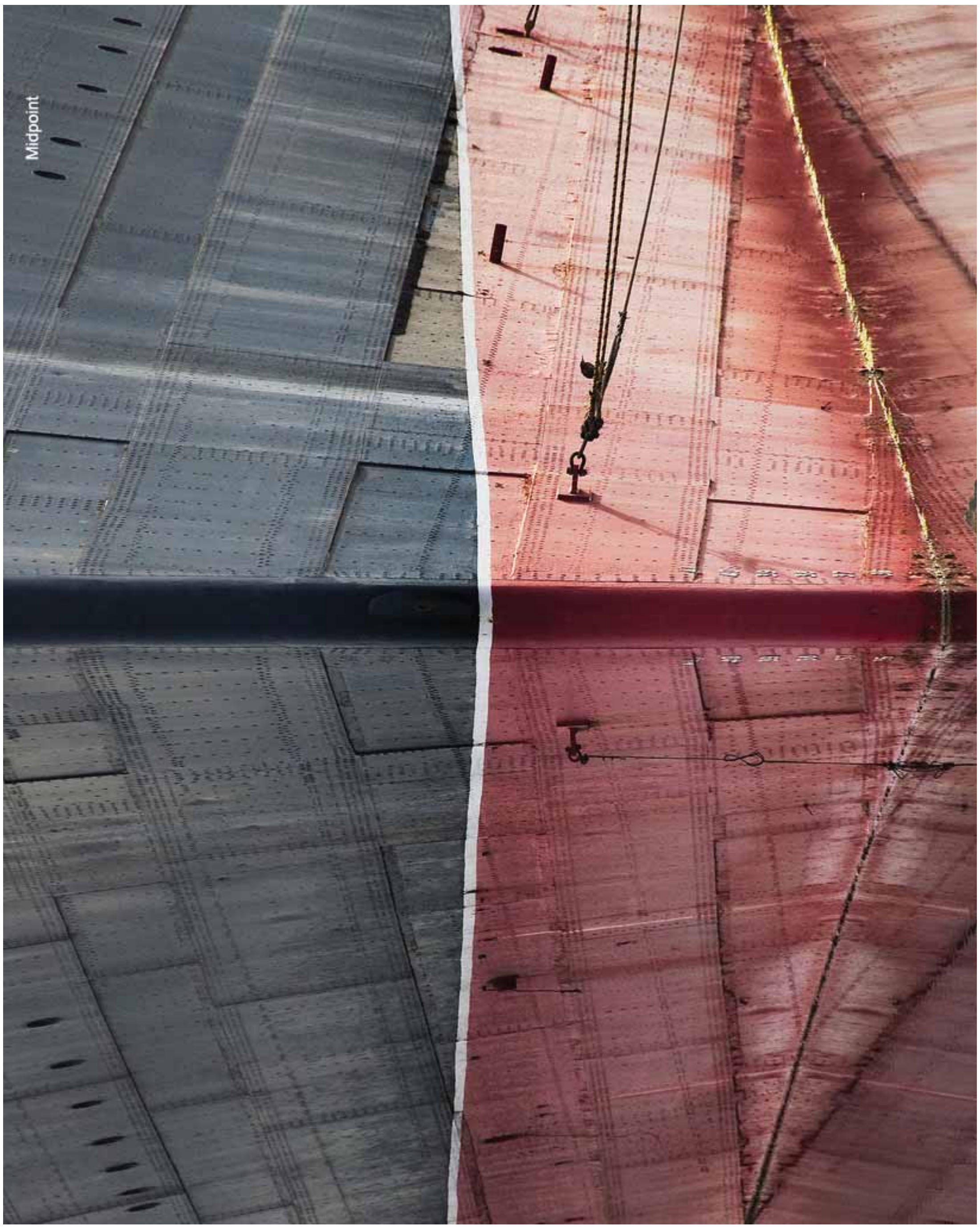
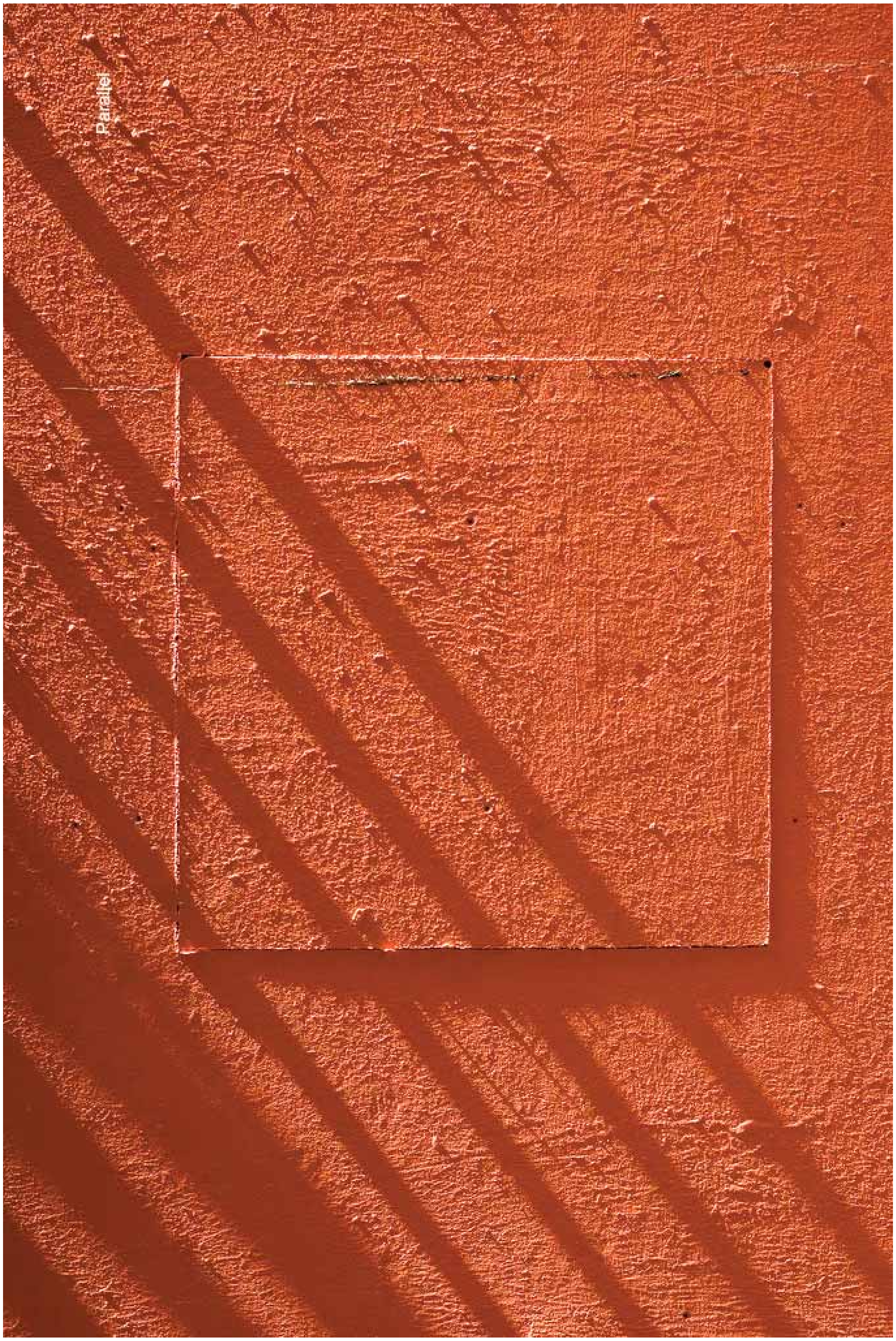
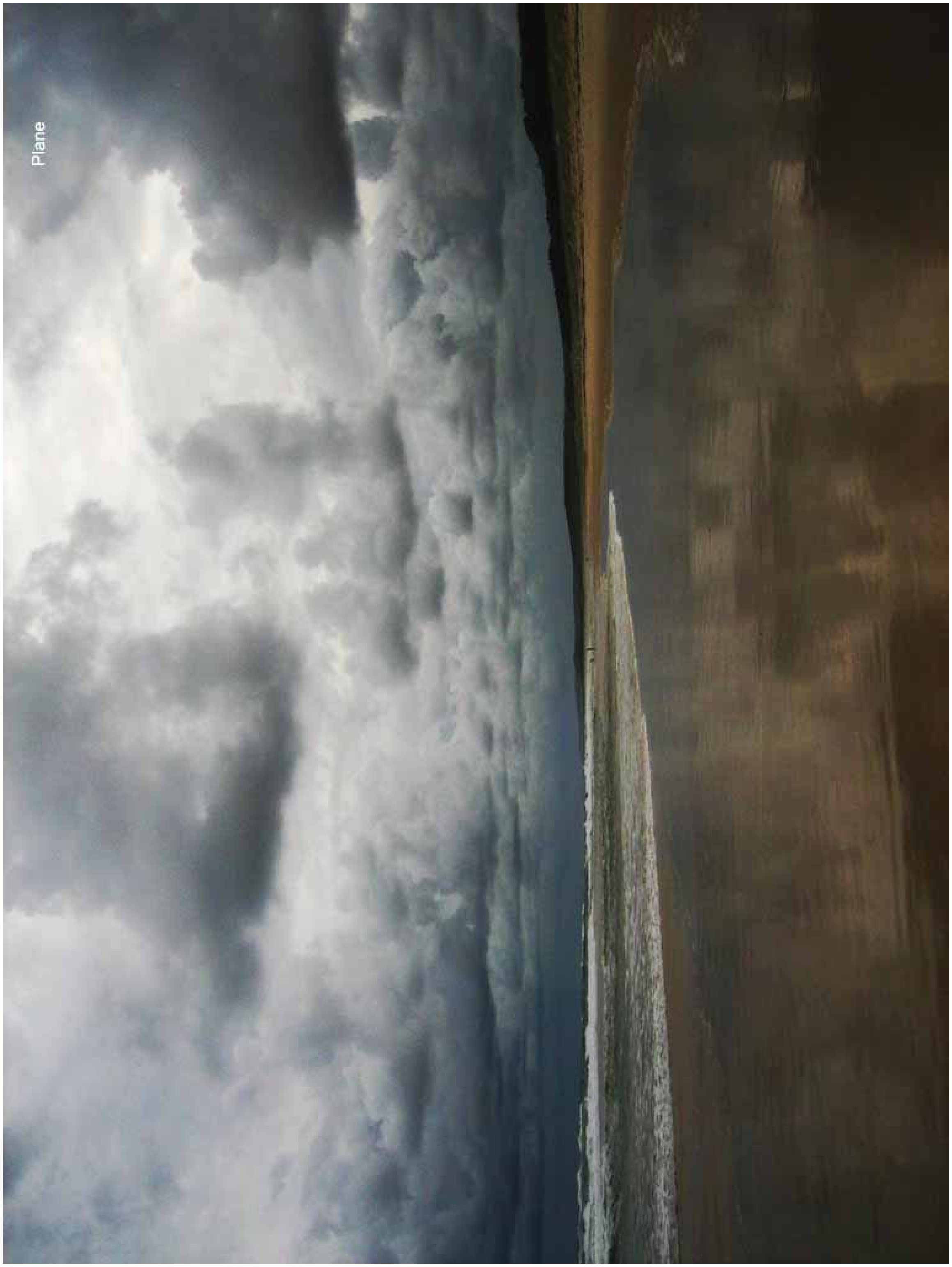
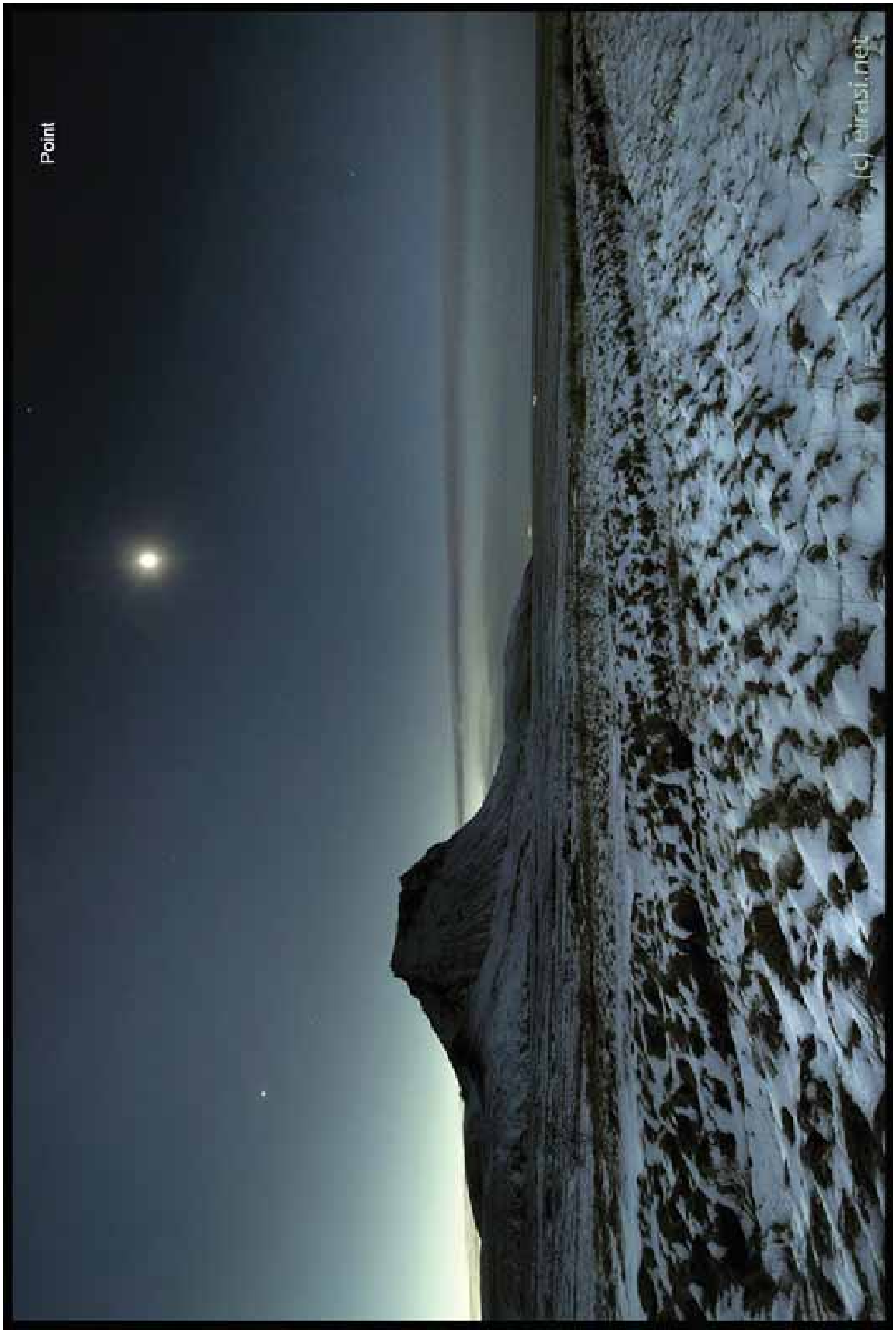

Line


Midpoint


Parallel


Plane


Point
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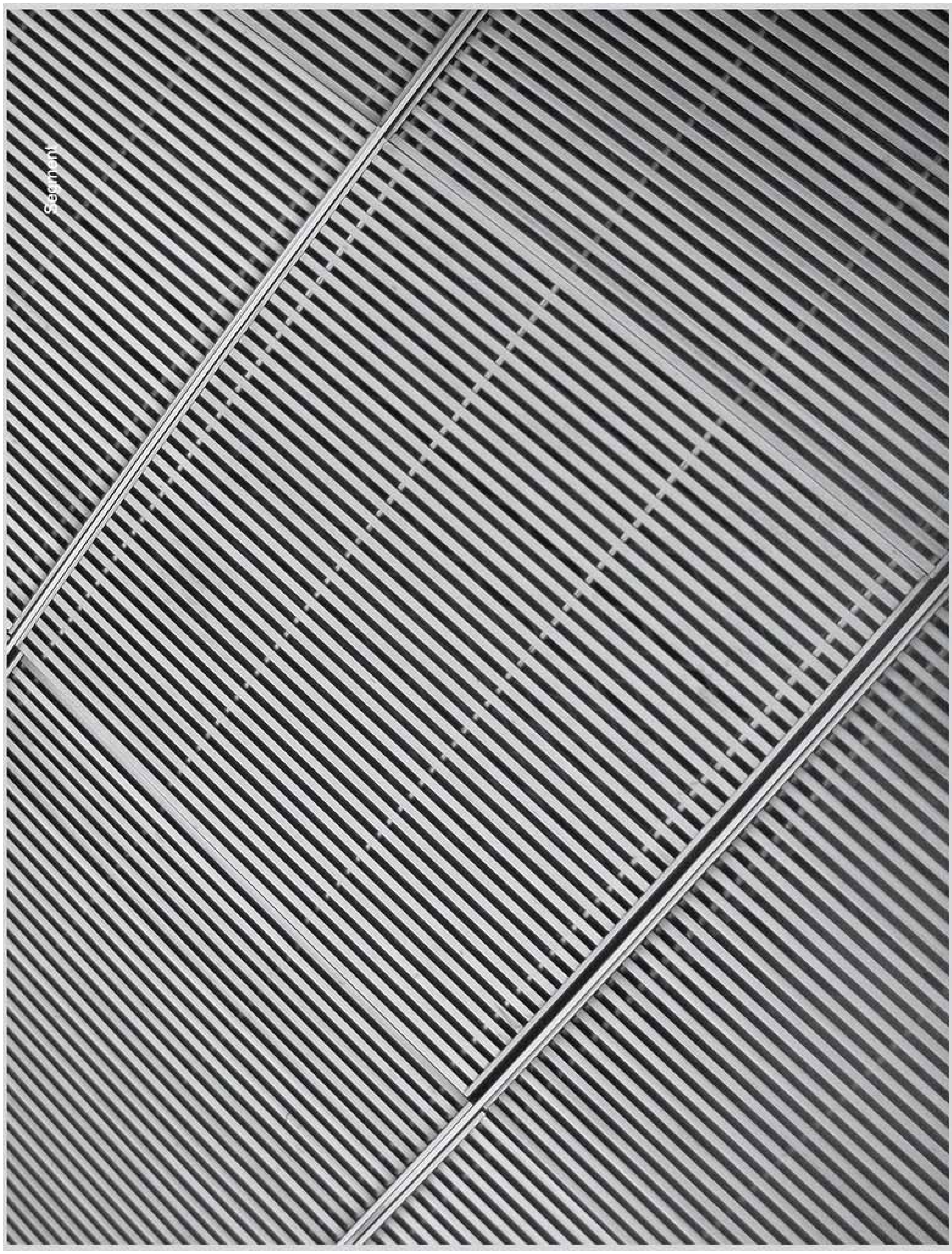
Ray


Segment


Space

True-False Sentences

(Listening and/or Reading Comprehension)

1. An **infinite** number cannot be measured.
2. The floor of a house has two **dimensions**.
3. The **space** in a box cannot be measured.
4. A **point** has no dimensions.
5. A **line** can be curved.
6. A line **segment** has two dimensions.
7. A segment is divided in half by its **midpoint**.
8. Four points that are on the same line are **collinear.**
9. Two lines can **intersect** in only one point.
10. A **ray** can be curved.
11. An **angle** is made up of two rays.
12. Two objects that are the same shape are **congruent**.
13. A **plane** is infinite in only two directions.
14. Two lines are always **coplanar**.
15. Lines that meet in a common point are **parallel**.

Answers: 1T, 2T, 3F, 4T, 5F, 6F, 7T, 8T, 9T, 10F, 11T, 12F, 13F, 14F, 15F

1. There are an **infinite** number of trees in the Tongass National Forest.
2. A box has one **dimension**.
3. A hockey puck exists in **space**.
4. A **point** is always round.
5. A **line** goes on forever in two directions.
6. A line **segment** has a measurable length.
7. A **midpoint** is at the end of a line segment.
8. Two points that are on the same line are called **collinear**.
9. Parallel lines can **intersect** each other.
10. A **ray** has a starting point.
11. An **angle** cannot be measured.
12. A soda can is **congruent** to another identical soda can.
13. A **plane** is always flat.
14. Lines on the same plane are **coplanar.**
15. **Parallel lines** are on the same plane.

Answers: 1F, 2F, 3T, 4F, 5T, 6T, 7F, 8F, 9F, 10T, 11F, 12T, 13T, 14T, 15T

Match the Halves

1. Parallel lines are on the same plane	A. has no length, width, or depth.
2. Points, lines, and figures	B. and it can be measured.
3. A plane is a flat surface that	C. connects two points.
4. Congruent objects are exactly equal	D. cannot be counted and has no limit.
5. An angle is made up of	E. divides it in half.
6. A ray is part of a line that	F. extends infinitely in one direction.
7. Intersecting figures	G. includes all points in three-dimensions.
8. Three or more points	H. are dimensions.
9. The midpoint of a line segment	I. two rays with a common starting point.
10. A line segment has two endpoints	J. are coplanar if they are on the same plane.
11. A line is a straight path that	K. is two-dimensional and extends infinitely in all directions.
12. A point is a position in space that	L. and they do not intersect.
13. Space is infinite and	M. share at least one common point.
14. Length, width, and height	N. on the same line are collinear.
15. Something that is infinite	O. in both size and shape.

Answers: 1L, 2J, 3K, 4O, 5I, 6F, 7M, 8N, 9E, 10B, 11C, 12A, 13G, 14H, 15D

Definitions

Infinite. Unlimited or unending.

Dimension. Directions of extension, like length, width, and height.

Space. The set of all points.

Point. A position in space.

Line. A straight path that connects two points.

Segment. A piece or section of a line with two endpoints.

Midpoint. A point that divides a line segment in half.

Collinear Points. Three or more points that lie on the same line.

Intersect. To meet, or share a common point.

Ray. Part of a line that extends infinitely in one direction from a starting point.

Angle. Two rays with a common starting point.

Congruent. Exactly equal in size and shape.

Plane. A flat, two-dimensional surface extending infinitely in all directions.

Coplanar. On the same plane.

Parallel lines. Coplanar lines that do not intersect.

Which Belongs

1. A (point, line segment, angle) has no length, width, or depth.
2. The universe is (infinite, 2-dimensional, congruent) because it is unlimited and cannot be measured.
3. The vertical corner-posts on the front of a building represent lines that are (collinear, parallel, infinite).
4. Two triangles have the same size and shape so they are (parallel, congruent, coplanar).
5. A (midpoint, endpoint, starting point) is a point that divides a segment in half.
6. The school building has three (dimensions, angles, midpoints) because it can be measured in more than two directions.
7. A part of a line that starts but does not end is a (segment, ray, angle)
8. A 3-dimensional place where a line might exist is (space, a plane, a point)
9. The gym floor represents part of a (plane, line, dimension).
10. When a line and a line segment share a common point they have (a midpoint, an intersection, a dimension).
11. The windows on a flat wall are (parallel, coplanar, 3-dimensional).
12. A (line, ray, line segment) is straight, connects two points, and is infinite.
13. Three points on the same ray are (collinear, coplanar, congruent).
14. (An angle, a line segment, a plane) can be measured in degrees.
15. A (ray, segment, point) is a piece of a line that can be measured.

Answers: 1. point, 2. infinite, 3. parallel, 4. congruent, 5. midpoint,
6. dimensions, 7. ray 8. space, 9. plane, 10. an intersection,
11. coplanar, 12. line, 13. collinear, 14. an angle, 15. segment

Multiple Choice

1. What does it mean if something is infinite?
   A. It can only be measured in one direction.
   B. It is unlimited and unending.
   C. It takes a very long time to count it.

2. How many dimensions are represented by the surface of a piece of paper?
   A. 1 dimension
   B. 2 dimensions
   C. 3 dimensions

3. Which of these statements about "space" is true?
   A. It has 3 dimensions.
   B. It is infinite.
   C. Both A and B are true

4. Why can't you measure a point?
   A. It is too small.
   B. It is infinite.
   C. It has no dimensions.

5. What is an important characteristic of a line?
   A. Its length can be measured.
   B. It has one dimension
   C. It is straight.

6. The edge of a table is straight and has a length of 4 feet. Which of the following does that edge represent?
   A. A line segment.
   B. A plane.
   C. A Dimension.

7. Why can't a line have a midpoint?
   A. It doesn't have enough dimensions.
   B. Its endpoints are too far apart.
   C. It is infinite and cannot be measured.

8. Why does "collinear" refer to three or more points?
   A. Any time you have just two points, you can draw a line through them.
   B. Collinear objects are three-dimensional.
   C. So that it does not get confused with "coplanar",

9. When two roads intersect, which cannot be true?
   A. They might be curved roads
   B. They are parallel roads
   C. They meet each other.

10. Why is a sun ray like a ray in geometry?
   A. It starts somewhere and travels in a straight direction.
   B. Both are hot
   C. It has two dimensions.

11. Which of the following does not represent an angle?
   A. The hands of a clock
   B. The corner of a piece of paper
   C. A pinpoint.

12. Which of these might be congruent?
   A. Two rays
   B. Two line segments
   C. Two planes

13. Why doesn't the ocean surface represent a plane?
   A. It is not infinite
   B. It is not flat
   C. Both A and B are true.

14. Which of these has to be coplanar?
   A. Two intersecting lines
   B. Four points
   C. Three line segments

15. The two edges of a perfectly straight, flat road would be
   A. Collinear and congruent.
   B. Parallel and coplanar
   C. Infinite and tw

Answers:

1. B
2. B
3. C
4. C
5. C
6. A
7. C
8. A
9. B
10. A
11. C
12. B
13. C
14. A
15. B

Complete the Sentence

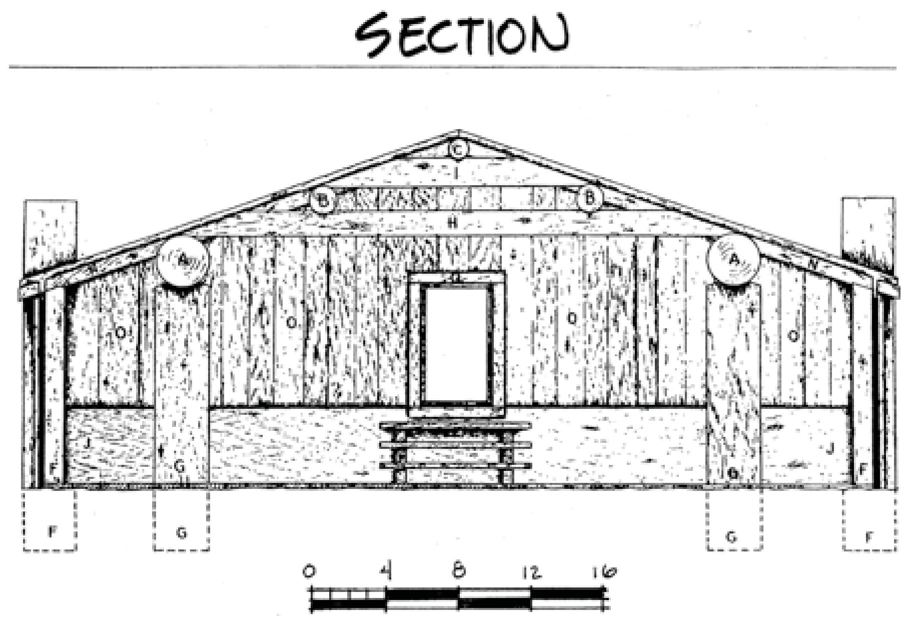
1. ________________ has three dimensions and is boundless and unlimited.
2. Three bowling pins arranged in a straight row might be called ______________ .
3. The line of the roof formed an ______________with the line of the wall.
4. A ______________ might be represented by a beam of light.
5. The distance that a plane extends in space is __________________
6. The flat surface of the ice reminded him of a _____________.
7. A straight line has one ____________________and a triangle has two _____________.
8. A position or location in space is called a ______________ and it has no length, width, or depth.
9. A section of a line called a ___________________can be measured.
10. A segment is divided in half by its ______________________.
11. All of the lines on the basketball court floor are ________________ .
12. The two roads ________________________ near the upper part of the map.
13. The two squares on the paper are ________________ because they are the same size.
14. The straight railings on the bridge were ________________to each other.
15. The _______________between the two points extended forever in both directions.

Answers:

1. Space
2. Collinear
3. Angle
4. Ray
5. Infinite
6. Plane
7. Dimension
8. Point
9. Segment
10. Midpoint
11. Coplanar
12. Intersect
13. Congruent
14. Parallel
15. Line

Creative Writing

Have the students write sentences of their own, based on the picture below. When finished, have each student read his/her sentences to the others.



Place-Based Practice Activity

Have a scavenger hunt in the classroom, at home, and/or outdoors, to find representations of points, lines, planes, segments, angles, intersections, and other terms from this unit.

Divide the class into teams, and allow class time for teams to find and list as many examples of each as they can find. Give a time limit.

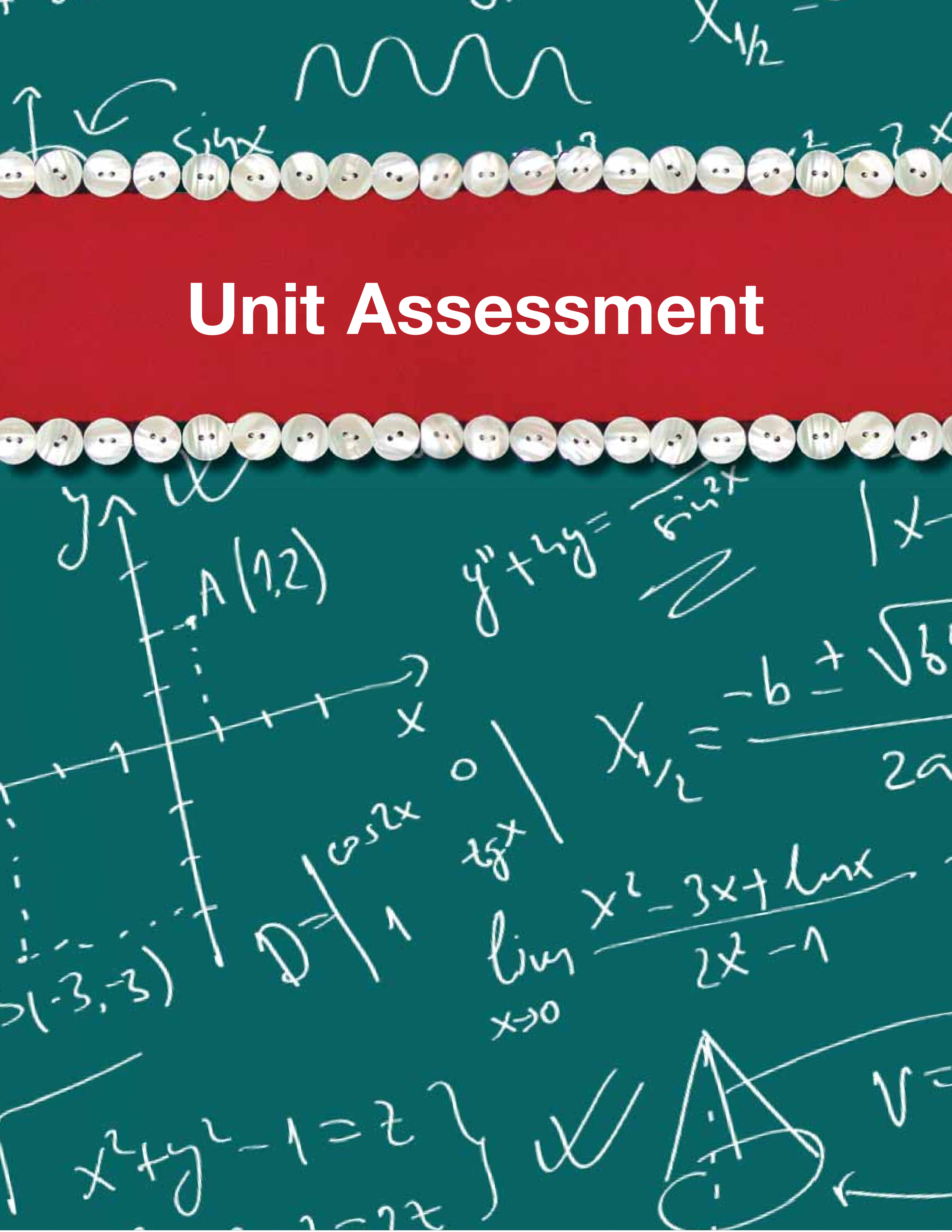
OR

Assign the scavenger hunt as homework, then give each team time to compile their “master list” at the beginning of class.

Have the teams exchange lists and critique. Discuss any examples that raise questions, as a class.

Offer extra credit or a prize for the team with the most examples, or give credit to any team that exceeds a given number of correct examples.

Unit Assessment



Unit 1 Geometry

An Introduction to Math Vocabulary

Name: ___________________
Date: ___________________

Match the definition in the column on the right with the key vocabulary in the column on the left. Place the letter of the definition in front of the word it matches.

1) _____ space
2) _____ dimension
3) _____ point
4) _____ line
5) _____ ray
6) _____ angel

a. an infinitely small position in space with no size or dimension.
b. the straight path that connects two points and goes on forever in both directions.
c. the 3-dimensional place in which an object can exist or events can take place.
d. directions of extension- length, width, and height
e. half a line, or part of a line that has a starting point and extends infinitely in one direction.
f. made up of two rays with a common starting point

Multiple Choice: Read each statement below and choose the best answer from the choices provided. Circle the best choice.

7) The point in the middle of a line segment that divides a line segment in half is known as ___________.

a) the halfway point

b) the midpoint

c) the intersect

8) A piece or section of a line with two endpoints, that contains all the points in between and can be measured is a __________________.

a) midpoint

b) collinear point

c) segment

9) When something is unlimited or unending, goes on forever and cannot be measured or counted it is ____________________.

a) a segment

b) infinite

c) a ray

10) Telephone wires or lines on the pavement model or represent ________________ objects.

a) rays

b) intersects

c) two dimensional

11) Collinear points is/are __________ or more points that lie on the same line,

a) one

b) two

c) three

Fill in the Blank: Complete each of the statements below with the word that fits best. Choose words from the Word Bank below.

Word Bank		
Congruent	infinite	infinite
intersect	line	plane
plane	point	rays

12) A dot can be used to represent a _______ on a map.

13) Space is _______. We can2019t measure all of space, and we can2019t measure the _______ number of points in any given space.

14) A _______ is made up of infinitely many points in a straight arrangement. It has no thickness; it has one dimension.

15) Lines, line segments, rays, and other figures are said to _______ if they meet, or share a common point

16) The sun2019s ________ 2013 they start at the sun but do not end and are part of a line that has a starting point and extends infinitely in one direction.

17) When points, lines, or figures are coplanar, it means they are on the same ________.

18) ________ means exactly equal in size and shape.

19) A ________ is a flat surface that extends infinitely in all directions. It is two- dimensional; it has length and width but no thickness.

Illustrations for Key Vocabulary: Choose the correct illustration to match the vocabulary word.

20) Look at the illustration below and write in the space provided, the key vocabulary word that it represents.

________________.

21) Look at the two illustrations below. Circle the illustrations with **parallel lines.**

Unit 1 Geometry
An Introduction to Math Vocabulary

Name: ___________________
Date: ___________________

Match the definition in the column on the right with the key vocabulary in the column on the left. Place the letter of the definition in front of the word it matches.

1) _c_ space
2) _d_ dimension
3) _a_ point
4) _b_ line
5) _e_ ray
6) _f_ angel

a. an infinitely small position in space with no size or dimension.
b. the straight path that connects two points and goes on forever in both directions.
c. the 3-dimensional place in which an object can exist or events can take place.
d. directions of extension- length, width, and height
e. half a line, or part of a line that has a starting point and extends infinitely in one direction.
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c) segment

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b) infinite

c) a ray

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b) intersects

c) two dimensional

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a) one

b) two

c) three

Fill in the Blank: Complete each of the statements below with the word that fits best. Choose words from the Word Bank below.

Word Bank		
Congruent	infinite	infinite
intersect	line	plane
plane	point	rays

12) A dot can be used to represent a **point** on a map.

13) Space is **infinite**. We can2019t measure all of space, and we can2019t measure the **infinite** number of points in any given space.

14) A **line** is made up of infinitely many points in a straight arrangement. It has no thickness; it has one dimension.

15) Lines, line segments, rays, and other figures are said to **intersect** if they meet, or share a common point

16) The sun2019s __rays__ 2013 they start at the sun but do not end and are part of a line that has a starting point and extends infinitely in one direction.

17) When points, lines, or figures are coplanar, it means they are on the same __plane__.

18) __Congruent__ means exactly equal in size and shape.

19) A __plane__ is a flat surface that extends infinitely in all directions. It is two- dimensional; it has length and width but no thickness.

Illustrations for Key Vocabulary: Choose the correct illustration to match the vocabulary word.

20) Look at the illustration below and write in the space provided, the key vocabulary word that it represents.

ILLUSTRATION OF COPLANAR________________.

Coplanar

21) Look at the two illustrations below. Circle the illustrations with **parallel lines.**

ILLUSTRATIONS ADDED for parallel and non parallel lines.

UNIT 2
Angles

Sealaska Heritage Institute

Grade Level Expectations for Unit 2

Unit 2—Angles

Alaska State Mathematics Standard A
A student should understand mathematical facts, concepts, principles, and theories.

A student who meets the content standard should:

A5) construct, draw, measure, transform, compare, visualize, classify, and analyze the relationships among geometric figures;

Alaska State Mathematics Standard C
A student should understand and be able to form and use appropriate methods to define and explain mathematical relationships.

A student who meets the content standard should:

C1) express and represent mathematical ideas using oral and written presentations, physical materials, pictures, graphs, charts, and algebraic expressions;

C2) relate mathematical terms to everyday language;

GLEs
The student demonstrates an understanding of geometric relationships by

[9] G-1 identifying, analyzing, comparing, or using properties of angles (including supplementary or complementary)

The student demonstrates an understanding of geometric relationships by

[10] G-1 identifying, analyzing, comparing, or using properties of plane figures:
• *supplementary, complementary or vertical angles*

The student communicates his or her mathematical thinking by

[9] PS-3 representing mathematical problems numerically, graphically, and/or symbolically, translating among these alternative representations; or using appropriate vocabulary, symbols, or technology to explain, justify, and defend strategies and solutions

[10] PS-3 representing mathematical problems numerically, graphically, and/ or symbolically, communicating math ideas in writing; or using appropriate vocabulary, symbols, or technology to explain, justify, and defend strategies and solutions

Vocabulary & Definitions

Introduction of Math Vocabulary

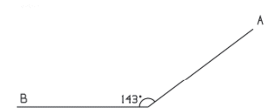
Angle

An angle is made up of two rays with a common starting point. The symbol for angle is

Angles can be seen all around you: on buildings, clocks, road intersections, and in the way you bend your arms and legs. Those are just a few examples.

Angle measure

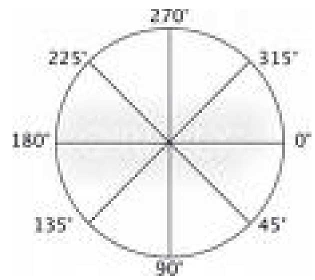
The size of an angle, or amount of turning or space between the two rays of an angle, measured in degrees or radians. Protractors and other devices are used to measure angles.



To achieve good form and speed, this skier might want to know the angle measure between his skis, and the angle measure of his spine in relation to the ground.
Ask students if they can think of other reasons to measure angles (i.e. builders measure angles for roofs).

Introduction of Math Vocabulary

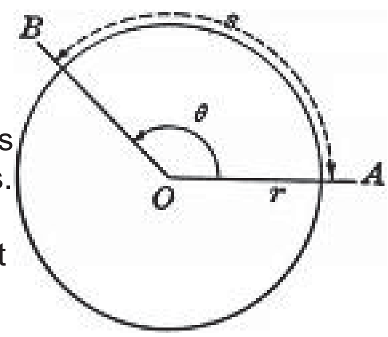
Degree



A unit of angle measure. There are 360 degrees in a circle or a complete revolution. The symbol for degree is °.

A compass measures directions using degrees.

Radian



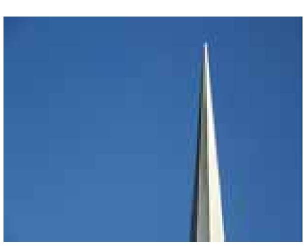
Another unit for measuring angles. The are 2ϖ radians in a circle or a complete revolution. $180^{o} = \varpi$ radians.

Radians are most often used to measure the speed at which wheels and machine parts revolve.

Vertex (of an angle)

The point where two rays making up an angle meet, or the corner point.

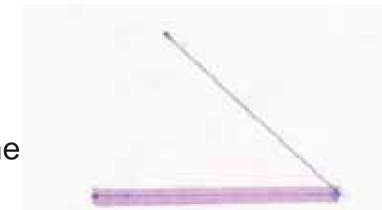
The tip of the spire shown in the photo represents a vertex.
Another example might be the corner of a piece of paper, where the two edges meet.



Introduction of Math Vocabulary

Side (of an angle)

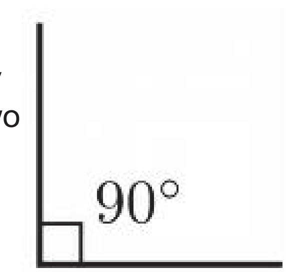
Either of two rays that make up an angle.



In the photo, the hands of a clock represent the sides of an angle.

Right angle

A right angle is a 90° angle. When lines are perpendicular, they form right angles. Right angles are easy to find; they are very common in buildings. Usually the angle between two walls is a right angle, and the corners of windows and doors are right angles.

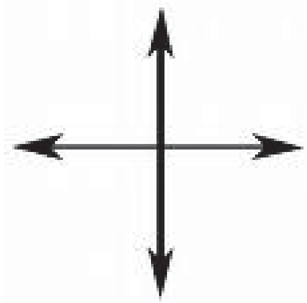


The mast of this boat forms a right angle with the horizon.

Introduction of Math Vocabulary

Perpendicular

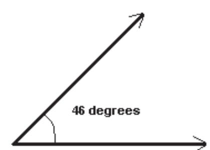
At a right (90°) angle.



In this picture, the lines of grout between the tiles are perpendicular. Other examples of perpendicular lines are (usually) the adjoining sides of doors and windows.

Acute angle

An angle that has a measure less than 90°.

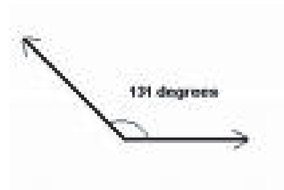


At 12:05, the hands of a clock form an acute angle. Acute angles can be found on roofs, on signs, and in triangles. In this photo, the laptop is open to an acute angle.

Introduction of Math Vocabulary

Obtuse angle

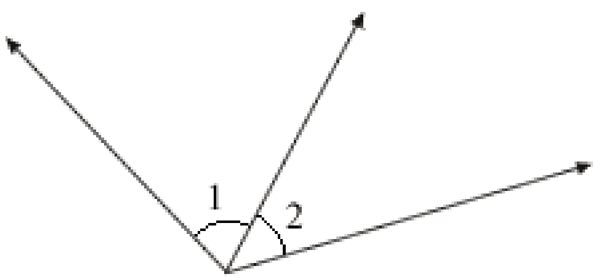
An angle that has a measure more than 90° and less than 180°.



A stop sign has obtuse angles. In the photo, the scissors are open to an obtuse angle.

Adjacent angles

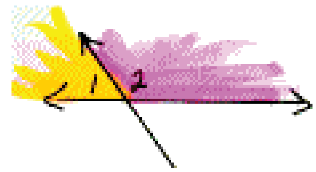
Angles that are immediately next to each other. They are in the same plane, share a common vertex and a common side, and do not overlap.



On the bicycle in the picture, there are adjacent angles of the frame with vertices at the crank. Ask students if they can find other examples of adjacent angles on the bicycle.

Introduction of Math Vocabulary

Linear pair



A pair of adjacent angles formed by intersecting lines.

On the picture of intersecting jet trails, there are four linear pairs of angles.

Complementary angles

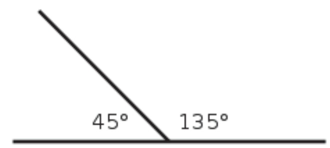
Two acute angles that add up to 90°. For example, a 40° angle and a 50° angle are complementary.

In the photo of a gate, the diagonals divide the corners into complementary angles.

Introduction of Math Vocabulary

Supplementary angles

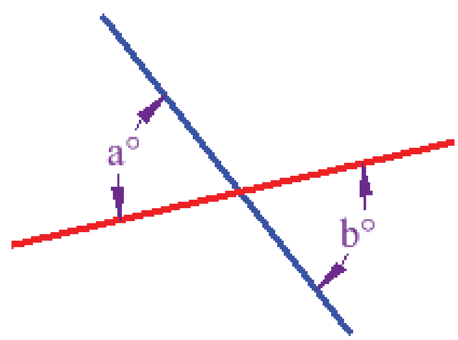
Two angles whose measures add up to 180º. For example, a 110º angle and a 70º angle are supplementary.



Ask students if they can find the supplementary angles in this photo of a skin boat frame, where the supports intersect.

Vertical angles

A pair of angles that are opposite each other, formed by two lines that intersect.

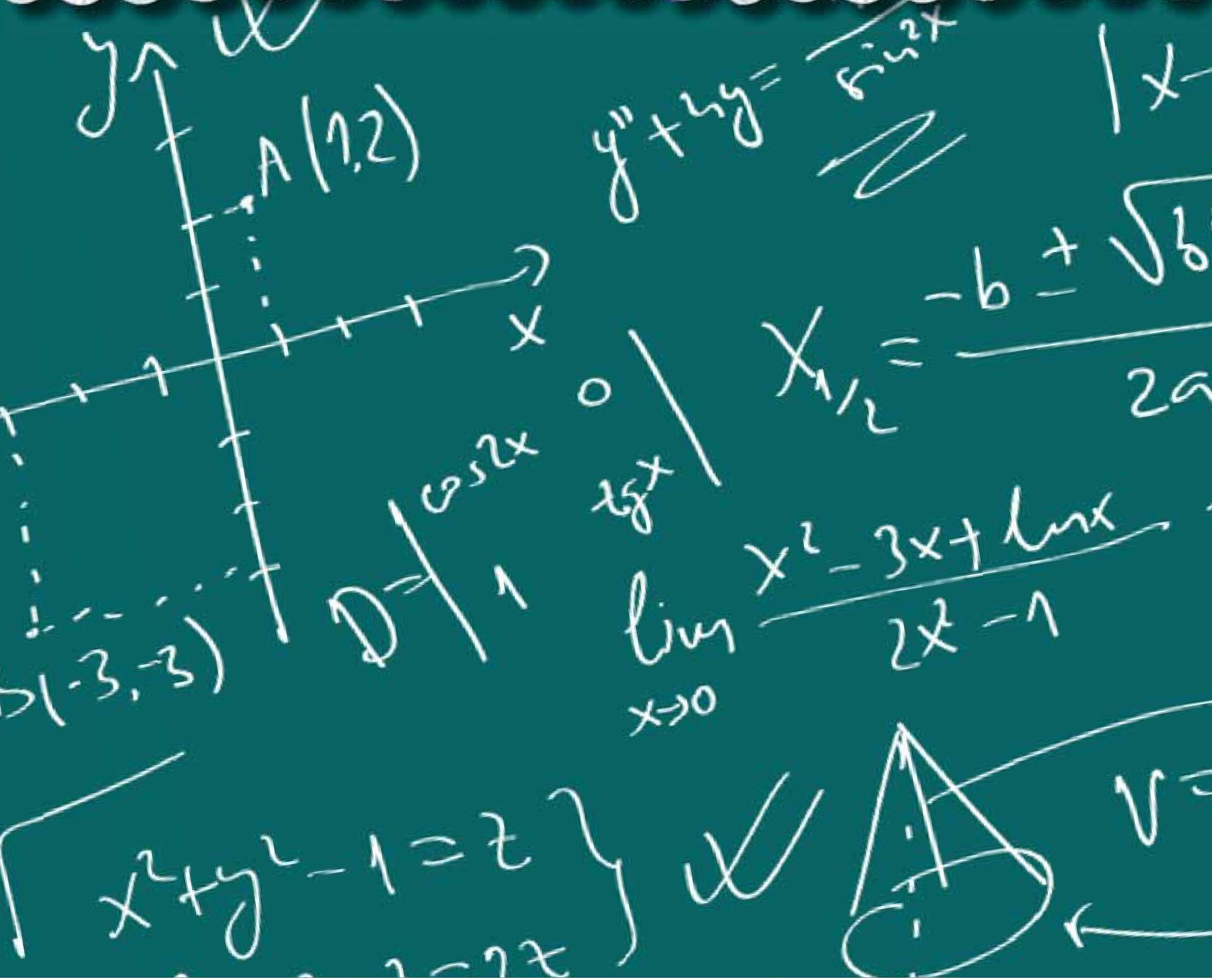


Angles 1 and 4 are vertical angles, and angles 2 and 3 are vertical angles.

Many different vertical angles can be found on the photo of the quilt. Vertical angles can also be found at road intersections, on buildings, and other objects.

Language and Skills Development

Using the Math Vocabulary Terms



Language & Skills Development

LISTENING

Use the activity pages from the Student Support Materials.

Illustration Bingo

Provide each student with a copy of the mini-illustration activity page from the student support materials. The students should cut out the illustrations. Each student should turn his/her illustrations face-down on the desk. Then, each student should turn ONE illustration face up. Say a vocabulary word. Any student or students who have the illustration for the vocabulary word you said face up on their desks, should show their illustrations. Those illustrations should then be put to the side and the students should turn over another illustration. The first student or students to have no illustrations left on their desks, win the round. The illustrations may be collected, mixed, and re-distributed to the students for the different rounds of the activity.

SPEAKING

Role'm Again!

Mount the vocabulary illustrations on teh chalkboard. Number each illusteration, using the numbers 1 to 6. Give dice to the students. Have each student roll his/her dice. The student should identify a picture with the same number showing on his/her die and then use that word in a sentence.

READING

Use the activity pages from the Student Support Materials.

Sight Word Bingo

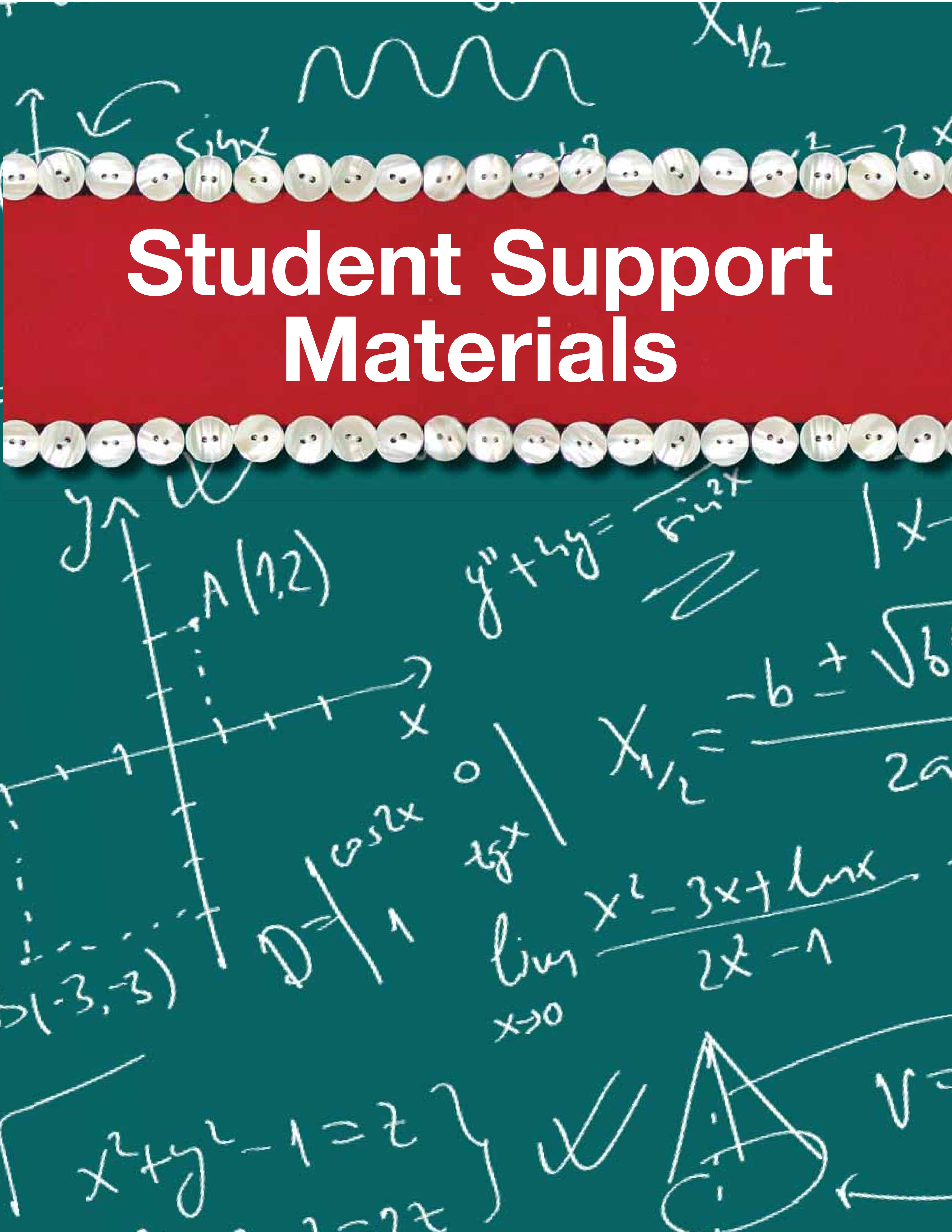
Provide each student with a set of sight words from this unit. Each student should place one word on his/her desk, holding the others separately. Show a vocabulary picture. If a student has the word for that picture on his/her desk, he/she should show it to you; the student should then put that word to the side and place another one on the desk. Continue in this way until a student has no words left.

WRITING

Use the activity pages from the Student Support Materials.

What's Your Letter?

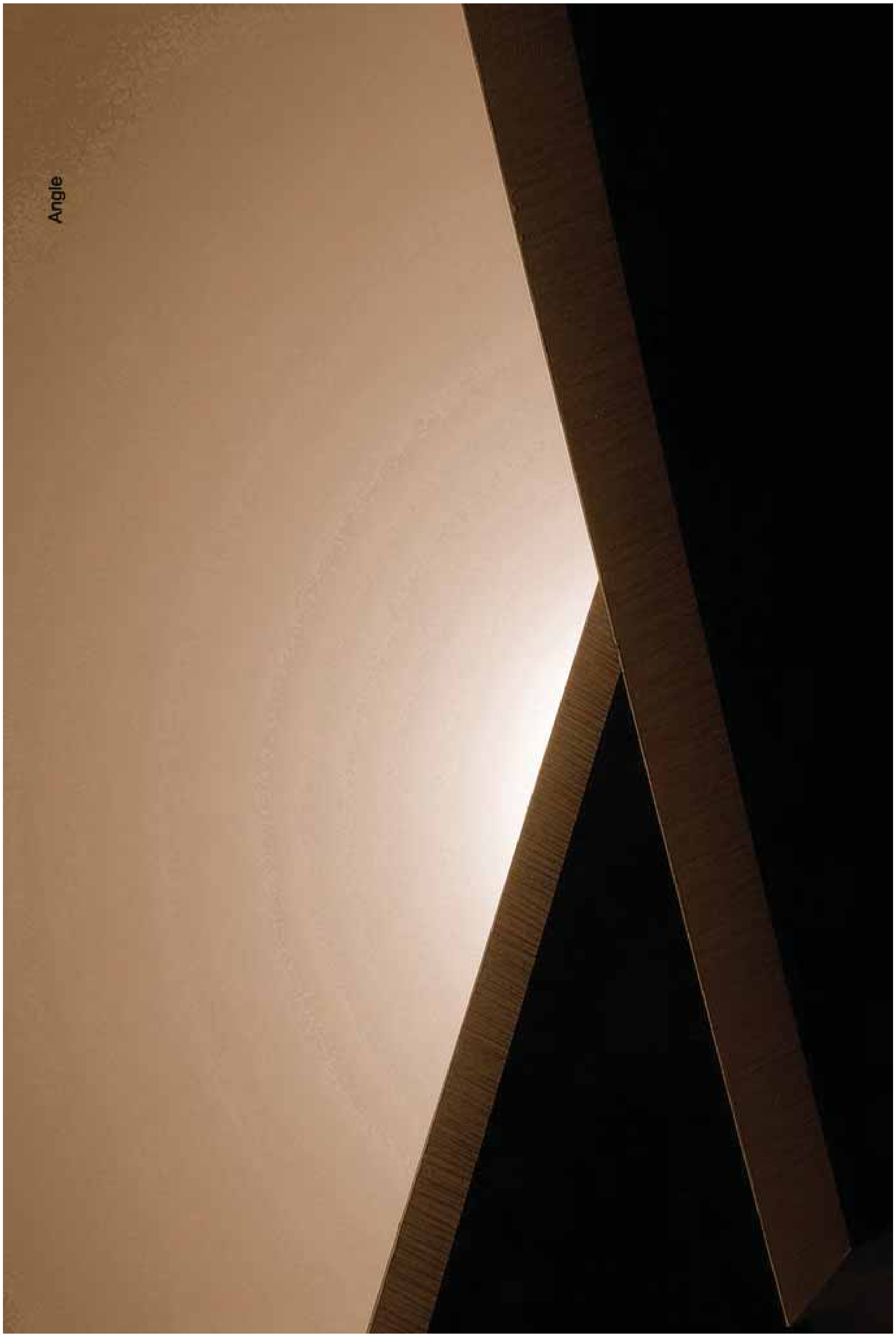
Show one of the vocabulary pictures to the students. Each student should then write ONE letter that is in the word for that picture. Then, check all the students' letters to determine if all of the letters of the word were written. Have the students identify the "missing letters," if there are any.



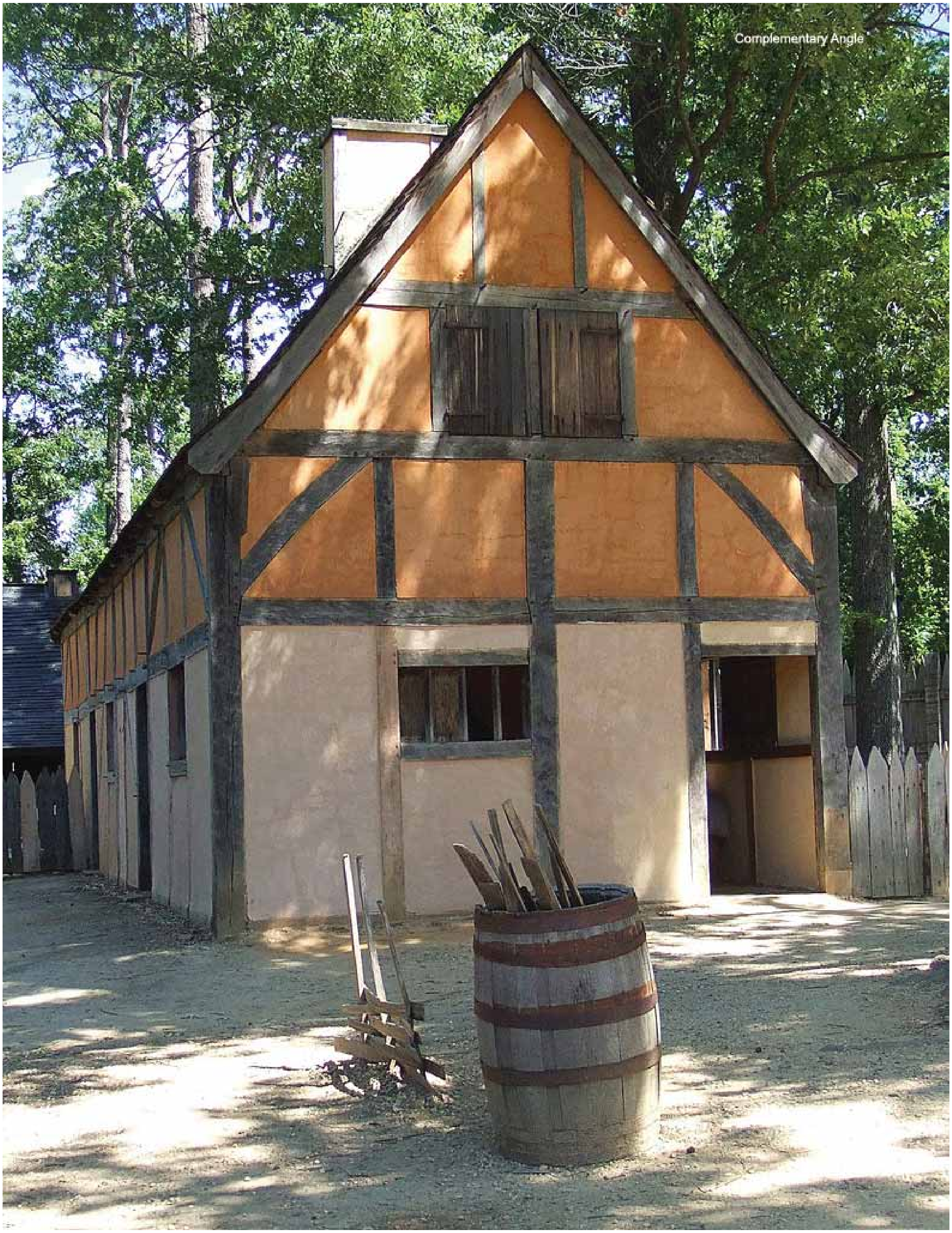
Student Support Materials

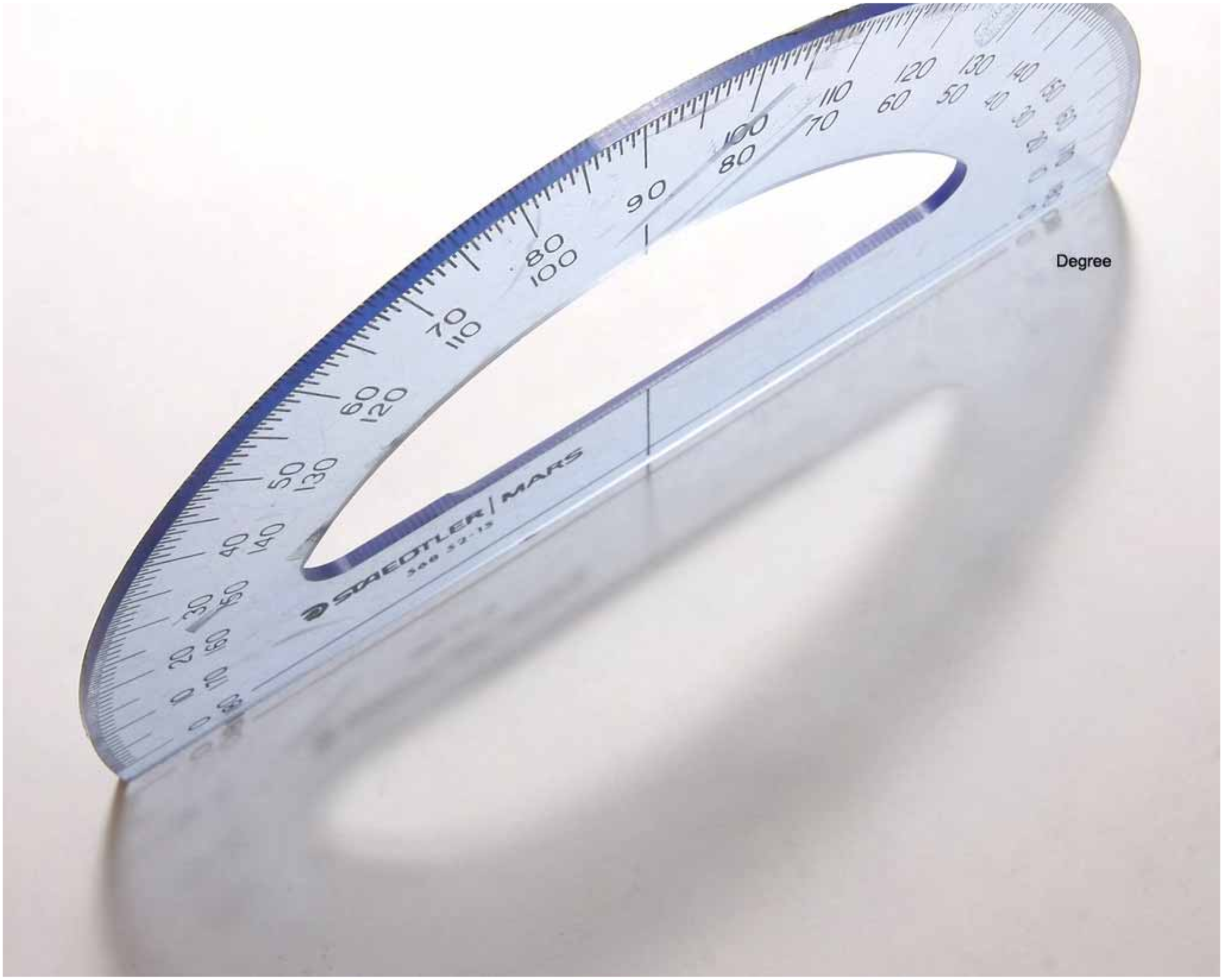

Acute angle


Adjacent

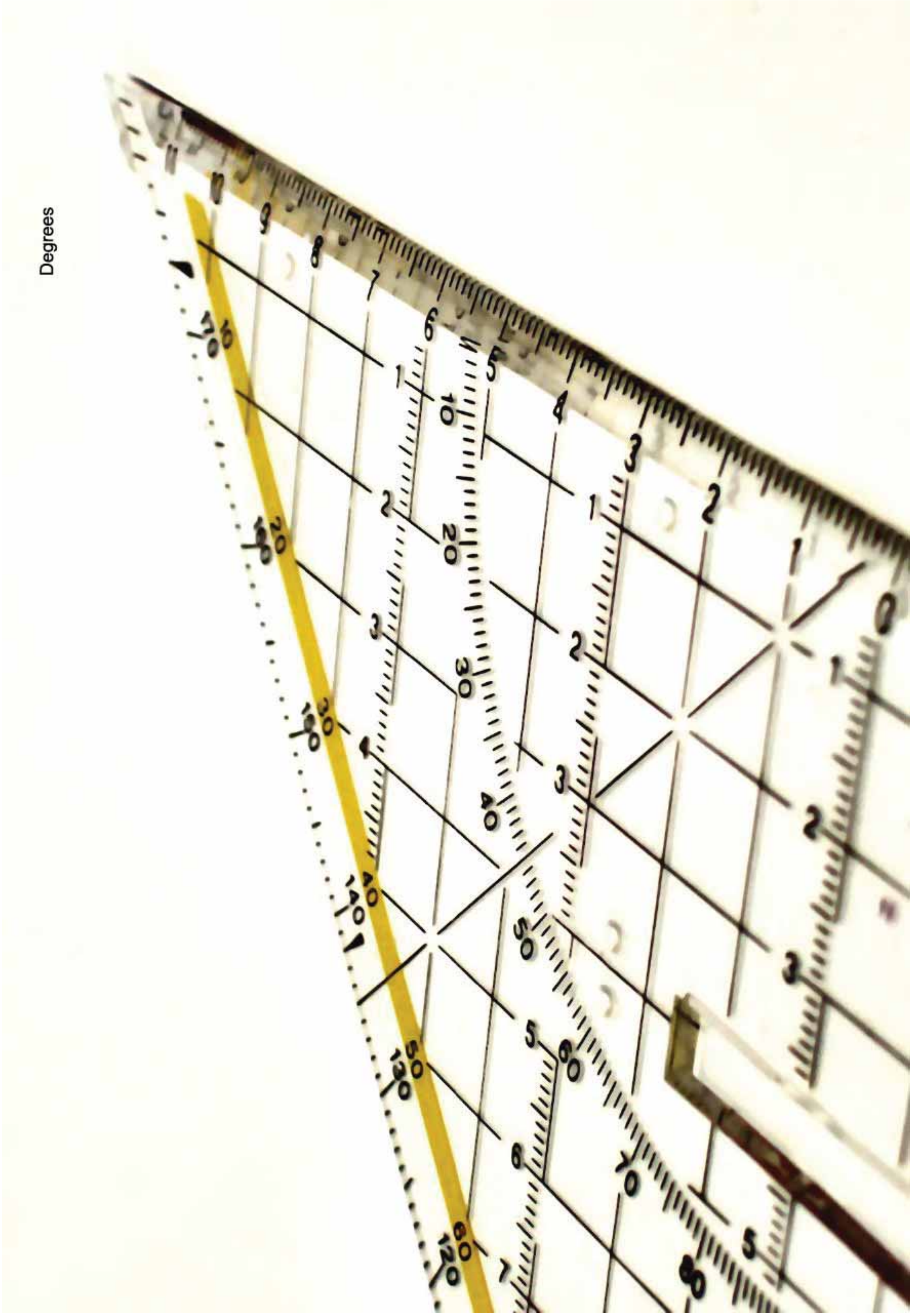

Angle

Angle Measure


Complementary Angle



Degree

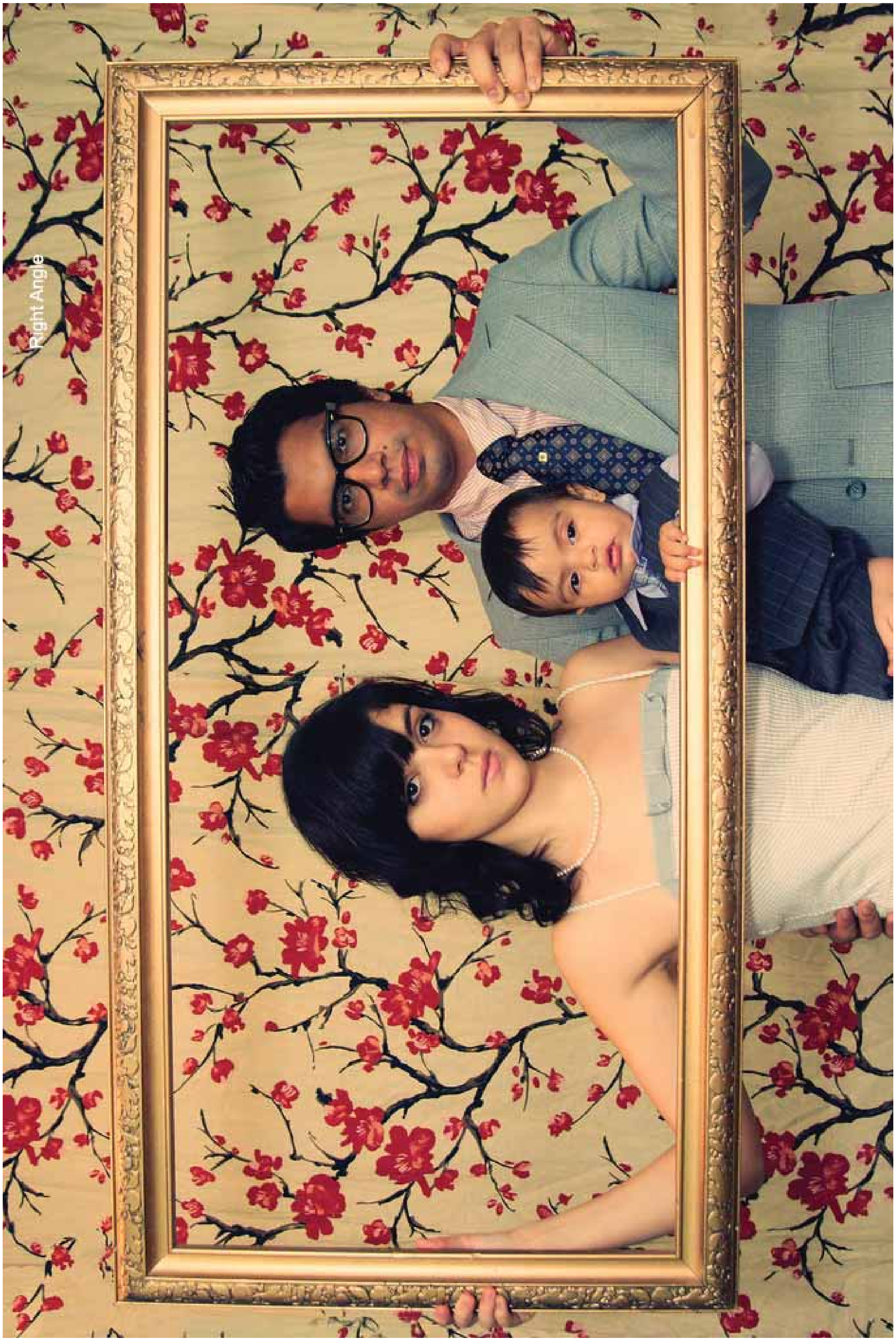


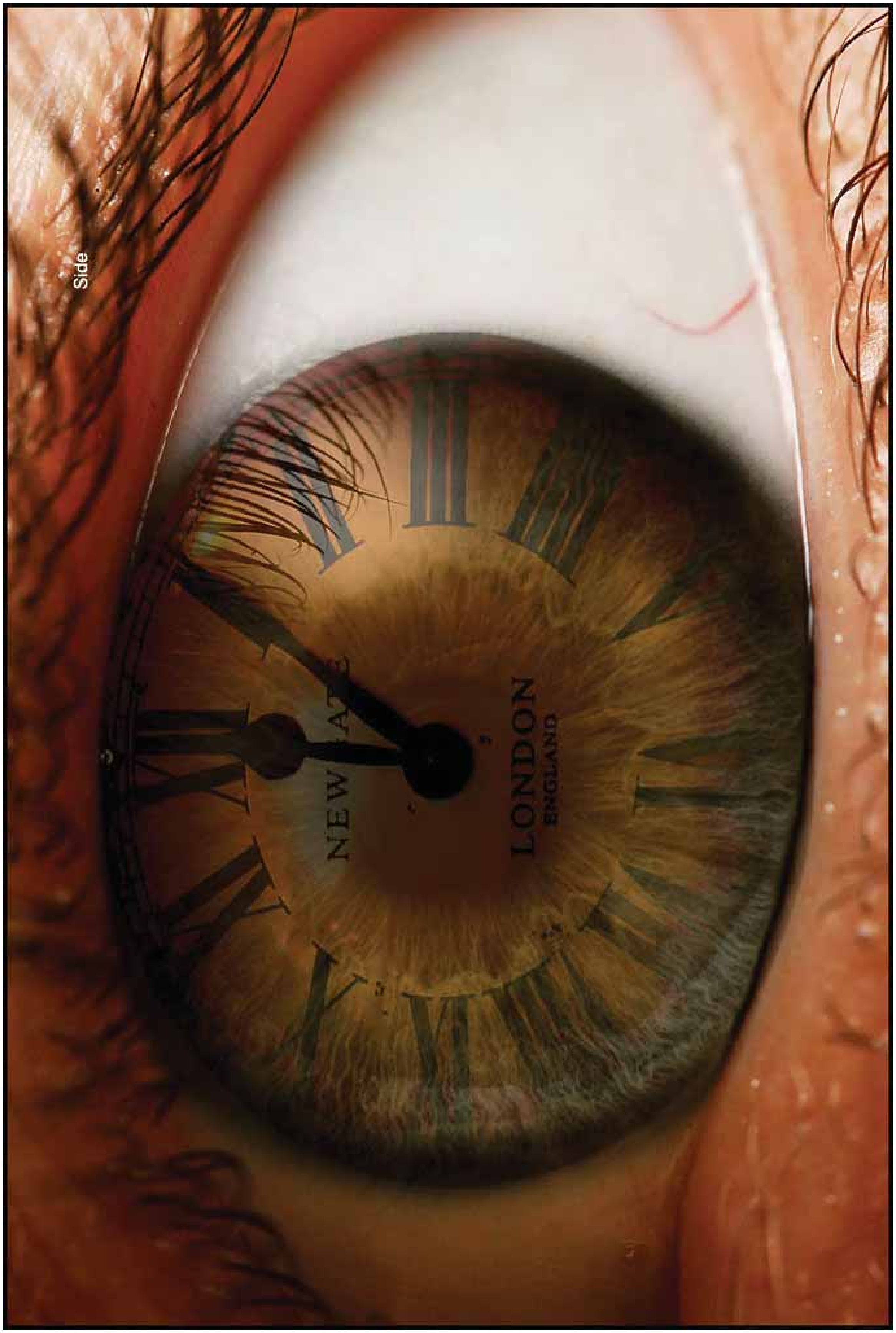

Linear Pair

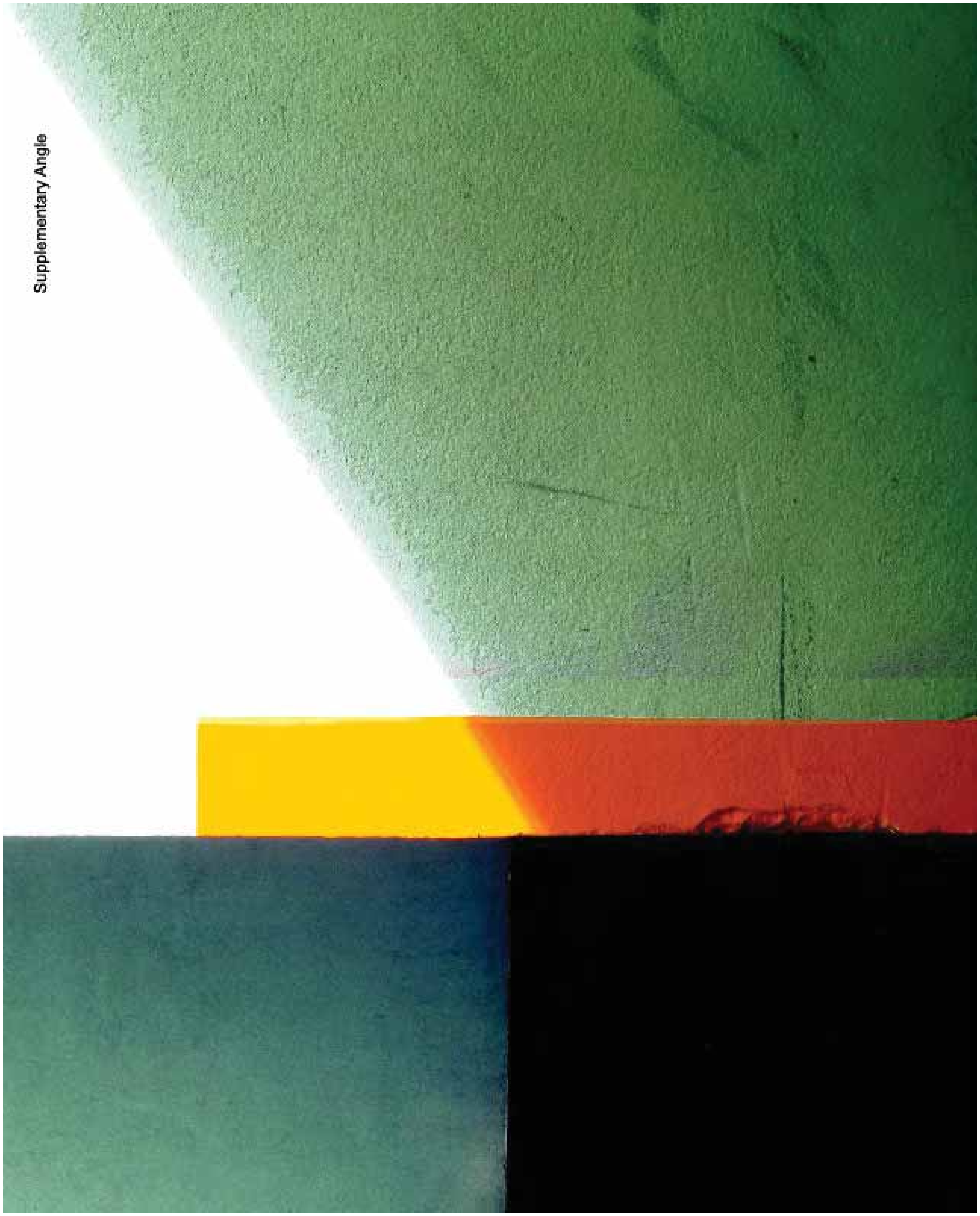

Obtuse Angle


Perpendicular Angle

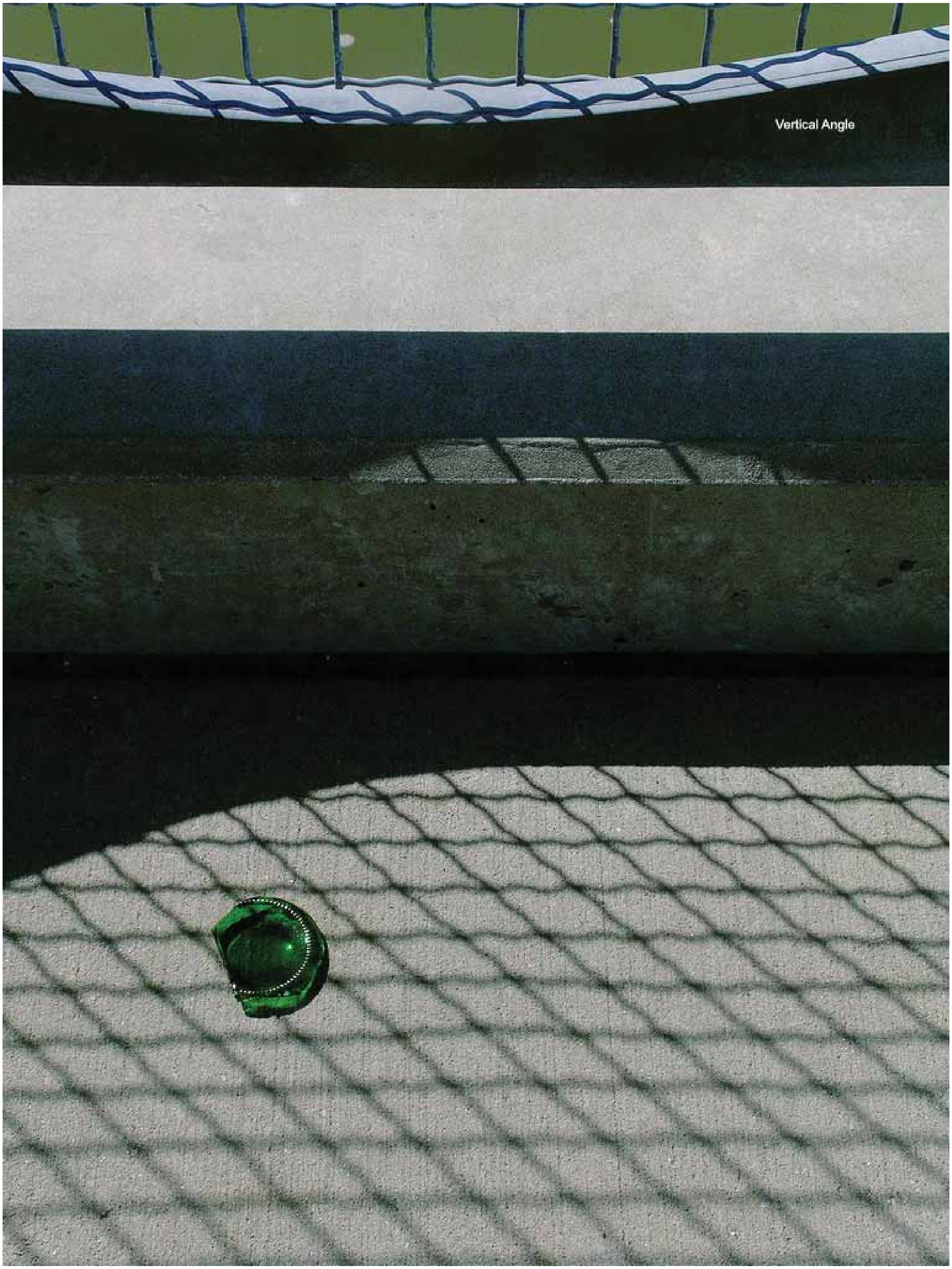

Radian
$\frac{\pi}{2}$
$\frac{\pi}{3}$
$\frac{\pi}{6}$
0
$\frac{11\pi}{6}$
$\frac{5\pi}{3}$
$\frac{3\pi}{2}$
$\frac{4\pi}{3}$
$\frac{7\pi}{6}$
π
$\frac{5\pi}{6}$
$\frac{2\pi}{3}$


Right Angle


Side
LONDON
ENGLAND



Supplementary Angle


Vertical Angle

True-False Sentences

(Listening and/or Reading Comprehension)

1. The two rays that make up an **angle** have a common starting point
2. A ruler can be used to get an **angle measure.**
3. A **degree** is one of 360 divisions of a circle.
4. A **radian** is the unit of measure used on a compass
5. Not all angles have a **vertex**.
6. Every angle has three **sides**.
7. The adjacent sides of a square form **right angles.**
8. **Perpendicular** lines never intersect.
9. A small, sharp angle would be an **acute angle.**
10. An **obtuse angle** is larger than a right angle.
11. **Adjacent angles** could add up to 100 degrees.
12. Angles in a **linear pair** are always acute angles.
13. An obtuse angle can be **complementary** to another angle.
14. **Supplementary angles** must be acute angles
15. **Vertical angles** are formed by two intersecting lines

Answers: 1T, 2F, 3T, 4F, 5F, 6F, 7T, 8F, 9T, 10T, 11T, 12F, 13F, 14F, 15T

1. **Angles** can be measured in inches.
2. **Angle measures** represent the amount of “turning” between two rays.
3. Line segments are measured in **degrees**.
4. A circle is made up of 2ϖ (or about 6.28) **radians.**
5. The common starting point for the two rays in an angle is called the **vertex**.
6. The **side** of an angle is the same as one of the rays of the angle.
7. **Right angles** have measures of 100 degrees.
8. When two lines intersect to form right angles, they are **perpendicular.**
9. At 12:25, the hands of a clock form an **acute angle**.
10. An **obtuse angle** might have a measure of 85 degrees.
11. Two angles that are across from each other are **adjacent angles.**
12. In a **linear pair**, the angle measures add up to 180 degrees.
13. A 60 degree angle and a 30 degree angle are **complementary angles.**
14. Angles in a linear pair are **supplementary**.
15. **Vertical angles** are next to each other.

Answers: 1F, 2T, 3F, 4T, 5T, 6T, 7F, 8T, 9F, 10F, 11F, 12T, 13T, 14T, 15F

Match the Halves

1. Vertical angles	A. is given in degrees or radians.
2. Two rays with a common vertex	B. is one of its rays.
3. Two angles whose measures add up to 180^o	C. are perpendicular.
4. An angle measure	D. acute angles.
5. In an angle, the vertex is	E. share a common ray.
6. To make up a linear pair, angles	F. make up each and every angle
7. Angles with measures of 90^o are	G. are measured in radians.
8. One of 360 divisions of a circle	H. the point shared by two rays.
9. Complementary angles are always	I. measure less than 90 ^{o}
10. Angles related to the speed of revolution	J. are opposite each other.
11. The side of an angle	K. must be adjacent.
12. Adjacent angles	L. is known as a degree.
13. Angles between 90^o and 180^o are	M. right angles.
14. Lines that intersect to form right angles	N. obtuse angles.
15. Acute angles	O. are supplementary.

Answers:

1 J 2F 3O 4A 5H 6K 7M 8L 9D 10G 11B 12E 13N 14C 15I

Definitions

Angle: Two rays with a common starting point.

Angle measure: The size of an angle, or amount of turning or space between the two rays of an angle, measured in degrees or radians.

Degree: /360th of a circle; a unit of angle measure.

Radian: 1/2ϖ; a unit of angle measure often used to measure the amount of revolution.

Vertex (of an angle): The point where the two rays of an angle meet.

Side (of an angle): Either of the two rays that make up an angle.

Right angle: A 90^{o} angle.

Perpendicular: At a 90^{o} angle.

Acute angle: An angle that has a measure less than 90^{o}.

Obtuse angle: An angle that has a measure more than 90° and less than 180°.

Adjacent angles: Angles that are immediately next to each other.

Linear pair: A pair of adjacent angles formed by intersecting lines.

Complementary angles: Two acute angles that add up to 90^{o} .

Supplementary angles: Two angles whose measures add up to 180^{o}.

Vertical angles: A pair of angles that are opposite each other, formed by two lines that intersect.

Which Belongs

1. The size of an angle is known as (a radian, an angle measure, a degree).
2. When two lines intersect, they always form (vertical, acute, right) angles.
3. A unit of angle measure that commonly is associated with turning or revolutions is the (degree, radian, diameter).
4. If two adjacent angles are formed by intersecting lines, they are (vertical angles, a linear pair, complementary angles).
5. The (side, measure, complement) of an angle is either of its two rays.
6. (Complementary, Supplementary, Vertical) angles have measures that add up to 90^{o}.
7. When two adjoining rays are perpendicular, they form (an obtuse, a vertical, a right) angle.
8. (An acute, a right, an obtuse) angle has a measure larger than 90^{o}.
9. Lines, rays, or segments that are at a 90^{o} angles to each other are (vertical, perpendicular, adjacent).
10. Two rays of an angle meet at the (midpoint, vertex, side.)
11. At 3:10 PM, the hands of a clock represent (an acute, an obtuse, a right) angle.
12. There are 360 (degrees, radians, sides) in a circle.
13. Angles that share a common ray are (vertical, linear, adjacent) angles.
14. (A linear pair, a vertex, an angle) has two rays that meet at a common point.
15. If two angle measures add up to 180^{o}, the angles are (supplementary, complementary, adjacent).

1. An angle measure
2. Vertical
3. Radian
4. A linear pair
5. Side
6. Complementary
7. A right
8. An obtuse
9. Perpendicular
10. Vertex
11. An acute
12. Degrees
13. Adjacent
14. An angle
15. Supplementary

Multiple Choice

1. Which one of the following would not contain any representations of angles?
   a) an exercise ball.
   b) a pair of dice
   c) the roof of a house.

2. Which of the following describes an angle measure?
   a) the amount that the sides of an angle are spread apart, in degrees
   b) the size of an angle in centimeters
   c) the number of metric units in an angle.

3. Any circle contains
   a) 380 degrees
   b) 2ϖ radians
   c) both of the above

4. The angle of a roofline might be measured in
   a) ergs or degrees
   b) degrees or radians
   c) feet or radians

5. When two streets on a map intersect at an angle, the point where they meet would be
   a) the side of the angle
   b) the center of the angle
   c) the vertex of the angle

6. The side of an angle might be represented by
   a) a blade on an open pair of scissors
   b) the corner of a notebook
   c) the edge of a plate

7. In which of the following places would you find the most right angles?
   a) the dome of a cathedral
   b) a school building
   c) the interior of a car

8. A tree is perpendicular to the ground if
   a) it grows straight up
   b) it is growing in a place that is flat
   c) both of the above are true.

9. If you make a very sharp right turn at a road intersection, you would be turning at
   a) an acute angle
   b) a supplementary angle
   c) a perpendicular angle

10. An obtuse angle
   a) must measure less than 90^o
   b) cannot have a measure of more than 180^o
   c) could also be a right angle

11. When two lines intersect, they form
   a) one pair of adjacent angles and one pair of vertical angles
   b) two pairs of complementary angles and two pairs of adjacent angles
   c) four pairs of adjacent angles and two pairs of vertical angles.

12. Which of the following are the same?
   a) adjacent supplementary angles and a linear pair
   b) vertical angles and adjacent complementary angles
   c) adjacent right angles and complementary angles

13. If an angle is complementary to another angle, it must be
   a) a right angle
   b) an acute angle
   c) an obtuse angle

14. Vertical angles are never
   a) obtuse
   b) supplementary
   c) adjacent

15. Supplementary angles always
   a) make up a linear pair
   b) are adjacent
   c) have measures that add up to 180^o

1. a	6. a	11. c
2. a	7. b	12. a
3. c	8. c	13. b
4. b	9. a	14. c
5. c	10. b	15. c

Complete the Sentence

1. The two rays of an angle are also called the two ________________.
2. Complementary angles are always _____________________angles.
3. A(n) __________________________is the amount of turning or space between two rays that form an angle.
4. Angles that are formed by intersecting lines are _____________________if they are not adjacent.
5. When a ray moves in a complete circle, it covers a distance of 2 ϖ ____________.
6. When two rays begin at a common point, they form a(n) ____________________.
7. The corners of a rectangle are ________________angles.
8. _________________angles have measures that add up to equal a right angle's measure.
9. In most buildings the walls are ____________________to the floor.
10. In an angle, the __________________________ is the point where two rays meet.
11. Angles are _____________________if they are wider than right angles and measure less than 180^o.
12. On a compass, angles are measured in ____________________.
13. When supplementary angles are not adjacent, they don't form a _____________.
14. Two right angles would also be ____________________angles.
15. _______________________angles are next to each other, and share a common ray.

Answers

1. sides
2. acute
3. angle measure
4. vertical
5. radians
6. angle
7. right
8. complementary
9. perpendicular
10. vertex
11. obtuse
12. degrees
13. linear pair
14. supplementary
15. 15. adjacent

Creative Writing

Have the students write sentences of their own, based on the picture below. When finished, have each student read his/her sentences to the others.

Place-Based Practice Activity

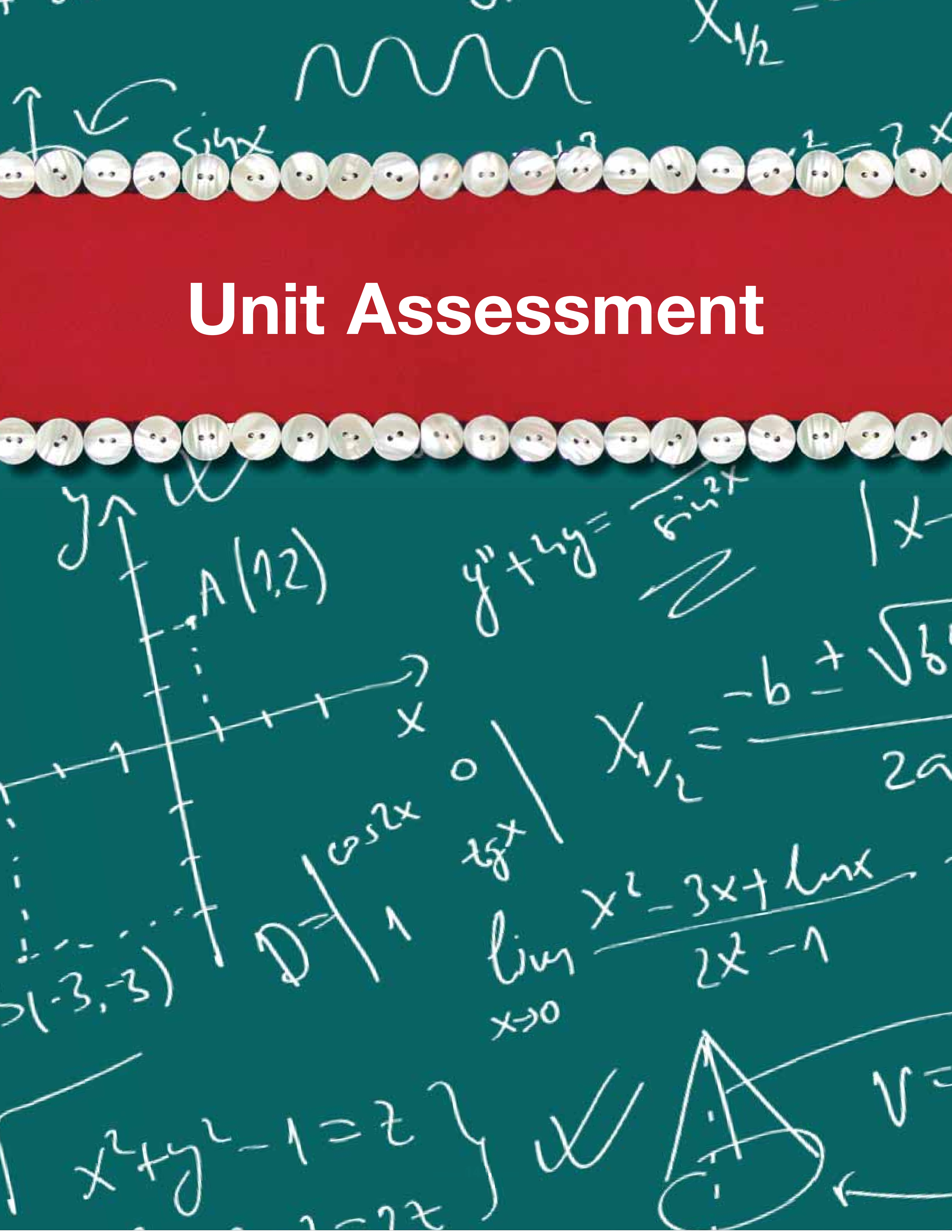
Ask students to find and photograph representations of different types of angles in their own environment. Students may work in pairs or small groups, sharing a camera, or they may sketch things they find if cameras are not available.

The following types of angles should be included:

Right angles
Acute angles
Obtuse angles
Vertical Angles
Linear pairs of angles
Adjacent angles
Supplementary angles
Complementary angles
Vertical angles

Depending on time available, have each student or group try to find at least one of each angle type, or assign two or three angle types to each student/group.

Allow class and/or homework time for students to take the photos, then share and compile them in a display or a slide show.



Unit Assessment

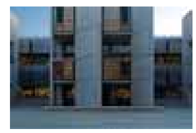
Geometry: Unit 2-Angles

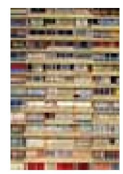
Name: ____________________
Date: ____________________

Match the symbol on the right with the word it represent on the left. Place the letter of the correct symbol in front of the word it matches.

1) _____ angles
2) _____ degree
3) _____ acute angle
4) _____ obtuse angle
5) _____ perpendicular
6) _____ linear pair
7) _____ adjacent angle
8) _____ complementary angle

a. 

b. 

c. 

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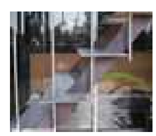
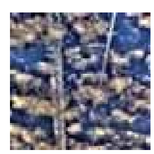
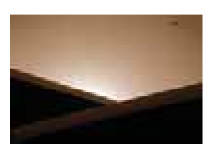
e. 

f. 

g. 

h. 

Word Bank		
acute	angle	complementary
degree	obtuse	perpendicular
right	vertex	vertical

9) A stop sign has ________ angles.

10) The lines of grout between tiles are ________.

11) On a clock with sweep hands, the time 12:05 creates a ________ triangle.

12) The corner of a window or of a door creates a ________ angle.

13) When you use a protractor to find out the size of an angle, or amount of turning or space between the two rays of an angle, measured in degrees or radians you calculating an ________ measure.

14) A pair of angles that are opposite each other, formed by two lines that intersect are ________ angles.

15) The corner of a piece of paper where the edges meet is the ________ of an angle.

Multiple Choice: Read each statement below and select the answer that fits best. Circle letter in front of you best choice.

16) Either of the two rays that make up an angle are the ____________ of an angle.

a) vertex

b) degree

c) side

17) Another unit for measuring angles, often used to measure the speed at which wheels and machine parts revolve is the ____________.

a) radian

b) vertex

c) degree

18) Two angles whose measures add up to 180^{o} are called _______________.

a) obtuse angles

b) complementary angles

c) adjacent angles

19) ___________ angles are pair of angles that are opposite each other, formed by two lines that intersect.

a) vertical

b) complementary

c) supplementary

20) A unit of angle measure is known as a _______.

Illustrations of key vocabulary:

21) Draw the triangles below each of the key vocabulary words they represent.

acute angle obtuse angle vertical angle adjacent angle

Geometry: Unit 2-Angles

Name: ___________________
Date: ___________________

Match the symbol on the right with the word it represent on the left. Place the letter of the correct symbol in front of the word it matches.

1) __g__ angles
2) __h__ degree
3) __f__ acute angle
4) __b__ obtuse angle
5) __e__ perpendicular
6) __d__ linear pair
7) __c__ adjacent angle
8) __a__ complementary angle

a. illustration of complementary angle
b. illustration of obtuse angle
c. illustration of adjacent angle
d. illustration of linear pair
e. illustration of perpendicular lines
f. illustration of acute angle
g. Illustration of angle
h. illustration of degree

Word Bank		
acute	angle	complementary
degree	obtuse	perpendicular
right	vertex	vertical

9) A stop sign has __obtuse__ angles.

10) The lines of grout between tiles are __perpendicular__.

11) On a clock with sweep hands, the time 12:05 creates a __acute__ triangle.

12) The corner of a window or of a door creates a __right__ angle.

13) When you use a protractor to find out the size of an angle, or amount of turning or space between the two rays of an angle, measured in degrees or radians you calculating an __angle__ measure.

14) A pair of angles that are opposite each other, formed by two lines that intersect are __vertical__ angles.

15) The corner of a piece of paper where the edges meet is the __vertex__ of an angle.

Multiple Choice: Read each statement below and select the answer that fits best. Circle letter in front of you best choice.

16) Either of the two rays that make up an angle are the ____________ of an angle.

a) vertex

b) degree

c) side

17) Another unit for measuring angles, often used to measure the speed at which wheels and machine parts revolve is the ____________.

a) radian

b) vertex

c) degree

18) Two angles whose measures add up to 180o are called _______________.

a) obtuse angles

b) complementary angles

c) adjacent angles

19) ____________ angles are pair of angles that are opposite each other, formed by two lines that intersect.

a) vertical

b) complementary

c) supplementary

20) A unit of angle measure is known as a **degree**.

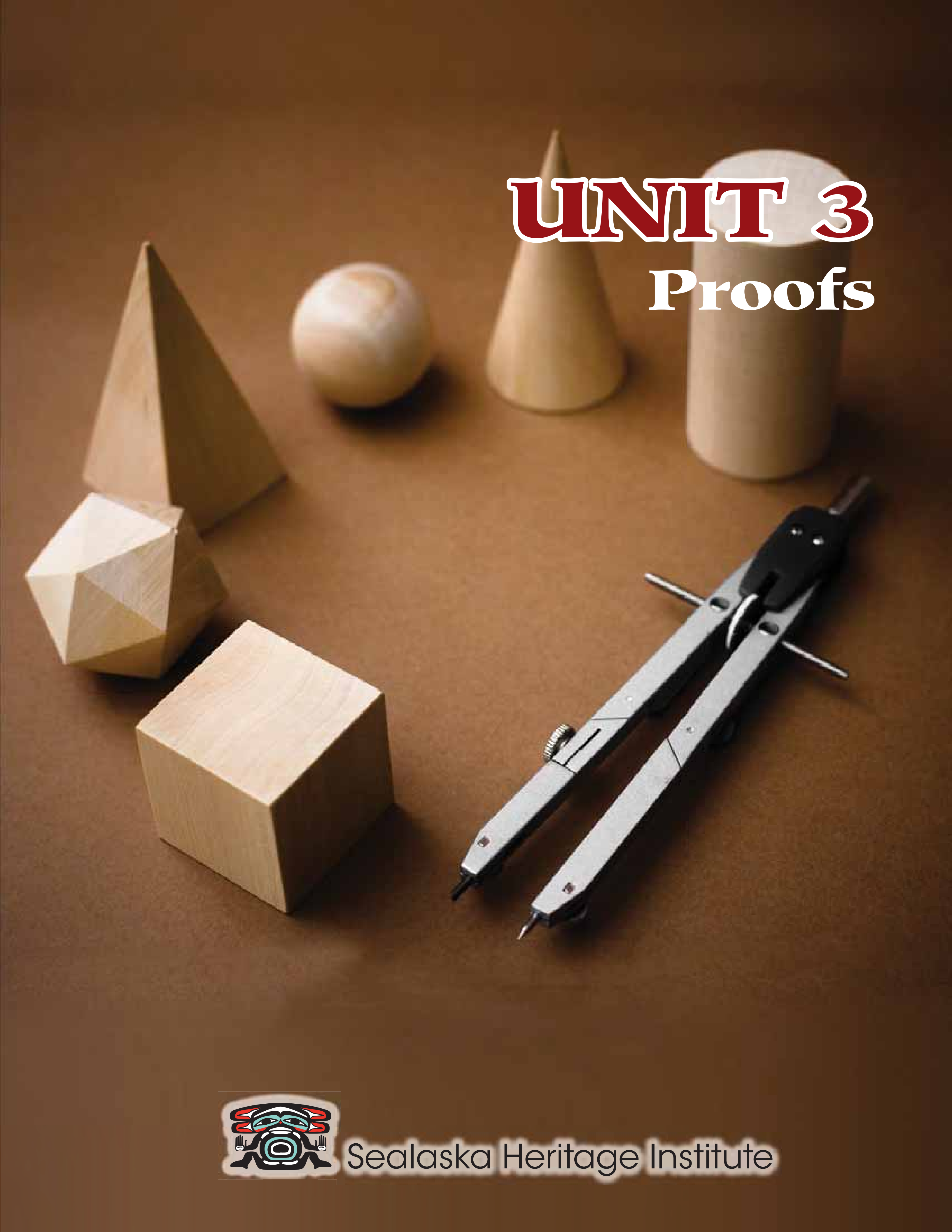
Illustrations of key vocabulary:

21) Draw the triangles below each of the key vocabulary words they represent.

acute angle obtuse angle vertical angle adjacent angle

Illustrations of acute angle obtuse angle vertical angle adjacent angle

UNIT 3
Proofs



Sealaska Heritage Institute

Grade Level Expectations for Unit 3

Unit 3—Proofs

Alaska State Mathematics Standard C
A student should understand and be able to form and use appropriate methods to define and explain mathematical relationships.

A student who meets the content standard should:

C1) express and represent mathematical ideas using oral and written presentations, physical materials, pictures, graphs, charts, and algebraic expressions;

C2) relate mathematical terms to everyday language;

GLEs
The student communicates his or her mathematical thinking by

[9] PS-3 representing mathematical problems numerically, graphically, and/or symbolically, translating among these alternative representations; or using appropriate vocabulary, symbols, or technology to explain, justify,

and defend strategies and solutions

[10] PS-3 representing mathematical problems numerically, graphically, and/ or symbolically, communicating math ideas in writing; or using appropriate vocabulary, symbols, or technology to explain, justify, and defend strategies and solutions

The student demonstrates an ability to use logic and reason by

[9] PS-4 following and evaluating an argument, judging its validity using inductive or deductive reasoning and logic; or making and testing conjectures

[10] PS-4 using methods of proof including direct, indirect, and counterexamples to validate conjectures

Vocabulary & Definitions

Introduction of Math Vocabulary

conditional statement

A conditional statement is the combination of two statements in an "if-then" structure. For example: "If it is raining, then the field is wet." Ask students to help you think of more examples of "if-then" statements.

hypothesis

The hypothesis is the first part, or the "if" part, of an "if-then" statement. Use the picture to help students find the hypothesis of the previous statement. "If it is raining….." is the hypothesis in the conditional statement "If it is raining, then the field is wet".

conclusion

Conclusion means the last part of anything, the termination, or the end. It also means a reasoned deduction or inference. In geometry proofs, a conclusion is the part of an "if-then" (conditional) statement that comes after "then". Ask students if they know the conclusion for the conditional statement "If it is raining, then the field is wet" and show the picture.

converse

The converse of an "if –then" (conditional) statement is the statement that results when the two parts (hypothesis and conclusion) are switched. The converse of "If it is raining, then the field is wet" is "If the field is wet, then it is raining".

Show students the picture of the switch to help them remember that in the converse of a statement, the parts are switched.

Introduction of Math Vocabulary

negation

To negate something means to rule it out or deny it. In geometry proofs, a negation is a denial or an opposite statement, often created by inserting the word "not". For example, "It is not raining" is the negation of "It is raining".

inverse

Inverse means reversed in position, order, or direction. In geometry proofs, the inverse of a conditional ("if-then") statement is the statement that results when the "if" part (hypothesis) and the "then" part are both negated. For example, the inverse of "If it is raining, then the field is wet" would be "If it is not raining, then the field is not wet".

In the picture, the snowboard is turned to the opposite side, to represent the idea that you would write opposite statements when you negate both the hypothesis and the conclusion.

contrapositive

A contrapositive is a statement that results when the two parts (hypothesis and conclusion) of an "if-then" (conditional) statement are switched and both are negated. For example, if a conditional statement says "If it is raining, then the field is wet", its contrapositive would be "If the field is not wet, then it is not raining."

The picture shows something that is both upside down and backwards, to represent a contrapositive; because in a contrapositive you both switch the order of statements and create their opposites.

Introduction of Math Vocabulary

conjecture

A conjecture is a statement or opinion that is not based on evidence. It is an educated guess. Share some examples of conjectures:

"It will rain next week."
"Halibut tastes better than salmon to most people."
"Tourists are good for our town."

counterexample

A counterexample is an example that proves a statement to be false. For instance, the example "There is a cedar tree in my yard" proves that the statement "All trees in Southeast Alaska are hemlocks" cannot be true. It is a counterexample. (Assuming, of course, that the yard is in Southeast Alaska!).

The picture shows a counterexample of the statement "All swans are white". Or, maybe "All swans are black".

Introduction of Math Vocabulary

deductive reasoning

Deductive reasoning is a form of thinking that moves from the general to the particular. In deductive arguments, if the first statement (the premise or hypothesis) is true, the conclusion MUST be true. Arguments based on laws, rules, or other widely accepted principles are best expressed deductively. Here are a few examples of deductive reasoning:

> Newton's Law says that everything that goes up must come down (a general statement), so if I throw this ball into the air, it will come down (a particular situation).
>
> Alaskan residents are residents of the United States (a general rule or definition), so my mom is a resident of the United States (a particular example).
>
> All bears are mammals (a rule). All mammals have lungs (a rule). So bears must have lungs (a specific example).

The picture of the gavel represents the idea that deductive arguments start with laws, rules, and accepted principles.

inductive reasoning

Inductive reasoning is the opposite of deductive reasoning. It is a form of thinking that moves from the specific to the general. Generalizations are made based on individual instances. In inductive reasoning, statements are made that support a conclusion but that do not automatically insure that it will be true. If the statements are true, then the conclusion is POSSIBLY true. Arguments based on experience or observations are best expressed inductively. Here are a few examples of inductive reasoning:

> The last three times that I threw a ball into the air, it came down again. So, if I throw a ball in the air now, it will come down again.

Introduction of Math Vocabulary

My mom is a resident of the United States and so am I, so all Alaskan residents are residents of the United States.

Every bear we have seen is black, so the next bear we see will be black.

This picture of a person observing bears expresses the idea that inductive reasoning begins with observations and experiences.

proof

A proof in geometry is a demonstration of the truth of a mathematical or logical statement based on postulates and theorems. In a proof, a sequence of steps, statements, or demonstrations that leads to a valid conclusion.

postulate

A postulate is a statement accepted as true without proof. A postulate should be so simple and direct that it seems to be unquestionably true. Examples of postulates used in geometry are:

"Through any two points, there is exactly one line." Or "A circle can be drawn with a center and any radius."

Show the picture and tell students "You might not really question this man; he is expressing himself in a very simple and direct way!"

Introduction of Math Vocabulary

theorem

Theorem is a mathematical statement that can be proved true using the rules of logic. A theorem is proven from properties, postulates, or other theorems already known to be true.

This picture of a sign represents "theorem" because theorems are statements that have been proven according to rules.

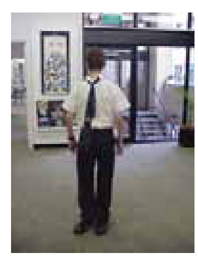
corollary

A corollary is a natural consequence or easily drawn conclusion. In geometry, it is a theorem or proposition that follows with little or no proof required from one already proven. A special case of a more general theorem which is worth noting separately.

The picture represents a corollary: If a person eats a lot of fat-laden food, a natural consequence would be that they gain weight!

indirect proof

An indirect proof is proof by contradiction. A statement (conjecture) is proved by assuming that the conjecture is false. If this assumption leads to a contradiction (something absurd!), it shows that the assumed false conjecture is impossible. Therefore the original statement must have been true. In an indirect proof, all of the alternatives are ruled out.



For example, imagine that John, Joe, Sue, and Terry are the only people on an isolated island and Joe has been shot with an arrow. Sue makes a conjecture that Terry was the shooter. To prove it, first she assumes that the conjecture is false: Terry was not the shooter.   Joe could not have shot himself, and Sue knew that she did not shoot him. So, it had to be John or Terry. John has a broken arm and can't shoot a bow. That contradicts the idea that he was the shooter. The assumed false conjecture that Terry was not the shooter is now impossible. So, Terry must have been the shooter.

The picture shows a young man who is turned around and backwards, so it might represent an indirect method of proof; a method that starts with an opposite conjecture.

Introduction of Math Vocabulary

verify

To verify something means to test and confirm its truth.   In ma
cess of confirming that a solution is correct by making sure it sa
all of the conditions, equations and/or inequalities in a problem.

summarize

To give a concise, comprehensive statement or an abridged account of something. A summary contains the important facts and main points without all of the details.

A summary is shorter and "smaller", like the little dog.

Language and Skills Development

Using the Math Vocabulary Terms

Language & Skills Development

LISTENING

Use the activity pages from the Student Support Materials.

The Hidden Words

Say a vocabulary word for the students. Tell the students to listen for that vocabulary word as you say a running story. Provide each student with writing paper and a pen. When the students hear the vocabulary word in the running story, they must make a check mark on their papers each time the word occurs. Depending upon the readiness of your students, you may wish to have them listen for two or three words. In this case, have the students make a check mark for one word, and a "X" and an "O" for the other words.

SPEAKING

What's the Date?

Before the activity begins, collect an old calendar or calendars of different years. Say the name of a month to a student. The student should then say a date within that month. Look on the calendar to see which day the date represents. If the date represents a day between Monday and Friday, the students should identify a vocabulary illustration you show or he/she should repeat a sentence you said at the beginning of the round. However, if the date named by the student is a Saturday or Sunday, the student may "pass" to another player. Repeat until many students have responded.

READING

Use the activity pages from the Student Support Materials.

The Lost Syllable

Say a syllable from one of the sight words. Call upon the students to identify the sight word (or words) that contain that syllable. Depending upon the syllable you say, more than one sight word may be the correct answer. This activity may also be done in team form. In this case, lay the sight word cards on the floor. Group the students into two teams. Say a syllable from one of the sight words. When you say "Go," the first player in each team must rush to the sight word cards and find the sight word that contains the syllable you said.

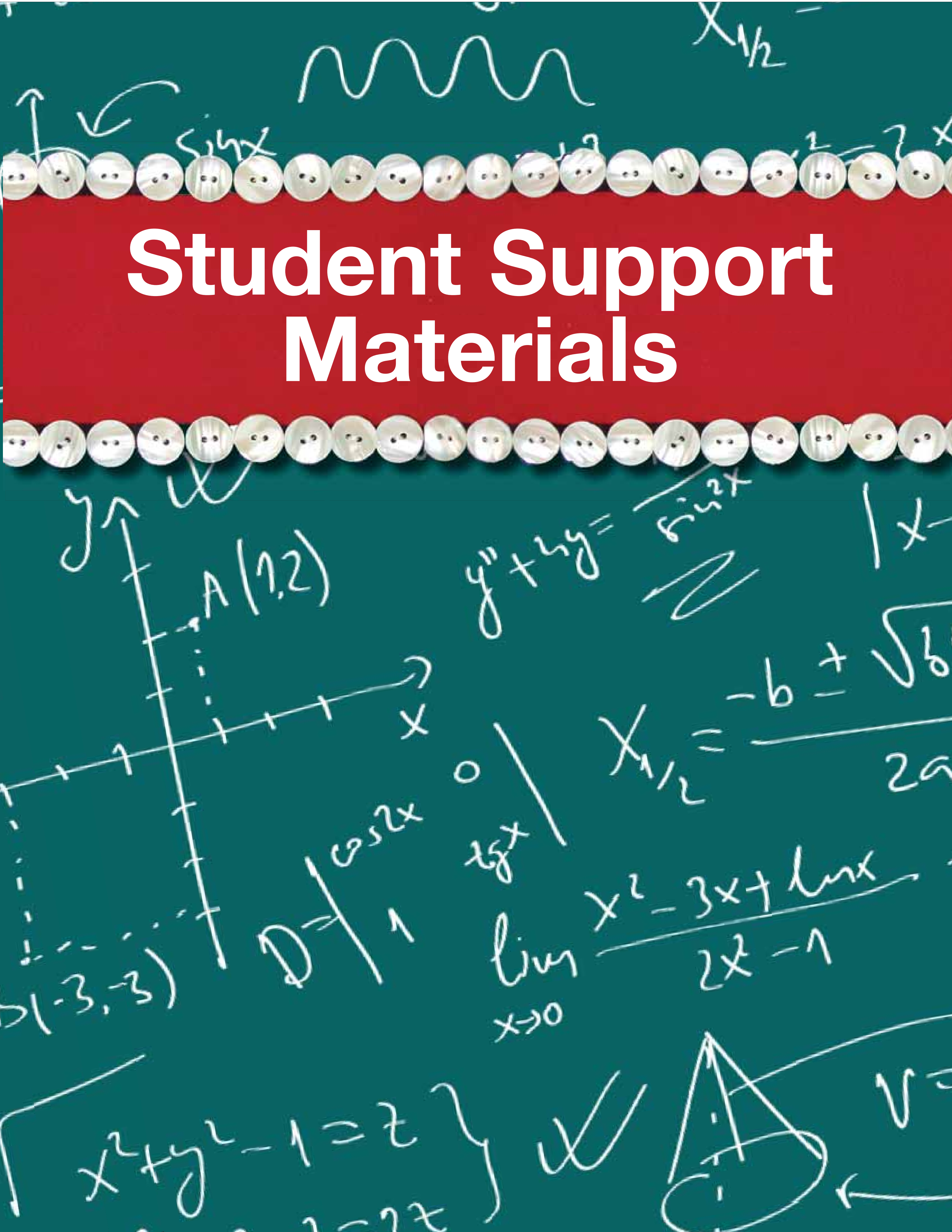
WRITING

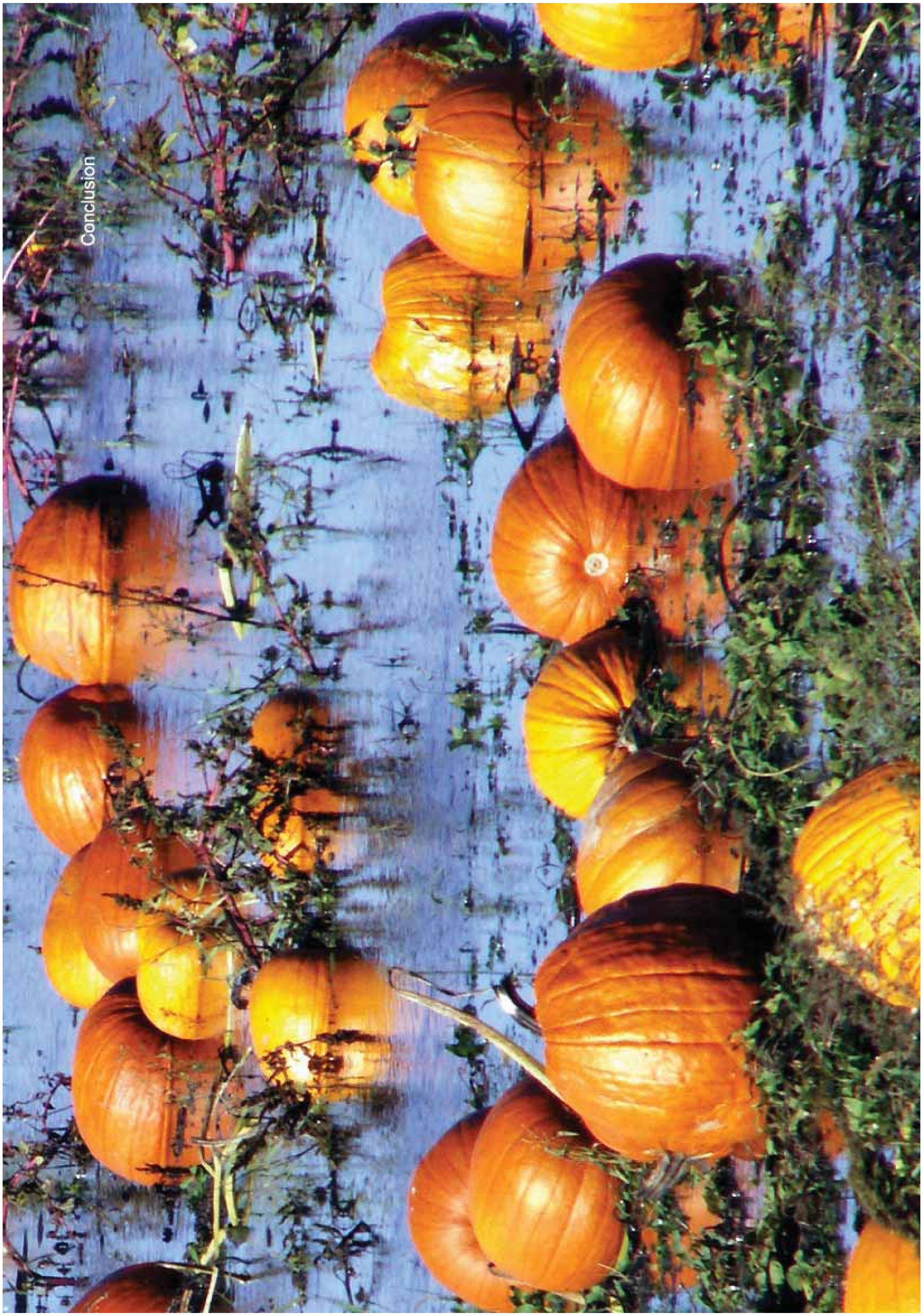
Use the activity pages from the Student Support Materials.

The Other Half

Cut each of the sight words in half. Give each student a sheet of writing paper, a pen and one of the word-halves. Each student should glue the word-half on his/her writing paper and then complete the spelling of the word. You may wish to have enough word-halves prepared so that each student completes more than one word. Afterwards, review the students' responses.

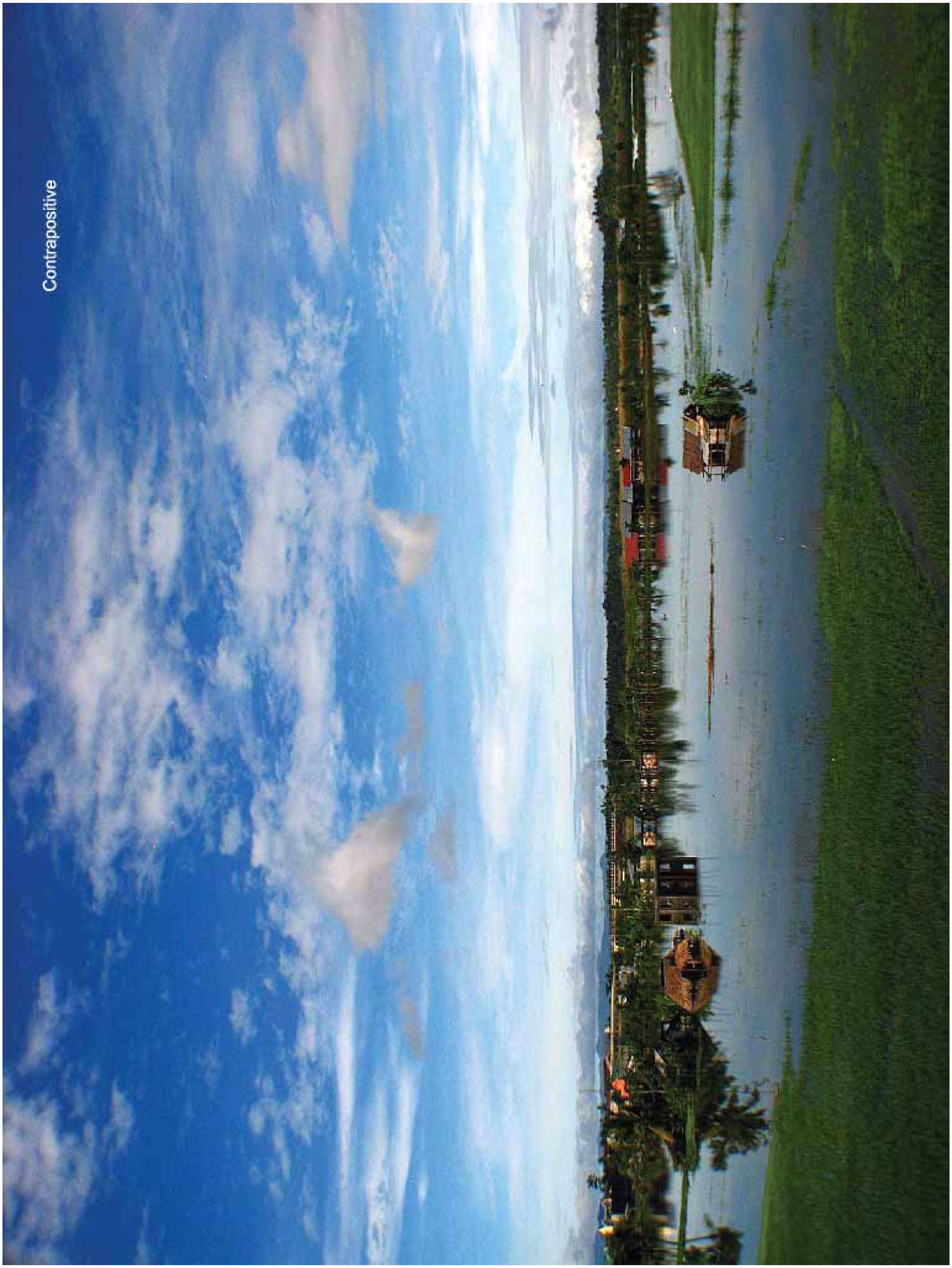
Student Support Materials

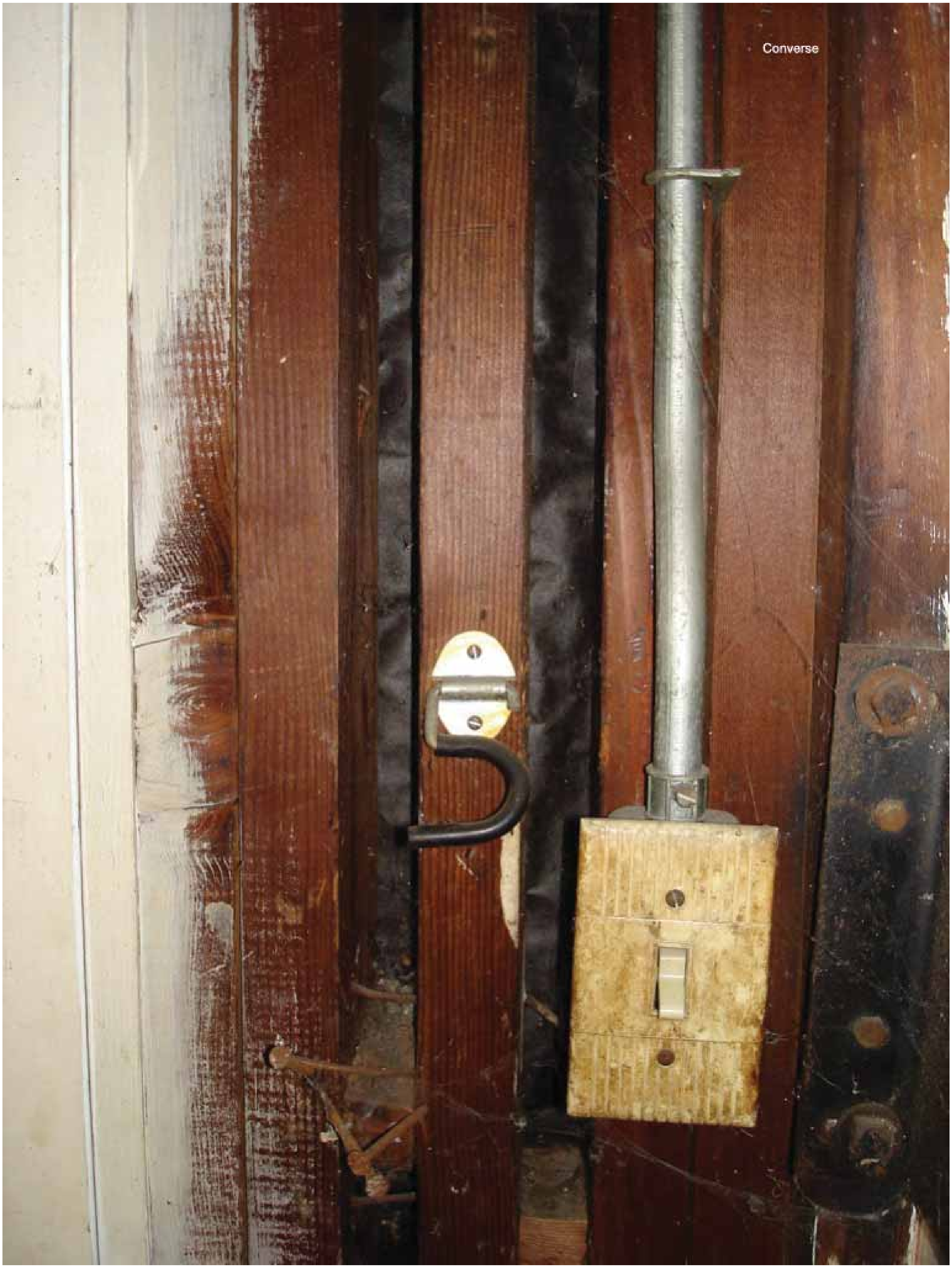



Conclusion

Conditional Statement

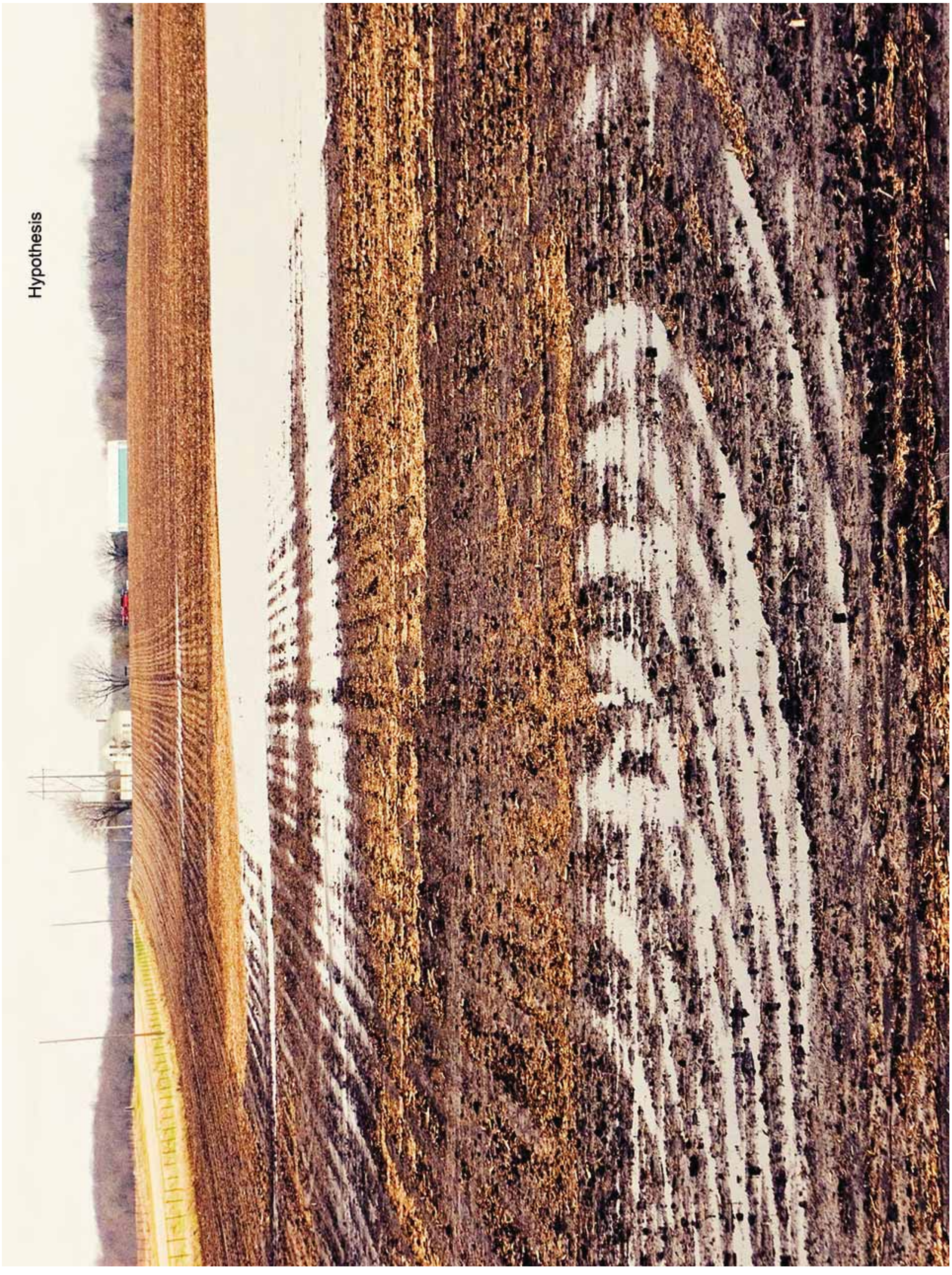

Conjecture

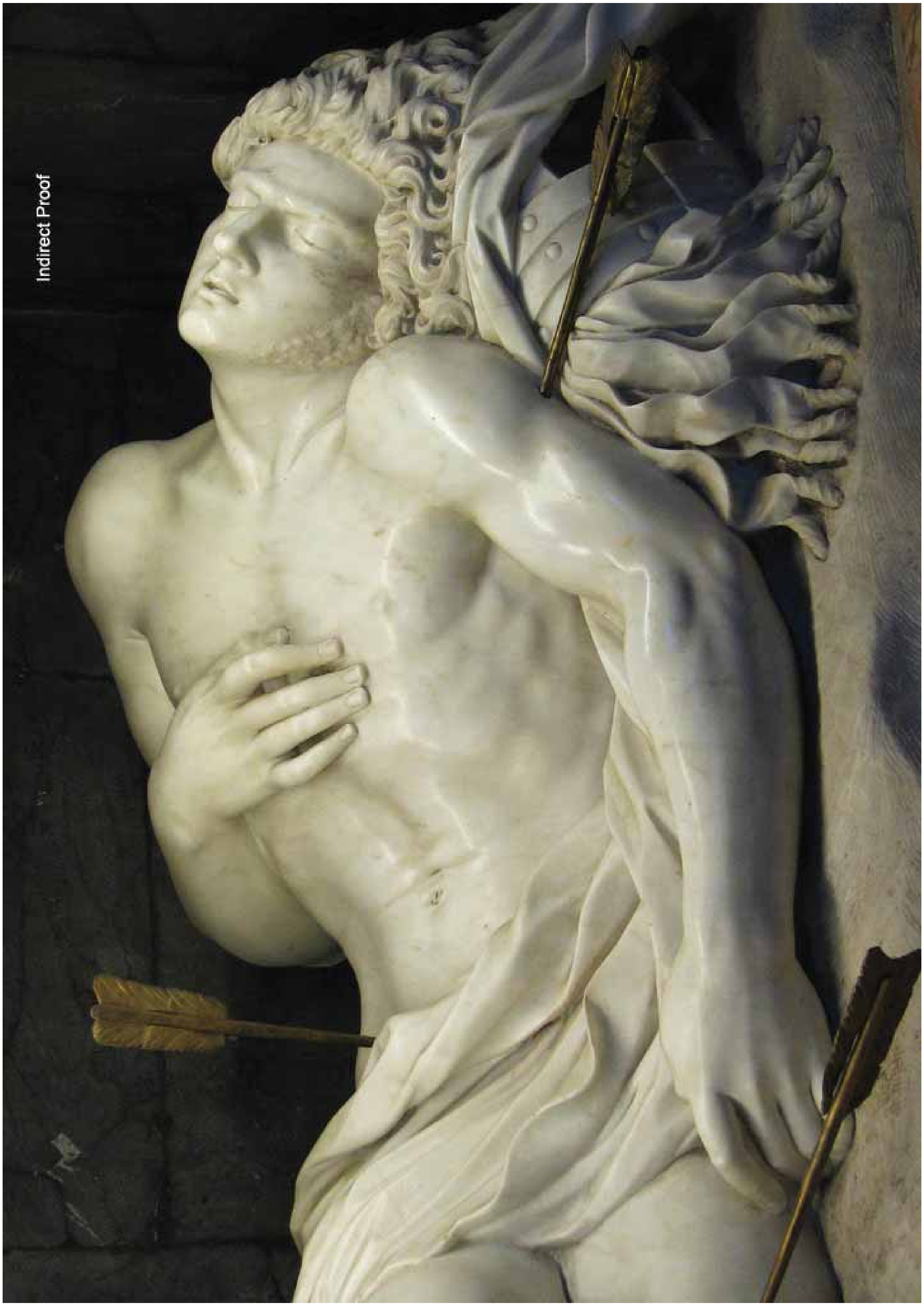




Counterexample

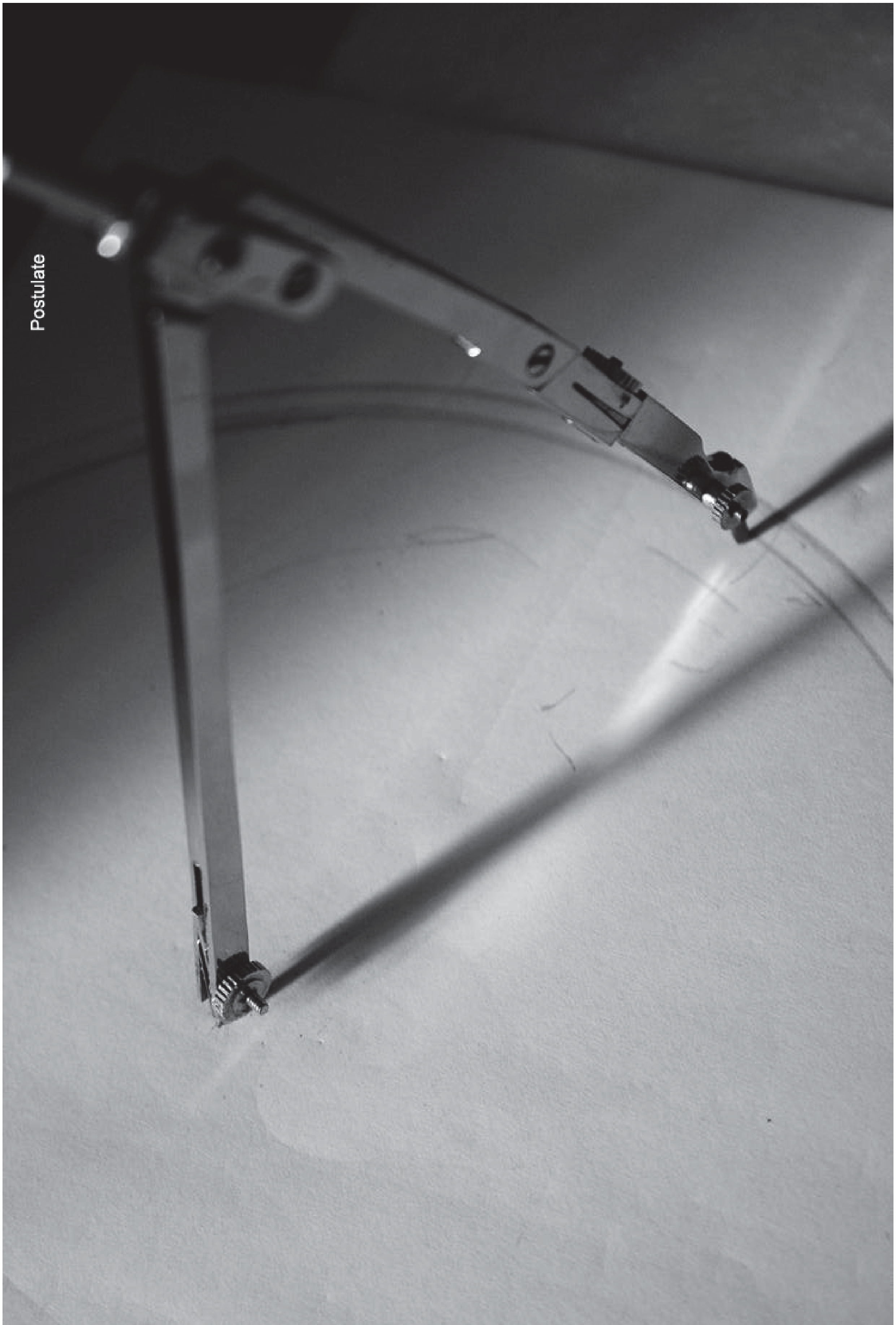

Deductive



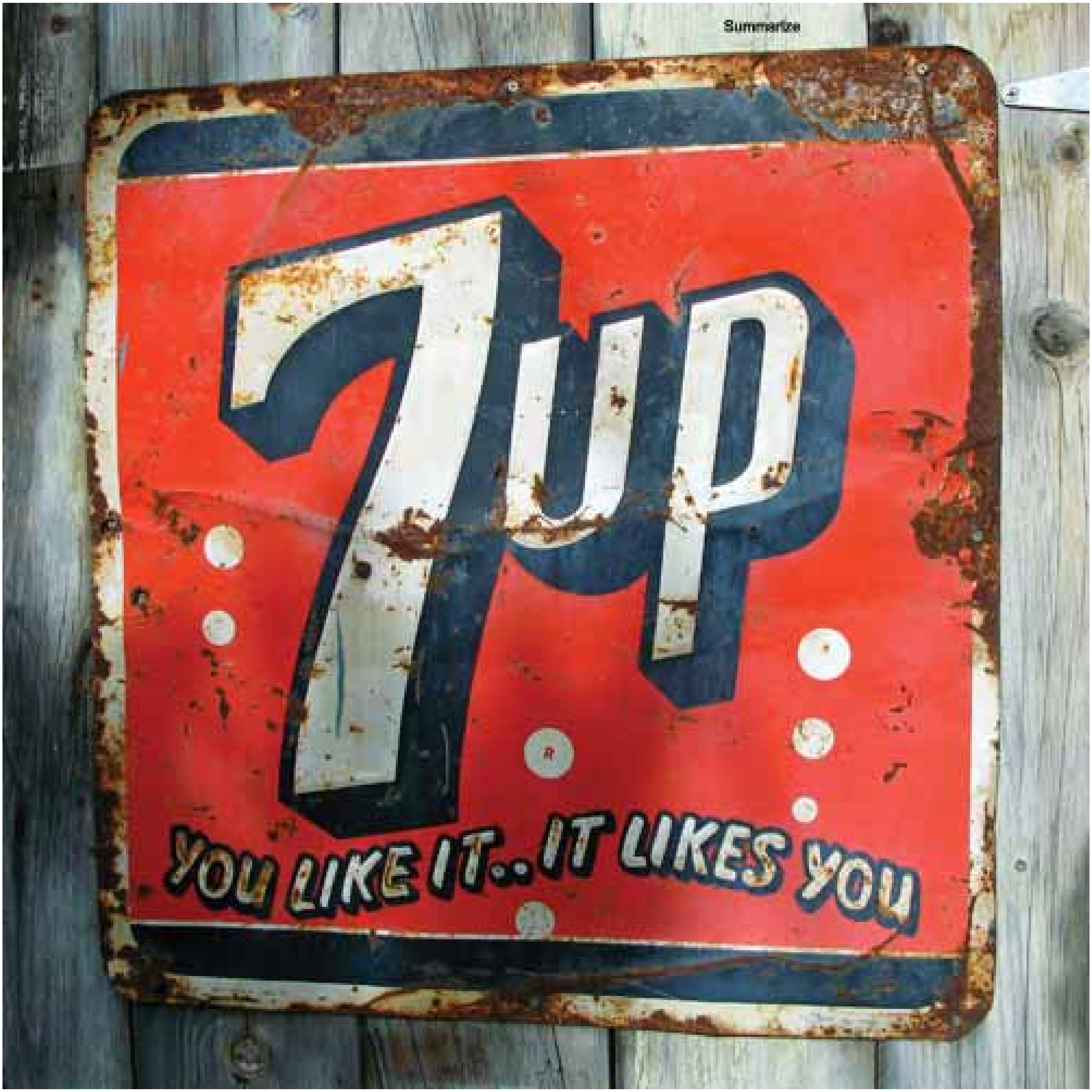



Inductive


Inverse
Topside
Underside




Proof


7up
YOU LIKE IT.. IT LIKES YOU


Theorem


Does he really have
his father's eyes?
DNA LAB CENTE
· PEACE OF MIND
· COURT DNA
· IMMIGRATION
718-940 4 DNA (362
2239 Church Avenue.
(BET: FLATBUSH & BEDFORD)

True-False Sentences

(Listening and/or Reading Comprehension)

1. "If tomorrow is Monday" could be an example of a **conclusion**.
2. A **conditional statement** always starts with "if".
3. "It will take 22 minutes to walk to school" is an example of a **conjecture**.
4. A **contrapositive** is created by negating the "if" and "then" parts of a statement and switching their order.
5. To create the **converse** of a statement, you negate both parts.
6. A floating canoe is a **counterexample** of the statement "all boats float".
7. An example of **deductive reasoning** might be "It rained for the last 20 days, so it will rain tomorrow".
8. **Inductive reasoning** involves drawing conclusions from observations and experiences.
9. To write the **inverse** of "If it snows, it is cold" you would say "If it snows, it is not cold".
10. To **negate** something, you have to prove that it is false.
11. A **proof** is a demonstration of the truth of a statement.
12. A statement that is accepted as true without proof is a **postulate.**
13. A **theorem** is a statement that has been proven according to rules of logic.
14. A **corollary** to a theorem is a special case of that theorem.
15. No assumptions are made as part of an **indirect proof**.
16. It is possible to **verify** every postulate in geometry.
17. When something is **summarized**, it is described in a concise way.
18. In science, the word **hypothesis** has exactly the same meaning that it does in geometry.

Answers: 1F, 2T, 3T, 4T, 5F, 6T, 7T, 8T, 9F, 10F, 11T, 12T, 13T, 14T, 15F, 16F, 17T, 18F

1. A **conclusion** always comes at the end of a conditional statement.
2. A **conditional statement** is never true.
3. A **conjecture** is usually incorrect.
4. The **contrapositive** of "If I go, then I will stay" would be "If I stay, then I do not go".
5. "If it is blue, then it is not red" is the **converse** of "If it is red, then it is not blue".
6. A **counterexample** shows that something cannot be true, by giving an example of something that doesn't fit the statement.
7. In **deductive reasoning,** an argument starts with a general rule or law, and applies that to a specific situation.
8. If you said "The legal speed limit is 55 mph, so driving at 50 mph is legal" you would be using **inductive reasoning**.
9. The **inverse** of a conditional statement is formed by negating both parts of the statement.
10. "I am not happy" is the **negation** of "I am happy".
11. In a **proof**, you can't use theorems that have already been proven.
12. An example of a **postulate** might be "All geometry students are smart and good-looking".
13. Every theorem automatically has a **corollary**.
14. A conjecture and a **theorem** are the same thing.
15. In an **indirect proof**, statements are proved by showing that the opposite of the statement creates a contradiction.
16. When you **verify** something, you test and check it to confirm that it is accurate.
17. To summarize something, you need to add extra information
18. A **hypothesis** is the first part of an "if-then" statement.

Answers: 1T, 2F, 3F, 4F, 5T, 6T, 7T, 8F, 9T, 10T, 11F, 12F, 13F, 14F, 15T, 16T,

Match the Halves

1. A conclusion is	A. Writing a concise, abridged account.
2. A conditional statement	B. A theorem
3. An educated guess or an opinion might be called	C. Showing that there is a contradiction when you assume that it is false.
4. A hypothesis is	D. Inserting the word “not”.
5. He summarized the process by	E. The last part of a conditional statement
6. When Calvin checked and confirmed that his proof was correct he was	F. A postulate
7. Mildred demonstrated the truth of the statement by	G. The inverse of the statement is created.
8. A simple, direct statement assumed to be true is	H. Writing a proof
9. A statement that has been proven using specific rules is	I. The contrapositive of the statement is created.
10. An indirect proof shows that something is true by	J. Is a statement that follows an “if-then” format.
11. A natural consequence or special case is	K. Is an example of deductive reasoning.
12. A statement might be negated by	L. Verifying his work
13. When the parts of a conditional statement are switched	M. Shows that a statement is false.
14. When the parts of a conditional statement are both negated	N. Is an example of inductive reasoning.
15. When the parts of a conditional statement are switched and both are negated	O. A conjecture
16. An argument that starts with rules or laws and applies them to a specific situation	P. A corollary
17. An argument that generalizes from observations and experiences	Q. The converse of the statement is created.
18. A counterexample	R. The first part of a conditional statement.

Answers: 1E 2J 3O 4R 5A 6L 7H 8F 9B 10C 11P 12D 13Q 14G 15I 16K 17N 18M

Definitions

conditional statement: the combination of two statements in an “if-then” structure.

hypothesis: the first part, or the “if” part, of an “if-then” statement.

conclusion: the part of an “if-then” (conditional) statement that comes after “then”.

converse: the statement that results when the two parts(hypothesis and conclusion) of an “if-then” statement are switched.

negation: a denial, often created by inserting or removing the word “not”.

inverse: the statement that results when the “if” part (hypothesis) and the “then” part of a conditional statement are both negated.

contrapositive: a statement that results when the two parts (hypothesis and conclusion) of an “if-then” (conditional) statement are switched and both are negated.

conjecture: a statement or opinion that is not based on evidence; an educated guess.

counterexample: an example that proves a statement to be false.

deductive reasoning: a form of thinking that starts with general rules and applies them to particular or specific situations.

inductive reasoning: a form of thinking that uses specific observations and experiences to reach general conclusions.

proof: a demonstration of the truth of a mathematical or logical statement based on postulates and theorems. In a proof, a sequence of steps, statements, or demonstrations that leads to a valid conclusion.

postulate: a statement accepted as true without proof.

theorem: a mathematical statement that can be proved true using the rules of logic. A theorem is proven from properties, postulates, and/or other theorems already known to be true.

corollary: a natural consequence or easily drawn conclusion. In geometry, it is a theorem or proposition that follows with little or no proof required from one already proven. A special case of a more general theorem which is worth noting separately.

indirect proof: proof by contradiction, in which a statement (conjecture) is proved by first assuming that the conjecture is false..

verify: to test and confirm the truth of something.

summarize: to give a concise, comprehensive statement or an abridged account of something. A summary contains the important facts and main points without all of the details.

Which Belongs

1. "If I don't have my socks on then my feet are not warm" would be the (contrapositive, converse, inverse) of "If I have my socks on then my feet are warm".
2. The (hypothesis, conclusion, corollary) is the last part of a conditional statement.
3. Rachel proved her statement about angles by using postulates and other proven statements, so she could say that her statement was a (conjecture, theorem, conditional statement).
4. The statement, "The dance will be crowded" cannot be a (conjecture, true statement, conditional statement).
5. "If it is not hot, then it is not cooked" is the (inverse, converse, contrapositive) of "If it is cooked, then it is hot".
6. A "blue bear" is a (negation, counterexample, proof) of the statement "All black bears are black in color".
7. To (summarize, verify, negate) the steps that she used, Beth wrote them in a shorter, more concise manner.
8. "A line has an infinite number of points" would be an example of a (conjecture, postulate, theorem).
9. (Deductive reasoning, inductive reasoning, indirect proof) is used in the explanation: Water freezes when the temperature is below 32^{o} F. So, if I leave my dog's water dish outside at 10^{o} F, the water in it will freeze.
10. When Fred packed his raingear and boots for the camping trip, he was using a (conjecture, postulate, theorem) about the weather.
11. When Ethan says "Every time I go fishing I catch a fish, so I will catch a fish today", he is using (deductive reasoning, inductive reasoning, a counterexample)
12. To prove that it was snowing, Kim first assumed that it was not snowing, then showed that there was a contradiction to that: snowflakes were falling from the sky and covering the ground. She was using (deductive reasoning, inductive reasoning, indirect proof).
13. When Julie said that her homework was not done, she was (proving, conjecturing, negating) her former statement that her homework was finished.
14. When Walter confirmed that his proof was correct by testing and checking it, he was (verifying, summarizing, concluding) the proof.
15. "If the wind is blowing, then there are whitecaps is the (converse, inverse, contrapositive) of "If there are whitecaps, then the wind is blowing".
16. To demonstrate that the statement "vertical angles are always congruent" was true, Allen wrote a (theorem, corollary, proof).
17. A special case that occurs as the consequence of a proven theorem is the (counterexample, corollary, converse) of the theorem.
18. The statement "If it is new, then it is unopened" is a (conditional, counterexample, hypothesis).

1. Inverse
2. Conclusion
3. Theorem
4. Conditional statement
5. Contrapositive
6. Counterexample
7. Summarize
8. Postulate
9. Deductive reasoning
10. Conjecture
11. Inductive reasoning
12. Indirect proof
13. Negating
14. Verifying
15. Converse
16. Proof
17. Corollary
18. Hypothesis

Multiple Choice

1. The conclusion to a conditional statement
   a) immediately follows the "if" part of the statement
   b) comes at the beginning of the statement
   c) is not necessarily true

2. A conditional statement always needs to have which two parts
   a) a hypothesis and a conclusion
   b) a conjecture and a negation
   c) a hypothesis and a negation

3. When Mark made a conjecture about the outcome of tomorrow's basketball game
   a) he was guessing based on his past observations and experiences
   b) he had already proven that it would be true
   c) he was making a conditional statement

4. When a person says "If pigs could fly…" they could be saying
   a) a counterexample
   b) a hypothesis
   c) a conjecture

5. The contrapositive of "If I am earning enough money, then I am going to Skagway" is
   a) If I am going to Skagway, then I am earning enough money
   b) If I am not going to Skagway, then I am not earning enough money
   c) If I am not earning enough money, then I am not going to Skagway

6. The converse of "If it is snowing, then the Eaglecrest ski area is open" is
   a) If the Eaglecrest ski area is open, then it is snowing.
   b) If it is not snowing, then the Eaglecrest ski area is not open.
   c) If the Eaglecrest ski area is not open, then it is not snowing.

7. When Christopher made the statement "All people in Alaska like snow" Rebecca gave a counterexample by saying:
   a) People in Alaska like snow because it is beautiful and they can go sledding.
   b) My aunt lives in Colorado and she loves the snow.
   c) I live in Alaska and I hate snow.

8. When you are using deductive reasoning you might
   a) begin by stating a proven fact
   b) generalize based on all of your experiences
   c) make conjectures to begin proving something

9. In inductive reasoning,
   a) you start with general statements and end with specific, particular examples.
   b) your conclusion is possibly true, but not absolutely certain
   c) you prove something by contradiction

10. The inverse of the statement “If it is after 3 pm, then school is out” is
   a) “If school is not out, then it is not after 3 pm”
   b) “If school is out, then it is after 3 pm”
   c) “If it is not after 3 pm, then school is not out”

11. To negate the statement “Summer is here” Phil wrote
   a) It is winter now
   b) Summer begins on June 22
   c) Summer is not here

12. When you are writing a proof, you have to
   a) base your statements on conjectures
   b) use postulates and proven facts
   c) summarize your work

13. If a mathematical statement has been proven, it could be a
   a) postulate
   b) theorem
   c) conjecture

14. Which of the following is not true of a corollary:
   a) it is an opinion or an educated guess
   b) it is a special case of a theorem that is worth noting
   c) it is a natural consequence of a theorem that has been proven

15. Which of the following might be part of an indirect proof
   a) assuming that a conjecture is false
   b) finding a contradiction
   c) both of the above

16. It would be a good idea to verify your work
   a) only if you are writing a proof
   b) only when the argument started with a conjecture
   c) any time that you care about being correct

17. When you summarize something, you are writing it in a way that is more
   a) detailed
   b) concise
   c) accurate

18. An example of a postulate might be
   a) A line has infinitely many points.
   b) If all dogs bark, then my dog Odie barks.
   c) Joan Poindexter will win the election.

Answers:

1. C	5. B	9. B	13. B	17. B
2. A	6. A	10. A	14. A	18. A
3. A	7. C	11. C	15. C	
4. B	8. A	12. B	16. C	

Complete the Sentence

1. In a(n)___________________________, a statement or conjecture is proven by contradiction.
2. "If I get a new pair of shoes, then I will run faster" is an example of a ___________________
3. "If I am working, then I am quiet" is the ____________________of the statement "If I am quiet, then I am working"
4. When a statement begins with a(n)_________________ followed by "then" , it is not always true.
5. ___________________________ is used when you know of some general rules or laws that apply to a specific situation.
6. The _____________________ is the final part of a conditional statement.
7. If you make a generalization based on your observations and experiences, you are using _____________________________.
8. A special case or natural consequence of something is its ________________.
9. When a statement says " If it is dark, then it is night", its _________________ would say "If it is not dark, then it is not night"
10. To write the ________________________ of a statement, you deny it, often by adding the word "not".
11. When the order of a conditional statement is switched and both parts are negated, you have a _____________________________.
12. A demonstration that something is true is a ___________________.
13. When you find a situation or a thing that disproves something, you have found a(n) _____________________ __________.
14. A(n) _______________________ is accepted to be true, even though it cannot be proven.
15. Suzanne __________________ her report because she knew that people would not have time to read the whole thing.
16. A statement that has been proven through a sequence of steps using other true statements is a ____________________.
17. Javier wanted to do well on the test, so he took the time to ________________all of his answers.
18. Frank made a(n) ________________when he said that the store would be open.

Answers:

1. Indirect Proof
2. Conditional Statement
3. Converse
4. Hypothesis
5. Deductive
6. Conclusion
7. Inductive
8. Corollary
9. Inverse
10. Negation
11. Contrapositive
12. Proof
13. Counterexample
14. Postulate
15. Summarized
16. Theorem
17. Verify

Creative Writing

Write about this picture of a moose stuck in telephone wires using the words from this unit. You might try some conjectures, conditional statements, and examples of deductive and inductive reasoning, for starters!

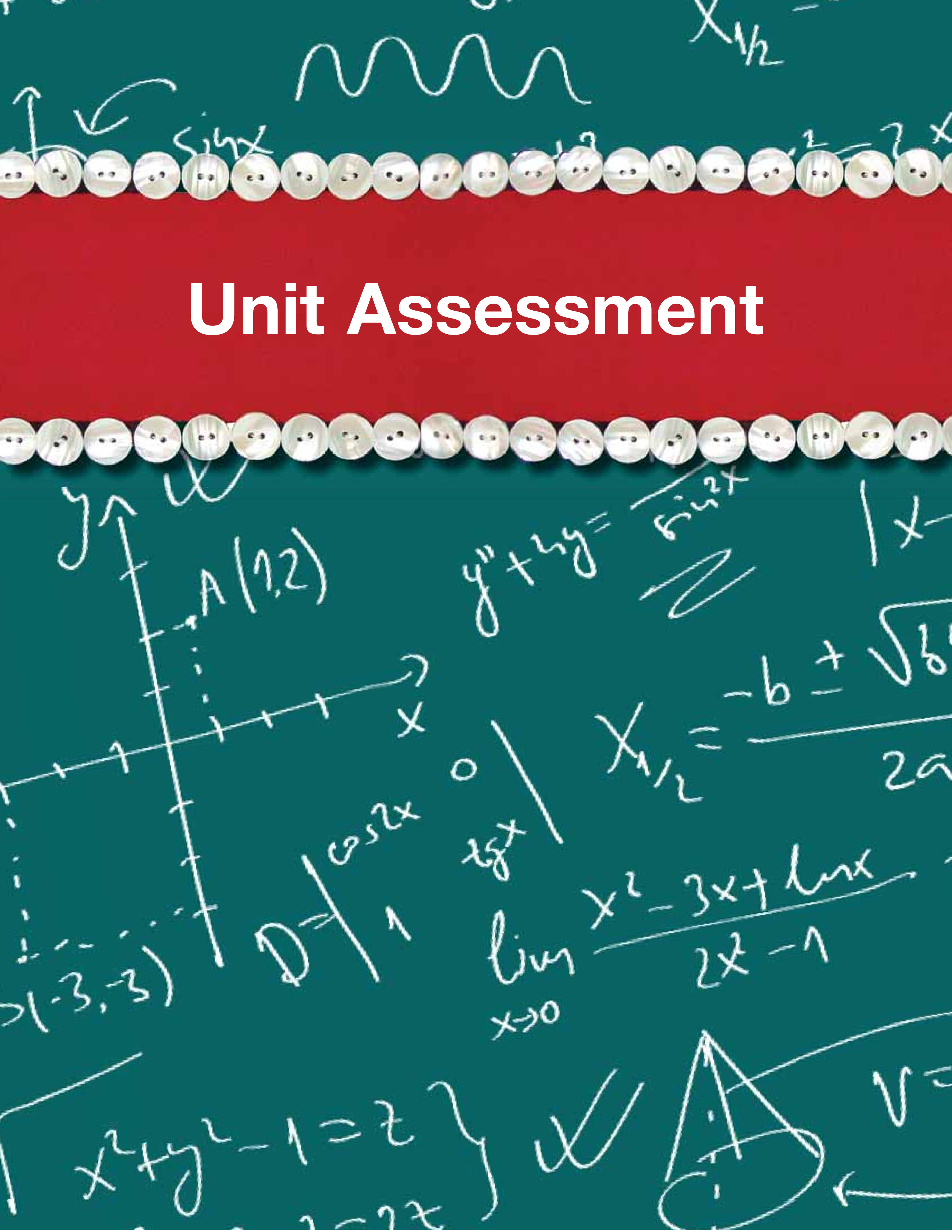
Place-Based Practice Activity

1) Ask students to write conditional statements that relate to their daily lives and the environment around them. In small groups, have the students exchange statements and practice coming up with the converse, inverse, and contrapositive of each statement.

2) Discuss the ways that conjectures, inductive reasoning, deductive reasoning, and indirect proof might apply in students' daily lives. Have students keep a log or record of examples that come up during the next week. They may be able to find examples in conversation with friends or family members, in books, in television shows or commercials, or in classes. Offer incentives for finding examples, and provide class time for students to share the examples that they found.

3) Research the ways that Native people in Southeast Alaska developed knowledge about the world around them by using inductive reasoning.

Unit Assessment



Geometry: Unit 3 Proofs

Name: ____________________
Date: ____________________

1) "If it is raining, then the field is wet" is a/an ________________.

   a) hypothesis

   b) conditional statement

   c) conclusion

2) The first part statement, "If it is raining..." is the _________________ .

   a) hypothesis

   b) conditional statement

   c) conclusion

3) In the same statement, the part of the sentence that states "...the field is wet" is the ______________.

   a) hypothesis

   b) conditional statement

   c) conclusion

Multiple Choice: Read the statement carefully and select the best choice for your answer. Circle your answer.

The statements below are using the sentence,
"If it is raining, the field is wet."
As the sentence changes, choose the type of statement it would be in a geometry proof.

4) When the two parts of an *IF-THEN* statement are switched it is a/an ____________ statement. "*If the field is wet then it is raining."*

   a) converse

   b) inverse

   c) negation

5) The ____________ of a *IF-THEN* statement is the statement that results when the *IF* part and the *THEN* part are both negated. *If it is not raining, then the field is not wet.*

a) converse

b) inverse

c) negation

6) *"It is not raining"* is an example of a _________________.

a) converse

b) inverse

c) negation

Short Answer: For each item, fill in the blank with the word that fits best. Choose your words from the Word Bank.

Word Bank		
conjecture	contrapositive	corollary
counterexample	hypothesis	indirect
summary	theorem	verify

7) A ________ is a statement or opinion that is not based on evidence. It is an educated guess. *"Halibut taste better than salmon to most people."*

8) In a statement when two parts of the "If then" part of the sentence are switched and are BOTH negative, the statement is ________. *201CIf the field is not wet, then it is not raining.201D*

9) An ________ proof is proof by contradiction. This kind of proof is a statement that is proved by assuming that the conjecture, or guess is false.

10) When someone gives a ________of something it is a concise, comprehensive statement or an abridged explanation.

11) An easily drawn conclusion or natural consequence is a ________, and requires little or no proof from one already proved. For example, if person east a lot of fatty food, then a natural consequence would be that they gain weight.

12) To ________ something means to test and confirm its truth.

13) When a mathematical statement can be proved using the rules of logic, and has already been shown to be true, it is a ________.

14) A ________ is one that proves a statement to be false. For instance, the statement about a yard in SE Alaska, 201C*There is a cedar tree in my yard201D* proves that the following statement cannot be true---*201CAll trees in Southeast Alaska are hemlocks.201D*

True or False: Read each statement below and decide if it is a true or a false statement. Circle the answer you think is the correct one.

15) The statement, *All bears are mammals. All mammals have lungs. So bears must have lungs* is an example of deductive reasoning.

a) True

b) False

16) A form of reasoning that moves from general to the particular is deductive reasoning.

a) True

b) False

17) Another example of deductive reasoning would be, *Every bear we have seen is black, so the next bear we see will be black.*

a) True

b) False

18) Inductive reasoning moves from the specific to the general.

a) True

b) False

19) An example of inductive reasoning is the following statement. *My mom is a resident of the United States and so am I, so all Alaskan residents are residents of the United States.*

a) True

b) False

20) With inductive reasoning, statements are made that support a conclusion but that does not automatically mean that the statements will be true.

a) True

b) False

Geometry: Unit 3 Proofs

Name: ___________________

Date: ___________________

1) "If it is raining, then the field is wet" is a/an _______________.

a) hypothesis

b) conditional statement

c) conclusion

2) The first part statement, "If it is raining..." is the ________________ .

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b) conditional statement

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a) converse

b) inverse

c) negation

5) The ____________ of a *IF-THEN* statement is the statement that results when the *IF* part and the *THEN* part are both negated. *If it is not raining, then the field is not wet.*

a) converse

b) inverse

c) negation

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Short Answer: For each item, fill in the blank with the word that fits best. Choose your words from the Word Bank.

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summary	theorem	verify

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8) In a statement when two parts of the "If then" part of the sentence are switched and are BOTH negative, the statement is **contrapositive**. *201CIf the field is not wet, then it is not raining.201D*

9) An **indirect** proof is proof by contradiction. This kind of proof is a statement that is proved by assuming that the conjecture, or guess is false.

10) When someone gives a **summary** of something it is a concise, comprehensive statement or an abridged explanation.

11) An easily drawn conclusion or natural consequence is a **corollary**, and requires little or no proof from one already proved. For example, if person east a lot of fatty food, then a natural consequence would be that they gain weight.

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13) When a mathematical statement can be proved using the rules of logic, and has already been shown to be true, it is a **theorem**.

14) A counterexample is one that proves a statement to be false. For instance, the statement about a yard in SE Alaska, 201C*There is a cedar tree in my yard201D* proves that the following statement cannot be true---*201CAll trees in Southeast Alaska are hemlocks.201D*

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b) False

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a) True

b) False

20) With inductive reasoning, statements are made that support a conclusion but that does not automatically mean that the statements will be true.

a) True

b) False

UNIT 4
Lines & Transversals

Sealaska Heritage Institute

Grade Level Expectations for Unit 4

Unit 4—Lines and Transversals

Alaska State Mathematics Standard A
A student should understand mathematical facts, concepts, principles, and theories.

A student who meets the content standard should:

A5) construct, draw, measure, transform, compare, visualize, classify, and analyze the relationships among geometric figures; and

Alaska State Mathematics Standard C
A student should understand and be able to form and use appropriate methods to define and explain mathematical relationships.

A student who meets the content standard should:

C1) express and represent mathematical ideas using oral and written presentations, physical materials, pictures, graphs, charts, and algebraic expressions;

C2) relate mathematical terms to everyday language;

GLEs
The student demonstrates an understanding of geometric relationships by

[9] G-1 identifying, analyzing, comparing, or using properties of angles (including supplementary or complementary)

The student demonstrates an understanding of geometric relationships by

[10] G-1 identifying, analyzing, comparing, or using properties of plane figures:

- supplementary, complementary or vertical angles
- angles created by parallel lines with a transversal

The student communicates his or her mathematical thinking by

[9] PS-3 representing mathematical problems numerically, graphically, and/or symbolically, translating among these alternative representations; or using appropriate vocabulary, symbols, or technology to explain, justify,and defend strategies and solutions

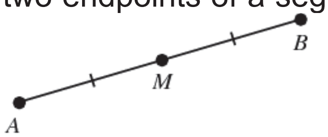
[10] PS-3 representing mathematical problems numerically, graphically, and/ or symbolically, communicating math ideas in writing; or using appropriate vocabulary, symbols, or technology to explain, justify, and defend strategies and solutions

Vocabulary & Definitions

Introduction of Math Vocabulary

Equidistant

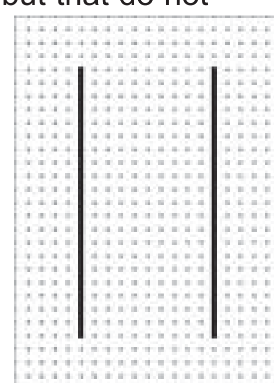
Equidistant means equally distant, or at the same distance. For example, the two endpoints of a segment are equidistant from its midpoint.



On a snowflake, each of the tips is equidistant from the center.

Parallel lines

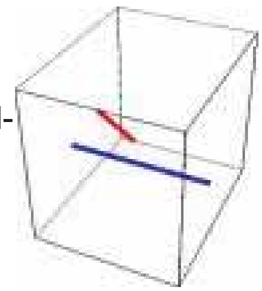
Parallel lines are lines that are on the same plane (coplanar) but that do not intersect. You can think of them as going in the same direction and staying the same distance apart.



Boards on a dock represent examples of parallel lines. When you are learning to ski, you might try to keep your skis parallel, as well.

Introduction of Math Vocabulary

Skew Lines



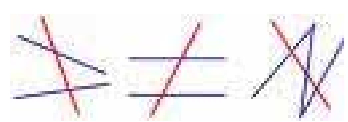
Skew lines are lines that do not intersect and that are not parallel. They cannot be coplanar.

You can see skew lines represented in this picture that was taken in Anchorage after the big earthquake in 1964.

(Picture is from VILDA UAF-1972-152-139)

Transversals

A transversal is a line that cuts across another set of lines.

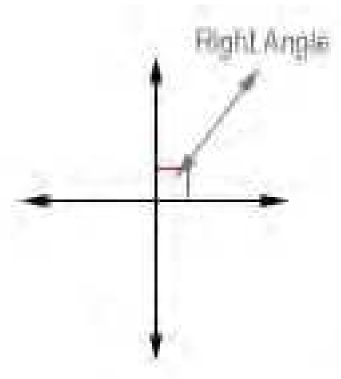


In the picture, if the trees represent lines, the fallen tree trunk is the transversal of the two standing trees.

Introduction of Math Vocabulary

Perpendicular lines

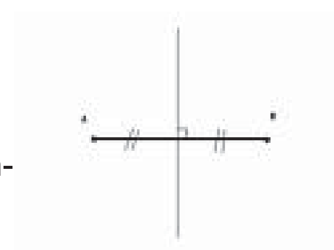
Perpendicular lines are lines that intersect at a right (90°) angle.



In this picture, the bars on the window are perpendicular. Other examples of perpendicular lines can be found on sidewalks, streets, lamp posts, fences, and buildings.

Perpendicular bisector

A perpendicular bisector is a line that is perpendicular to a segment, and that passes through its midpoint.



Ask students if they can find perpendicular bisectors on this brick wall.

Geometric figure

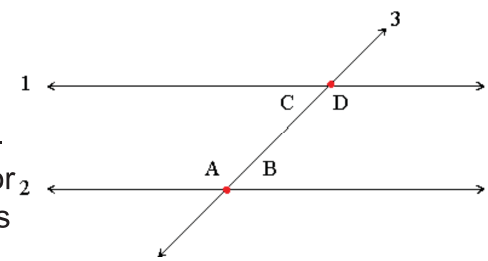
A geometric figure is any set of points on a plane or in space. Examples of geometric figures are points, segments, rays, curves, pentagons, and cubes.

Point out examples of geometric figures on this basket from Hoonah.

Introduction of Math Vocabulary

Interior Angles

An interior angle is an angle in the interior (inside) of a geometric figure.
A figure that shows two lines cut by a transversal is a type of geometric figure, and the interior angles are those that are between the two lines that are being cut.

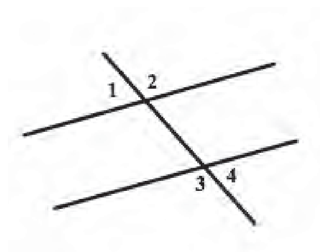


In this drawing, angles A, B, C, and D are interior angles.

Use this picture of electrical wires to identify interior angles.

Exterior Angles

Exterior angles are any of the four angles that do not include a region of the space between two lines intersected by a transversal. In this diagram, angles 1, 2, 3, and 4 are exterior angles.

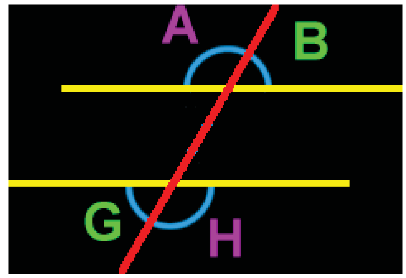


Find parallel lines cut by a transversal on this crossword puzzle, and identify the exterior angles.

Introduction of Math Vocabulary

Alternate Exterior Angles

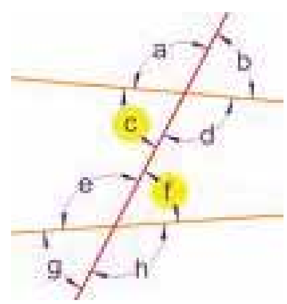
Alternate exterior angles are two exterior angles on opposite sides of a transversal that lie on different parallel lines. In the diagram, alternate exterior angles would be ‘a’ and ‘h’, or ‘b’ and ‘g’.

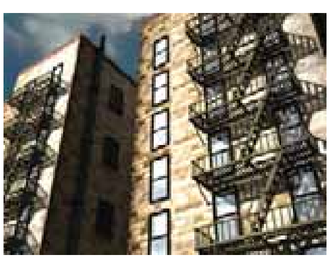


This picture of a guitar shows several sets of alternate exterior angles.

Alternate Interior Angles

Alternate interior angles are two interior angles which lie on different parallel lines and on opposite sides of a transversal. On the diagram, angles 3 and 6 are alternate interior angles. So are angles 4 and 5.



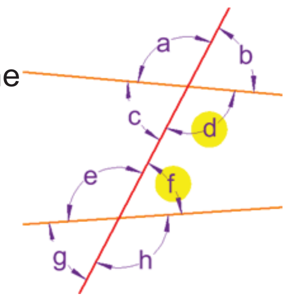


Pick out alternate interior angles on this picture of fire escapes.

Introduction of Math Vocabulary

Consecutive Interior Angles

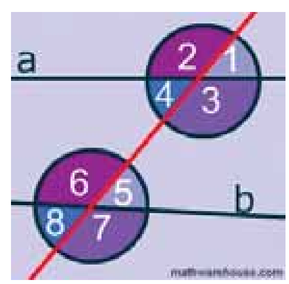
Consecutive means "following one after the other in order". Consecutive interior angles are two interior angles lying on the same side of the transversal cutting across two lines. In the diagram, angles d and f are consecutive interior angles, and angles c and e are consecutive interior angles.



Find consecutive interior angles on this fence:

Corresponding Angles

When two lines are crossed by another line (which is called the Transversal), the angles in matching corners or positions are called corresponding angles. In this figure, the pairs of corresponding angles are 1 and 5, 3 and 7, 2 and 6, and 4 and 8.

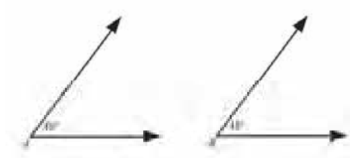


Many pairs of corresponding angles can be demonstrated on this picture of a bridge railing.

Introduction of Math Vocabulary

Congruent angles

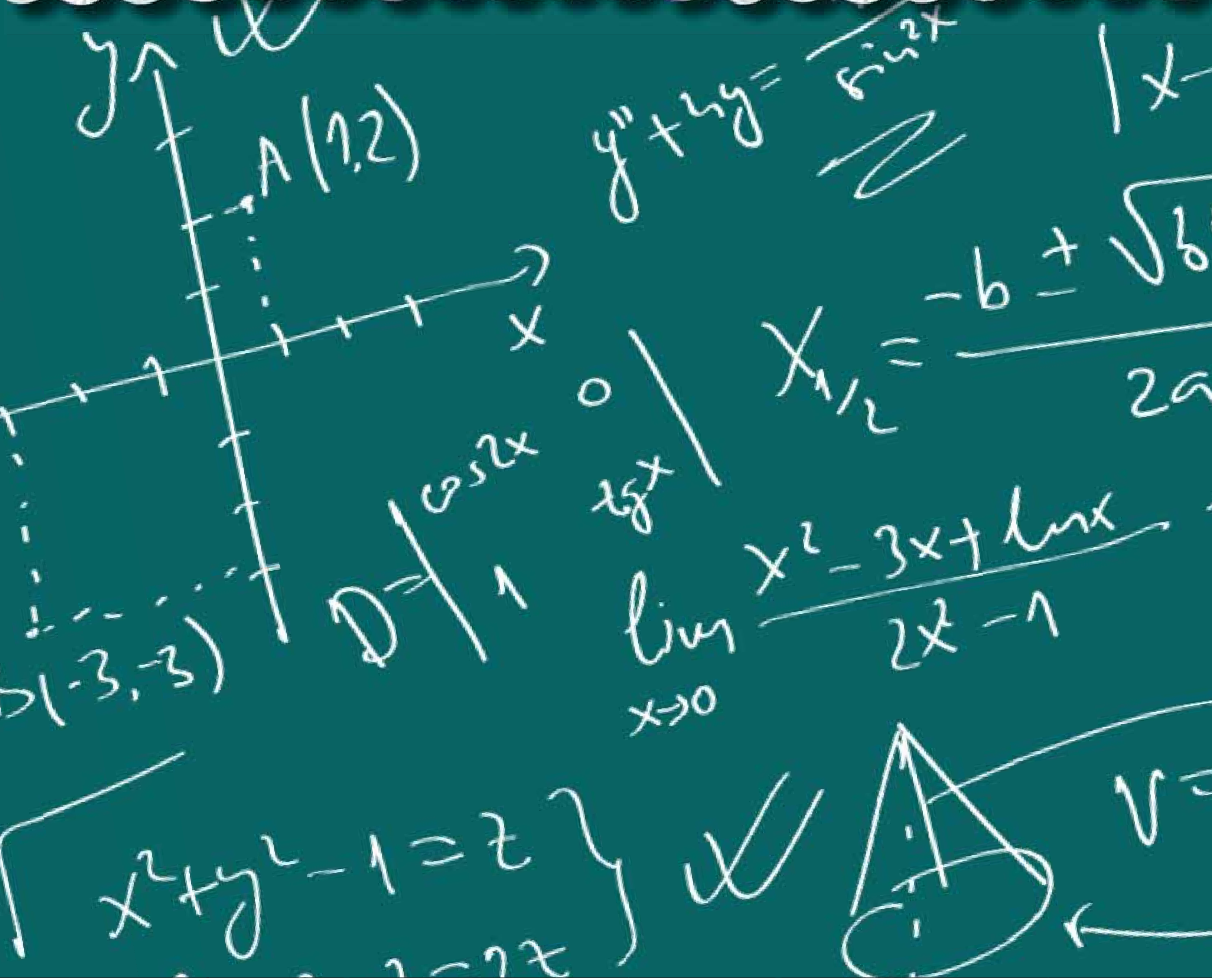
Congruent angles are angles that have the same angle measure. They are equal in size.



Here is a picture of an old chapel building in Yakutat.   Many examples of congruent angles can be found on this building.

Language and Skills Development

Using the Math Vocabulary Terms



Language & Skills Development

LISTENING

Use the activity pages from the Student Support Materials.

Let's Move

Identify an appropriate body movement for each vocabulary word. This may involve movements of hands, arms, legs, etc. Practice the body movements with the students. When the students are able to perform the body movements well, say a vocabulary word. The students should respond with the appropriate body movement. You may wish to say the vocabulary words in a running story. When a vocabulary word is heard, the students should perform the appropriate body movement. Rather than using body movements or, in addition to the body movements, you may wish to use "sound effects" for identifying vocabulary words. The students should perform the appropriate body movements/sound effects for the words you say.

SPEAKING

Right or Wrong?

Mount the vocabulary illustrations on the chalkboard. Point to one of the illustrations and say its vocabulary word. The students should repeat the vocabulary word for that illustration. However, when you point to an illustration and say an incorrect vocabulary word for it, the students should remain silent. Repeat this process until the students have responded a number of times to the different vocabulary illustrations.

READING

Use the activity pages from the Student Support Materials.

Half Time

Before the activity begins, cut each of the sight words in half. Keep one half of each sight word and give the remaining halves to the students. Hold up one of your halves and the student who has the other half of that word must show his half an say the sight word. Repeat in this way until all students have responded. An alternative to this approach is to give all of the word halves to the students. Say one of the sight words and the two students who have the halves that make up the sight word must show their halves. Depending upon the number of students in your class, you may wish to prepare extra sight word cards for this activity.

WRITING

Use the activity pages from the Student Support Materials.

Watch Your Half

Prepare a photocopy of each of the vocabulary illustrations. Cut the photocopied illustrations in half. Keep the illustration halves in separate piles. Group the students into two teams. Give all of the illustration halves from one pile to the players in Team One. Give the illustration halves from the other pile to the players in Team Two. Say a vocabulary word. When you say "Go," the student from each team who has the illustration half for the vocabulary word you said, should rush to the chalkboard and write the word on the board. The first player to do this correctly wins the round. Repeat until all players have participated. This activity may be played more than once by collecting, mixing and re-distributing the illustration halves to the two teams.

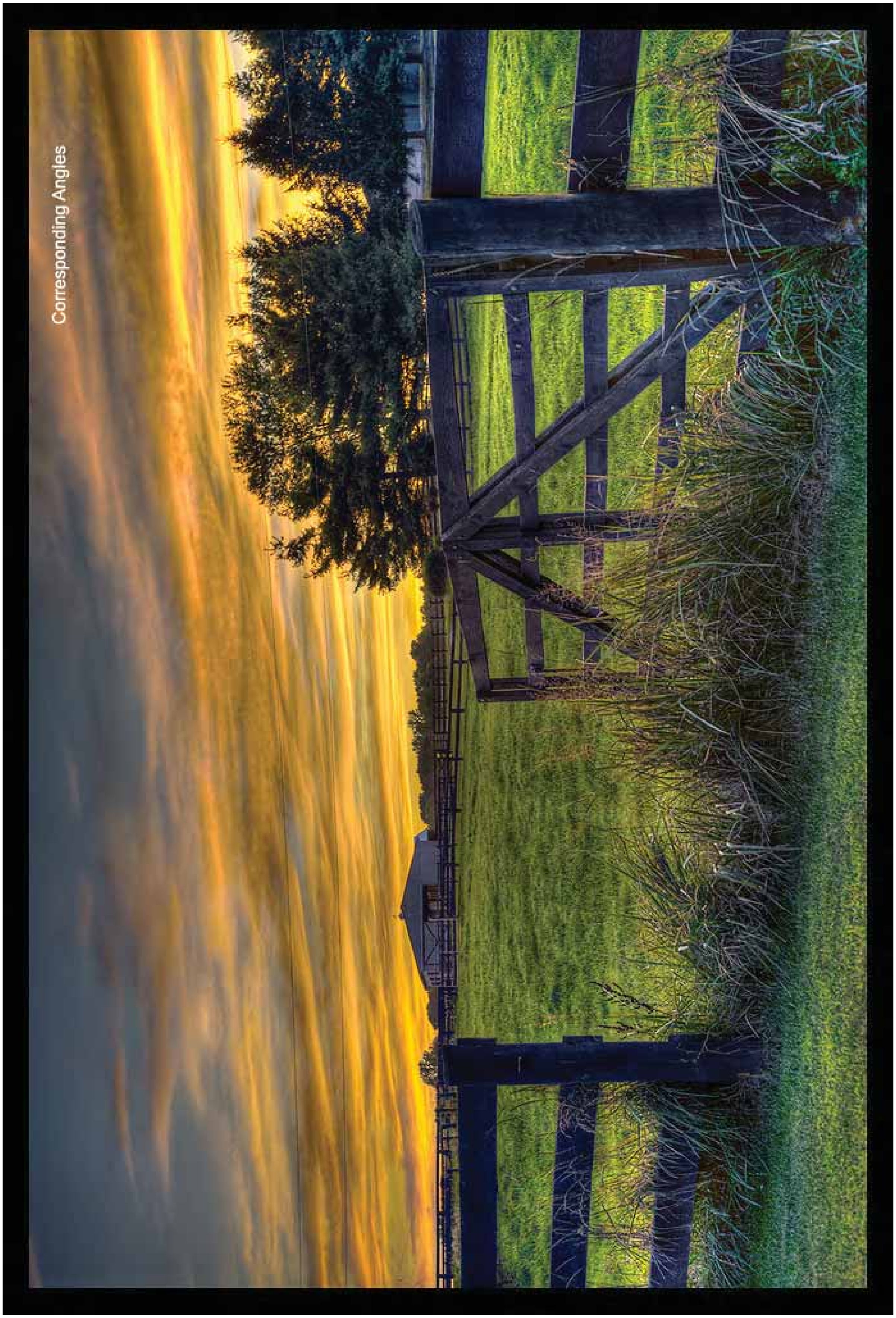
Student Support Materials

Alternate Exterior Angles

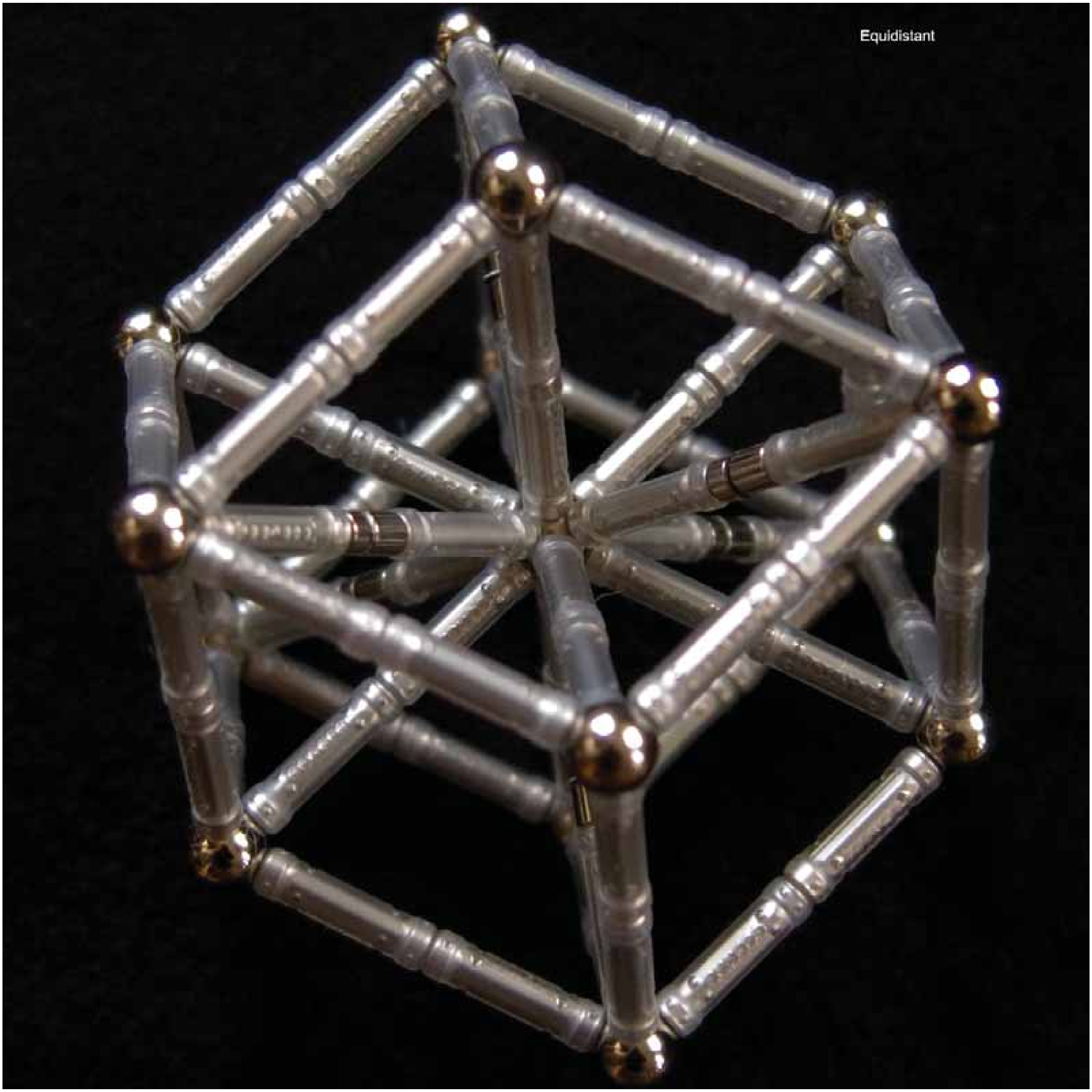

Alternate Interior Angles

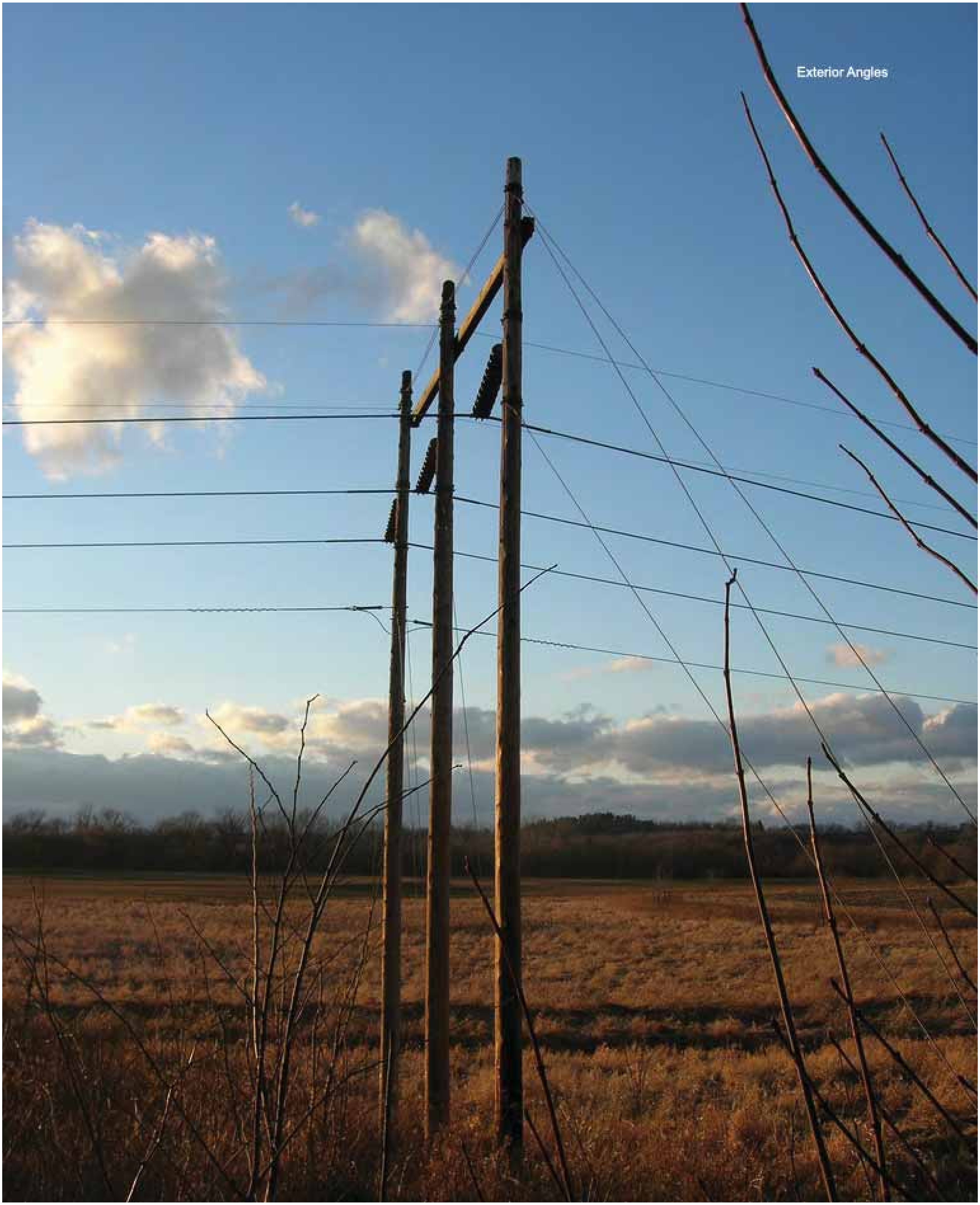

Congruent Angles

Consecutive Interior Angles

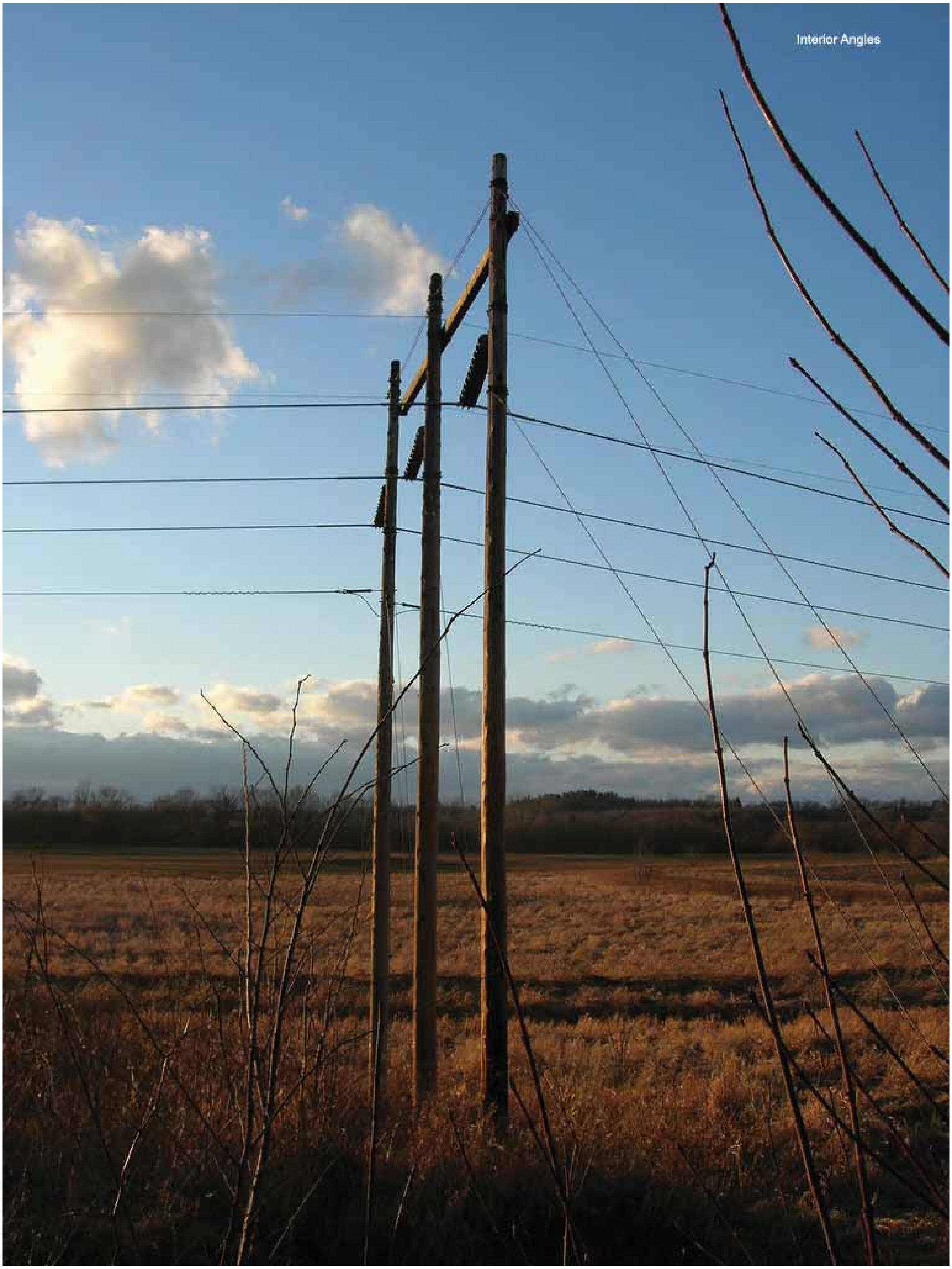


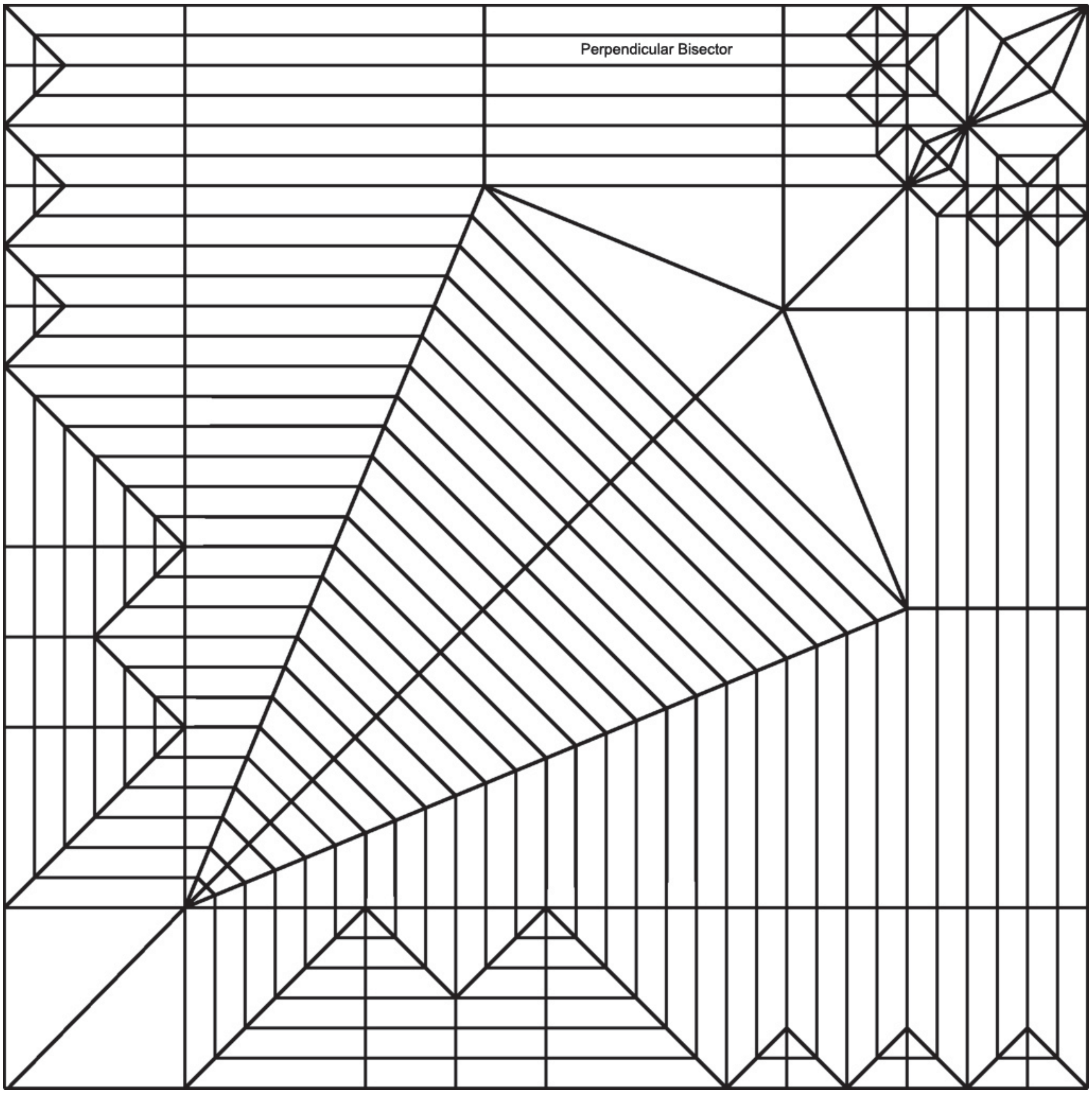
Corresponding Angles


Equidistant



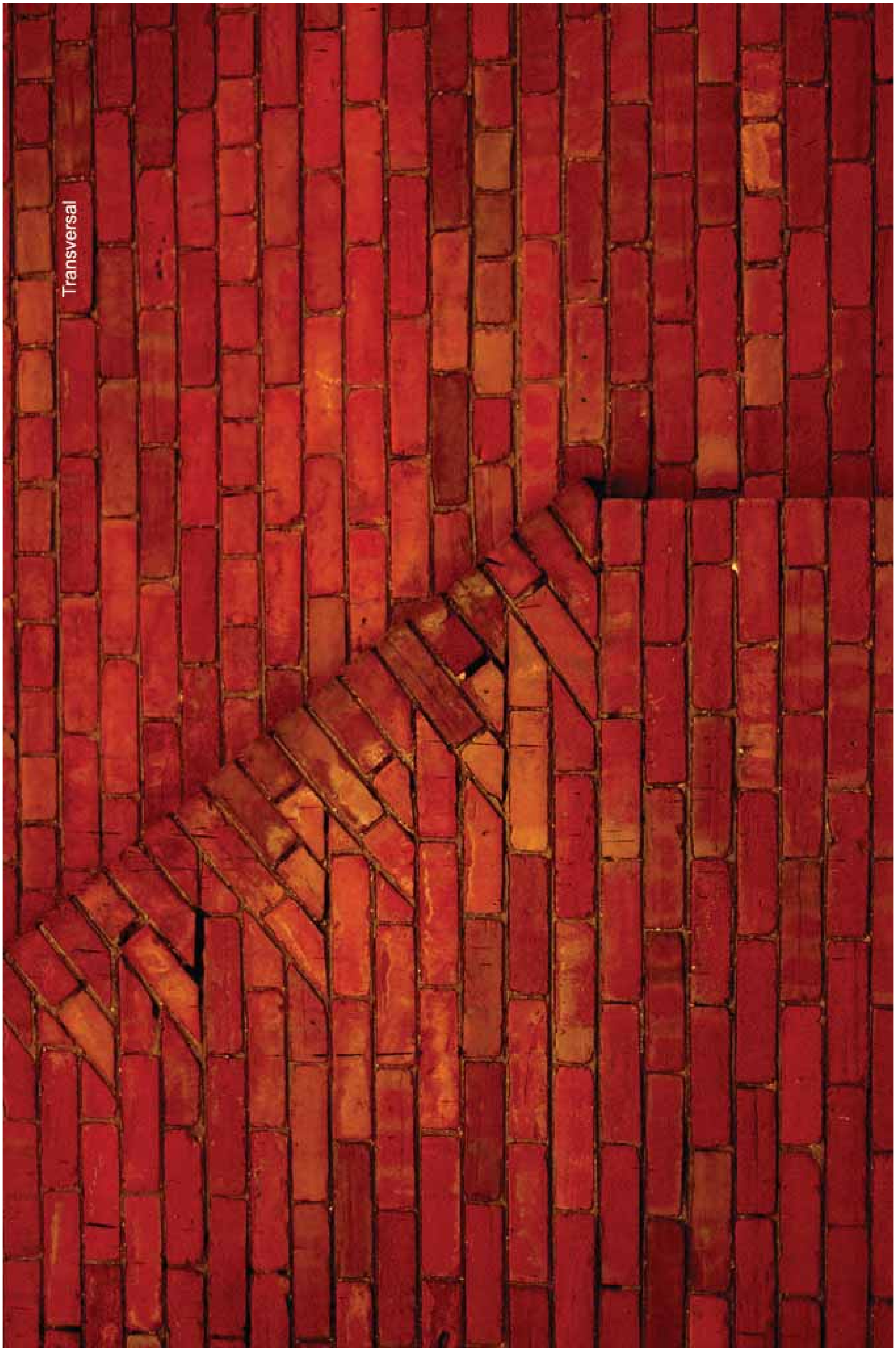

Geometric Figures


Interior Angles


Perpendicular Bisector

Parallel Lines

Perpendicular Lines



True-False Sentences

(Listening and/or Reading Comprehension)

1. On a ruler, the 1” mark and the 3” mark are **equidistant** from the 2” mark.
2. Parallel lines will always eventually intersect.
3. Skew lines are not necessarily straight lines.
4. When a **transversal** cuts across two lines, there are two points of intersection.
5. Perpendicular lines make up two sides of every triangle.
6. Perpendicular bisectors divide line segments in half.
7. All **geometric figures** have an interior and an exterior.
8. An obtuse angle cannot be an **interior angle**.
9. If angles are adjacent to each other, they cannot be **exterior angles**.
10. Vertical angles are a type of **alternate exterior angles**.
11. Alternate interior angles can form a linear pair.
12. Consecutive interior angles would never be adjacent to each other.
13. When two lines are cut by a transversal, there are always four pairs of **corresponding angles.**
14. If two angles each measure 90^o, they are **congruent angles**.

Answers: 1T, 2F, 3F, 4T, 5F, 6T, 7F, 8F, 9F, 10F, 11F, 12T, 13T, 14T

1. Sitka and Ketchikan are **equidistant** from Juneau.
2. If lines are **parallel**, they are also coplanar.
3. If lines are in the same plane, they cannot be **skew lines**.
4. The lines cut by a **transversal** have to be parallel lines.
5. It is important for a house builder to use **perpendicular lines**.
6. Lines and curves can both have **perpendicular bisectors**.
7. Geometric figures can be one-, two-, or three-dimensional.
8. Interior angles are in between two lines.
9. Exterior angles might be right angles.
10. Alternate exterior angles are always on opposite sides of a transversal.
11. Each angle in a pair of **alternate interior angles** has the transversal as one of its sides.
12. In a pair of consecutive interior angles, the angle measures are always the same.
13. Corresponding angles share the same vertex.
14. A triangle always has at least two **congruent angles**.

Answers: 1F, 2T, 3T, 4F, 5T, 6F, 7T, 8T, 9T, 10T, 11T, 12F, 13F, 14F

Match the Halves

1. The endpoints of a segment	A. all three lines are in the same plane.
2. The sides of a straight road	B. are interior angles.
3. Lines that never intersect are skew lines if they	C. divides a segment into two equal sections.
4. If a transversal intersects two parallel lines,	D. on opposite sides of a transversal.
5. Two adjoining sides of a square	E. are alternate interior angles.
6. A perpendicular bisector	F. are equidistant from the midpoint.
7. Squares, circles, and pyramids	G. are consecutive interior angles.
8. Any angles that are inside geometric figures.	H. are on the same side of a transversal.
9. Exterior angles are not between	I. are not parallel lines.
10. Alternate exterior angles are exterior angles	J. are examples of geometric figures.
11. Interior angles that are not consecutive or adjacent	K. the lines cut by a transversal.
12. Interior angles on the same side of a transversal	L. are perpendicular lines.
13. Corresponding angles	M. are congruent angles.
14. If angles have the same measure they	N. might represent parallel lines.

Answers: 1F 2N 3I 4A 5L 6C 7J 8B 9K 10D 11E 12G 13H 14M

Definitions

Equidistant: equally distant, or at the same distance

Parallel lines: lines that are on the same plane (coplanar) but that do not intersect.

Skew Lines: lines that do not intersect and that are not parallel.

Transversal: a line that cuts across another set of lines.

Perpendicular lines: lines that intersect at a right (90°) angle.

Perpendicular bisector: a line that is perpendicular to a segment and that passes through its midpoint.

Geometric figure: any set of points on a plane or in space.

Interior Angle: an angle in the interior (inside) of a geometric figure.

Exterior Angles: any of the four angles that do not include a region of the space between two lines intersected by a transversal.

Alternate Exterior Angles: two exterior angles on opposite sides of a transversal that lie on different parallel lines.

Alternate Interior Angles: two interior angles which lie on different parallel lines and on opposite sides of a transversal.

Consecutive Interior Angles: two interior angles lying on the same side of the transversal cutting across two lines.

Corresponding Angles: the angles in matching corners or positions, when two lines are crossed by a transversal.

Congruent angles: angles that have the same angle measure.

Which Belongs

1. (Skew, perpendicular, parallel) lines are not coplanar.
2. If angles are adjacent, they might be (interior angles, corresponding angles, consecutive angles).
3. (Perpendicular, skew, parallel) lines always intersect each other.
4. If angles are the same size, they must be (corresponding, congruent, vertical) angles.
5. (Exterior, congruent, corresponding) angles are on the outside of lines cut by a transversal.
6. Linear pairs are examples of (corresponding angles, geometric figures, alternate exterior angles).
7. A line along a wall intersects a line along a roof, so the lines cannot be (perpendicular, parallel, interior).
8. Two angles that are between lines cut by a transversal and on the same side of the transversal are (consecutive interior, congruent, corresponding) angles.
9. The midpoint of one side of a rectangle is (parallel to, equidistant from, perpendicular to) the corners on that side.
10. (Linear pairs, supplementary angles, alternate exterior angles) might have measures that add up to 90^o.
11. (Corresponding, interior, exterior) angles have matching positions in a system of lines cut by a transversal
12. Two lines cut by a transversal cannot have a(n) (perpendicular bisector, interior angles, exterior angle).
13. If angles are on opposite sides of a transversal, they might be (alternate interior, consecutive interior, corresponding) angles.
14. Lines crossed by a (bisector, perpendicular, transversal) do not have to be parallel.

1. Skew
2. Interior angles
3. Perpendicular
4. Congruent
5. Exterior
6. Geometric figures
7. Parallel
8. Consecutive interior
9. Equidistant from
10. Alternate exterior
11. Corresponding
12. Perpendicular bisector
13. Alternate interior
14. Transversal

Multiple Choice

1. Which is NOT an example of a point that must be **equidistant** from the endpoints of a segment:
   a) the midpoint of the segment
   b) the intersection of the segment with a line that crosses it
   c) the intersection of the segment and its perpendicular bisector

2. When two lines are **parallel**, they are also
   a) in the same plane
   b) intersecting at only one point
   c) extending in one direction

3. **Skew lines** might be represented by
   a) the sides of a picture frame
   b) two trees that are tilted at different angles
   c) the two rails of a straight, flat railroad track

4. **Transversals** are lines that always
   a) cut across at least two other lines
   b) cut across parallel lines
   c) are perpendicular to the lines they cross

5. Where would you be likely to find **perpendicular lines** represented;
   a) two edges of a piece of paper
   b) a railing on a deck
   c) both of the above

6. A **perpendicular bisector** might be described as follows:
   a) a line that is perpendicular to a segment and intersects its midpoint
   b) a line that is at 180^o to a segment and cuts it in half
   c) any segment that is at a right angle to another segment

7. Any set of points in space is a **geometric figure** if
   a) the points are on the same plane
   b) the points do not form curves
   c) there is at least one point in the set

8. A pair of **interior angles** can never also be
   a) corresponding angles
   b) adjacent angles
   c) on opposite sides of a transversal

9. If two angles are both **exterior** angles, they might be
   a) supplementary angles
   b) obtuse angles
   c) either of the above

10. Which two things are true about **alternate exterior angles**?
   a) they are on opposite sides of a transversal and on the outside of the lines that are being crossed
   b) they are on the same side of a transversal and on the outside of the lines that are being crossed
   c) they are adjacent and on the outside of the lines that are being crossed

11. **Alternate interior angles** cannot also be
   a) right angles
   b) congruent angles
   c) adjacent angles

12. Which must be true about **consecutive interior angles**?
   a) they are always adjacent to each other
   b) they are always complementary
   c) they are always on the same side of a transversal

13. **Corresponding angles** might be found on
   a) a design on a quilt
   b) a door frame
   c) a stop sign

14. Which of the following would always be **congruent angles**?
   a) two corners of a room
   b) two right angles
   c) two corresponding angles

Answers:

1. B	5. C	9. C	13. A
2. A	6. A	10. A	14. B
3. B	7. C	11. C	
4. A	8. A	12. C	

Complete the Sentence

1. A point, a pentagon, a sphere, and a pair of alternate interior angles are all examples of ____________________________________.
2. The door of Debbie's classroom was _______________ from the two ends of the hallway.
3. When a transversal intersects two lines, the angles in the upper right corner of each intersection would be ________________________________.
4. __________________________were represented when two bars on a window intersected at a right angle.
5. The white lines on the road intersected both sides of a crosswalk at an angle, and formed a __________________________________.
6. ___________________________ are in between two lines.
7. Angles that are on opposite sides of a transversal are _____________________ unless they are exterior angles.
8. If angles do not include any region of space between two lines, they are ______________.
9. "Outside" angles that are on opposite sides of a transversal are ____________________.
10. Pairs of acute angles, complementary angles, interior angles, exterior angles, or vertical angles all might be __________________________________.
11. As the boat tossed around on the waves, a pair of ______________________ were represented by its mast and the flagpole on shore.
12. If a pair of angles is between two lines and on the same side of a transversal, they are ____________________ angles.
13. The cross on Mt. Roberts has two pieces, and one piece is the ____________________ of the other.
14. The telephone wire ran along side by side, always the same distance apart, just like a pair of _____________________________.

Answers:

1. Geometric figures
2. Equidistant
3. Corresponding angles
4. Perpendicular lines
5. Transversal
6. Interior angles
7. Alternate interior angles
8. Exterior angles
9. Alternate exterior angles
10. Congruent angles
11. Skew lines
12. Consecutive interior angles
13. Perpendicular bisector
14. Parallel lines

Creative Writing

Write about the picture using words from this unit. Label or number things on the picture or use diagrams to help explain the words, if needed.

Place-Based Practice Activity

Find maps or aerial photos of your town, or find and print pages from Google Maps. Choose areas with lots of road intersections or other intersecting lines. Other options might be to obtain highway blueprints from the local road department, or to find maps of an area that you are planning to visit on a class trip.

Study the maps and/or photos to find examples of equidistant points, parallel lines, perpendicular lines and bisectors, and transversals and all of their associated angles.

Students can do this activity in small groups. Then they can share their findings with another group. The other group of students can decide if the examples are correct and can try to identify more examples.

Unit Assessment

Geometry: Unit 4

Name: ___________________
Date: ___________________

Match the key vocabulary words on the left with their definition on the right. Place the letter of the definition in front of the word that it matches.

1) _____ skew lines
2) _____ transversals
3) _____ perpendicular lines
4) _____ perpendicular bisector
5) _____ parallel lines

a. lines that are on the same plane (coplanar) but that do not intersect
b. lines that do not intersect and that are not parallel and cannot be coplanar.
c. lines that intersect at a right (90o) angle
d. is a line that is perpendicular to a segment, and that passes through its midpoint
e. lines that cuts across another set of lines

Fill in the Blank: Fill in the blank for each statement with the word that best fits. Choose the words from the Word Bank. Some words will not be used.

Word Bank		
equidistant	geometric figure	parallel
perpendicular	skew line	transversal

6) A line is ________ to another lines if the lines meet at 90 degrees.

7) ________ means equally distant, or at the same distance.

8) A ________ is a line that cuts across another set of lines.

9) Boards on a dock would be an example of ________ lines.

10) A ________ is any set of points on a plane or in space

Multiple Choice: Read each statement carefully and circle the best answer.

11) An angle in the interior inside of a geometric figure is a/an _______________ angle.

a) exterior

b) interior

c) alternate interior

d) alternate exterior

12) Two exterior angles on opposite sides of a transversal that lie on different parallel lines are __________________ angles.

a) exterior

b) interior

c) alternate interior

d) alternate exterior

13) The four angles that do not include a region of the space between two lines intersected by a transversal are the ______________ angles.

a) exterior

b) interior

c) alternate interior

d) alternate exterior

14) Two interior angles which lie on different parallel lines and on opposite sides of a transversal are _____________________ angles.

a) exterior

b) interior

c) alternate interior

d) alternate exterior

15) In the illustration below of the old chapel building in Yakutat, put an X on the congruent angles that are found on this building.

16) In the space below, illustrate or define **consecutive interior angles.**

17) In the space below, Illustrate OR write a definition for corresponding angles.

Geometry: Unit 4

Name: ____________________
Date: ____________________

Match the key vocabulary words on the left with their definition on the right. Place the letter of the definition in front of the word that it matches.

1) __b__ skew lines
2) __e__ transversals
3) __c__ perpendicular lines
4) __d__ perpendicular bisector
5) __a__ parallel lines

a. lines that are on the same plane (coplanar) but that do not intersect
b. lines that do not intersect and that are not parallel and cannot be coplanar.
c. lines that intersect at a right (90o) angle
d. is a line that is perpendicular to a segment, and that passes through its midpoint
e. lines that cuts across another set of lines

Fill in the Blank: Fill in the blank for each statement with the word that best fits. Choose the words from the Word Bank. Some words will not be used.

Word Bank		
equidistant	geometric figure	parallel
perpendicular	skew line	transversal

6) A line is __perpendicular__ to another lines if the lines meet at 90 degrees.

7) __equidistant__ means equally distant, or at the same distance.

8) A __transversal__ is a line that cuts across another set of lines.

9) Boards on a dock would be an example of __parallel__ lines.

10) A __geometric figure__ is any set of points on a plane or in space

Multiple Choice: Read each statement carefully and circle the best answer.

11) An angle in the interior inside of a geometric figure is a/an _______________ angle.

a) exterior

b) interior

c) alternate interior

d) alternate exterior

12) Two exterior angles on opposite sides of a transversal that lie on different parallel lines are __________________ angles.

a) exterior

b) interior

c) alternate interior

d) alternate exterior

13) The four angles that do not include a region of the space between two lines intersected by a transversal are the ______________ angles.

a) exterior

b) interior

c) alternate interior

d) alternate exterior

14) Two interior angles which lie on different parallel lines and on opposite sides of a transversal are _____________________ angles.

a) exterior

b) interior

c) alternate interior

d) alternate exterior

15) In the illustration below of the old chapel building in Yakutat, put an X on the congruent angles that are found on this building.

Arrows point to congruent angles on building.
Illustration of old chapel building with x's on congruent triangles.

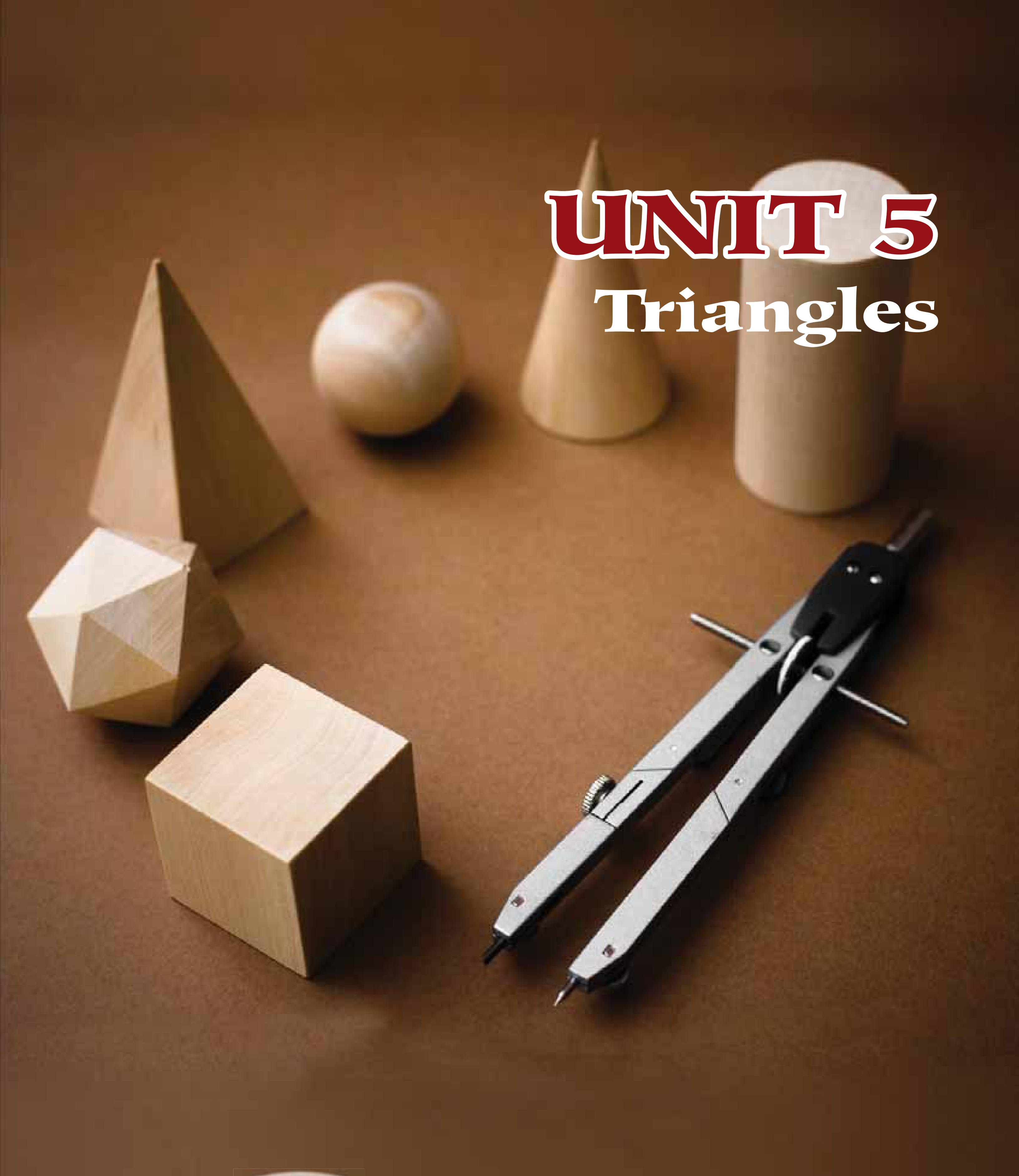
16) In the space below, illustrate or define **consecutive interior angles.**

Illustration ORConsecutive interior angles are two interior angles lying on the same side of the transversal cutting across two lines..

17) In the space below, Illustrate OR write a definition for corresponding angles.

OR
When two lines are crossed by another line. the angles in matching corners or positions are called corresponding angles.

UNIT 5
Triangles



Sealaska Heritage Institute

Grade Level Expectations for Unit 5

Unit 5—Triangles

Alaska State Mathematics Standard A
A student should understand mathematical facts, concepts, principles, and theories.

A student who meets the content standard should:

A5) construct, draw, measure, transform, compare, visualize, classify, and analyze the relationships among geometric figures; and

Alaska State Mathematics Standard C
A student should understand and be able to form and use appropriate methods to define and explain mathematical relationships.

A student who meets the content standard should:

C1) express and represent mathematical ideas using oral and written presentations, physical materials, pictures, graphs, charts, and algebraic expressions;

C2) relate mathematical terms to everyday language;

GLEs
The student demonstrates an understanding of geometric relationships by

[10] G-1 identifying, analyzing, comparing, or using properties of plane figures:

- supplementary, complementary or vertical angles
- sum of interior or exterior angles of a polygon

The student communicates his or her mathematical thinking by

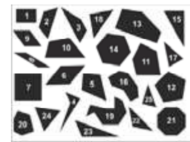
[9] PS-3 representing mathematical problems numerically, graphically, and/or symbolically, translating among these alternative representations; or using appropriate vocabulary, symbols, or technology to explain, justify, and defend strategies and solutions

[10] PS-3 representing mathematical problems numerically, graphically, and/ or symbolically, communicating math ideas in writing; or using appropriate vocabulary, symbols, or technology to explain, justify, and defend strategies and solutions

Vocabulary & Definitions

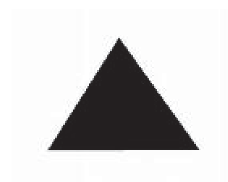
Introduction of Math Vocabulary

polygon



A polygon is a plane shape with three or more straight sides. Triangles, rectangles, trapezoids, pentagons, and octagons are a few examples of polygons. Ask students: “Which of these are polygons?” The answer is – all of them.

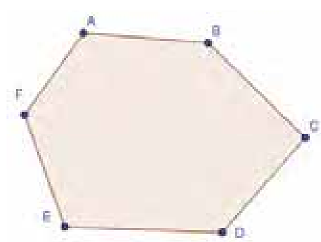
In northern areas with permafrost (permanently frozen ground), a pattern of polygons often develops on the ground surface. (You have to imagine that all the sides are straight)



triangle

A triangle is any polygon with three sides.

The triangle on this basketball hoop is an example of a triangle that you can see around you in the school, the community, or in nature.



interior

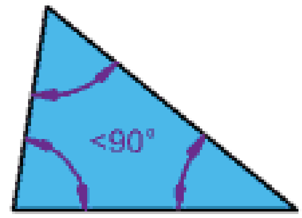
The interior is the set of points enclosed by a geometric figure. It does not include the vertices or the sides or edges of the figure.

The miners in the picture are in the interior of a mine.

Introduction of Math Vocabulary

acute triangle

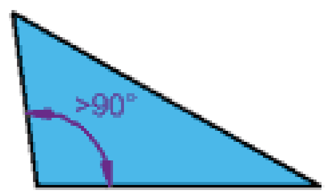
An acute triangle is a triangle in which all of the interior angles are acute, or less than 90°.



In the picture, the books on the shelf form an acute triangle.

obtuse triangle

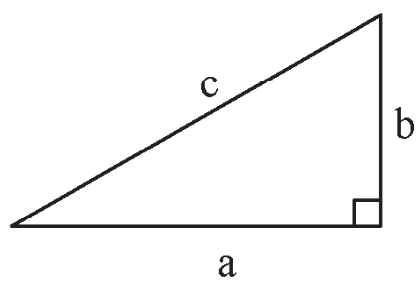
An obtuse triangle is a triangle that has an obtuse angle as one of its interior angles.

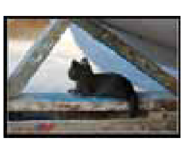


The turnovers in the picture are obtuse triangles.

right triangle

A right triangle is a triangle which has a right (90°) interior angle.



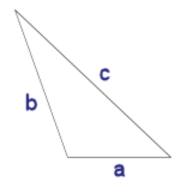


In this picture, the kitten has found a sheltered spot inside a right triangle.

Introduction of Math Vocabulary

scalene

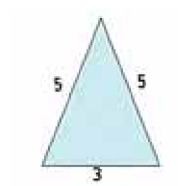
A scalene triangle is a triangle for which all three sides have different lengths.



The triangle shown on this railing is a scalene triangle.

isosceles

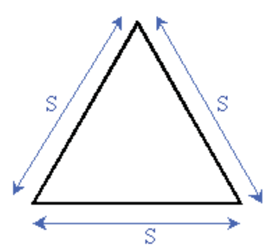
An isosceles triangle is a triangle with two sides that are the same length.



This coat hangar is shaped like an isosceles triangle.

equilateral

An equilateral triangle is a triangle for which all three sides are the same length (congruent).

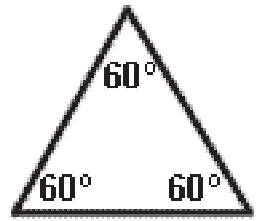


These candles are shaped like equilateral triangles.

Introduction of Math Vocabulary

equiangular

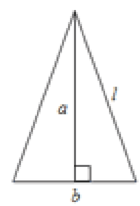
Equiangular means that all of the angles are equal.

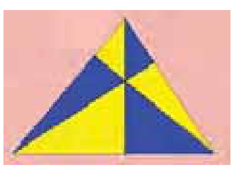


A musical triangle is an example of an equiangular triangle.

altitude

The altitude of a triangle is distance between a vertex of a triangle and the opposite side. In this diagram, segment "a" is the altitude.

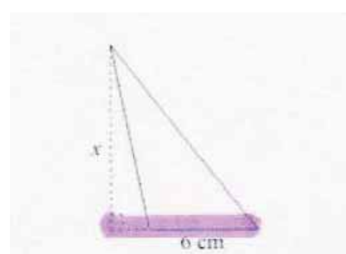




All three altitudes of a triangle are shown in this picture.

base

The base of a triangle is the side of the triangle that is perpendicular to the altitude. In the diagram, the 6cm is the base.

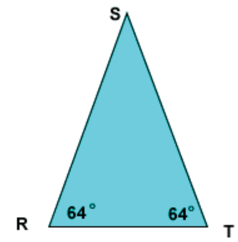


In this picture, one base of the triangle is on the man's head!

Introduction of Math Vocabulary

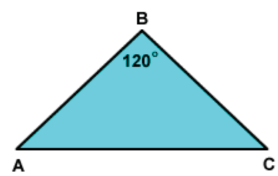
base angle

The base angle of a triangle is either of two angles that have the base for a side.
In this isosceles triangle, angles “R” and “T” are the base angles.



vertex angle

The vertex angle of a triangle is the angle opposite the base.
In this triangle, angle “B” is the vertex angle

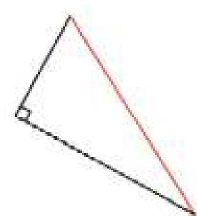


leg

The leg of a triangle is one of its sides. In a right triangle, the two sides opposite the acute angles are called the legs, and in an isosceles triangle the sides opposite the congruent angles are called the legs. Here’s a triangle in which two of the legs really are legs!

hypotenuse

A hypotenuse is the side of a right triangle opposite the right angle.

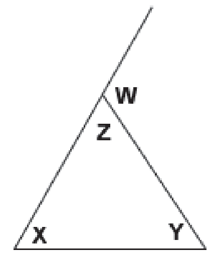


In this picture the bird is sitting on a hypotenuse

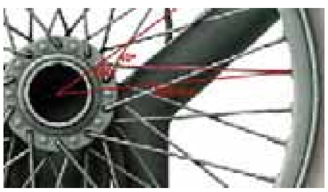
Introduction of Math Vocabulary

exterior angle (of a triangle)

An exterior angle is an angle formed outside a triangle when one side is extended.   In this diagram, angle W is an exterior angle.

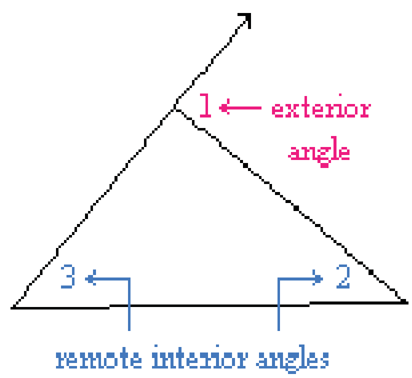


In the picture, the 40º angle is an example of an exterior angle of a triangle formed by the spokes of a bicycle wheel.



remote interior angle

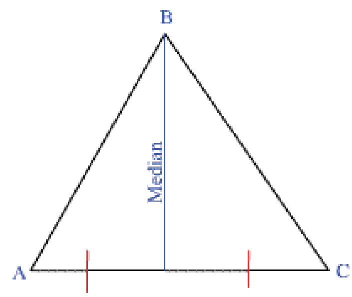
“Remote” means far away. Remote interior angles of a triangle are the two angles that are farthest from an exterior angle. A remote interior angle is not adjacent to the exterior angle.

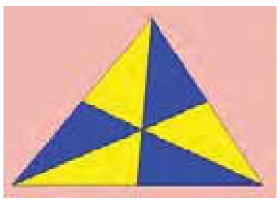


Introduction of Math Vocabulary

median

The median of a triangle is a line segment drawn from one vertex to the midpoint of the opposite side.

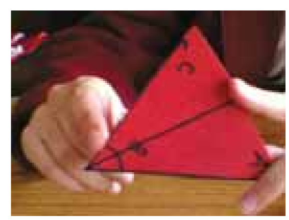




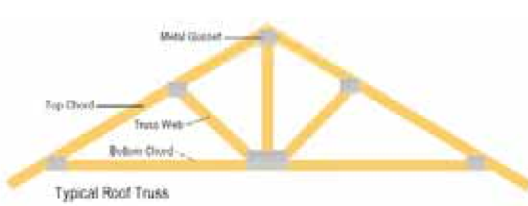
This picture shows the three medians of a triangle.

angle bisector

In a triangle, an angle bisector is a line that divides an interior angle in half.



The vertical post on this roof truss is an example of an angle bisector.



Language and Skills Development

Using the Math Vocabulary Terms

Language & Skills Development

LISTENING

Use the activity pages from the Student Support Materials.

Three Sentences
Provide each student with three blank flashcards. Each student should then write the numbers 1 to 3 on his/her cards - one number per card. Say three sentences, only one of which contains a vocabulary word. The students should listen carefully to the three sentences that you say. After saying the three sentences, each student should then show his/her number card that represents the number of the sentence which contained the vocabulary word. Repeat with other sets of sentences.

SPEAKING

Numbered Boxes
Before the activity begins, prepare a page that contains 20 (or more) boxes. Number each of the boxes. Provide each student with a copy of the numbered boxes. Each student should then shade in half of the boxes with a pencil (any ten boxes). When the students are ready, mount the vocabulary illustrations on the chalkboard and say the number of a box (between 1 and 20) to one of the students. The student should look on his/her form to see if that box number is shaded-in. If that box is shaded in, the student may "pass" to another player. However, if the box is not shaded-in, he/she should say a complete sentence about a vocabulary illustration you point to. The students may exchange pages periodically during this activity. Repeat until many students have responded in this way.

READING

Use the activity pages from the Student Support Materials.

Circle of Words
Before the activity begins, prepare a page that contains the sight words. Provide each student with a copy of the page. The students should cut the sight words from their pages. When a student has cut out the sight words, he/she should lay them on his/her desk, in a circle. Then, each student should place a pen or pencil in the center of the circle of sight word cards. Each student should spin the pen/pencil. Say a sight word. Any student or students whose pens/pencils are pointing to the sight word you said, should call "BINGO." The student or students should then remove those sight words from their desks. Continue in this way until a student or students have no sight words left on their desks.

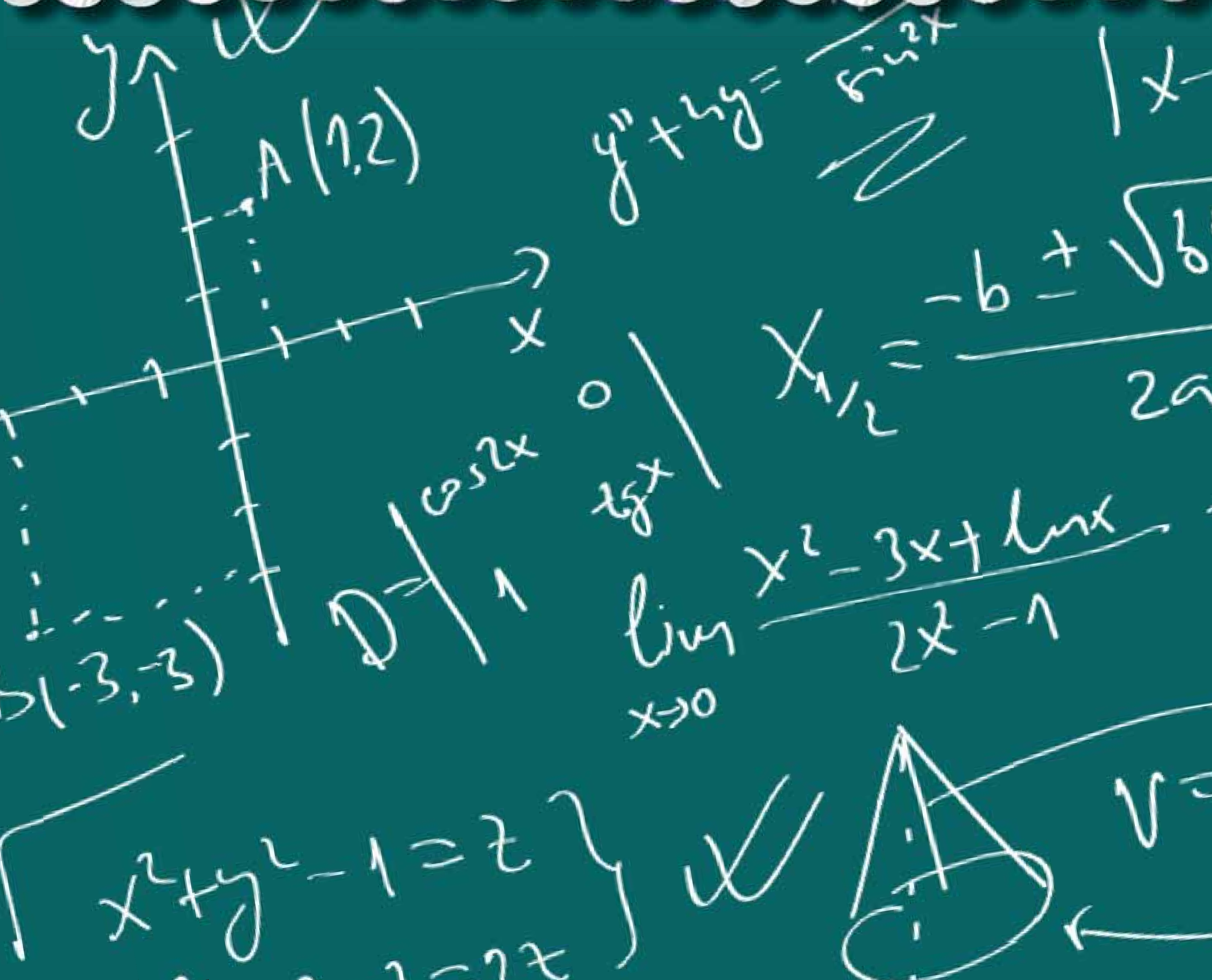
WRITING

Use the activity pages from the Student Support Materials.

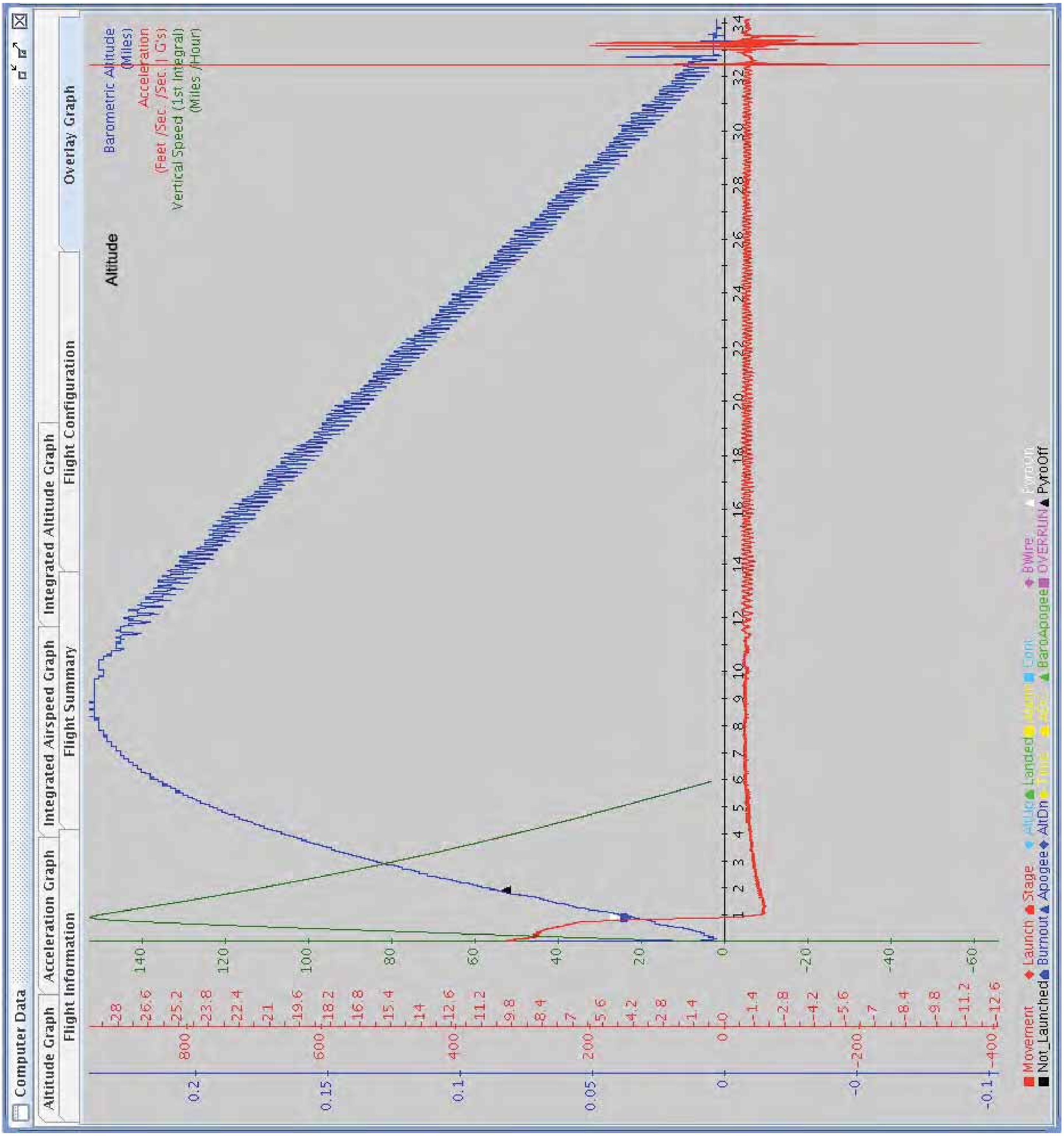
Every Second Letter
Write a sight word on the chalkboard, omitting every second letter. Provide the students with writing paper and pens. The students should look at the incomplete word on the chalkboard and then write the sight word for it on their papers. Repeat using other sight words.

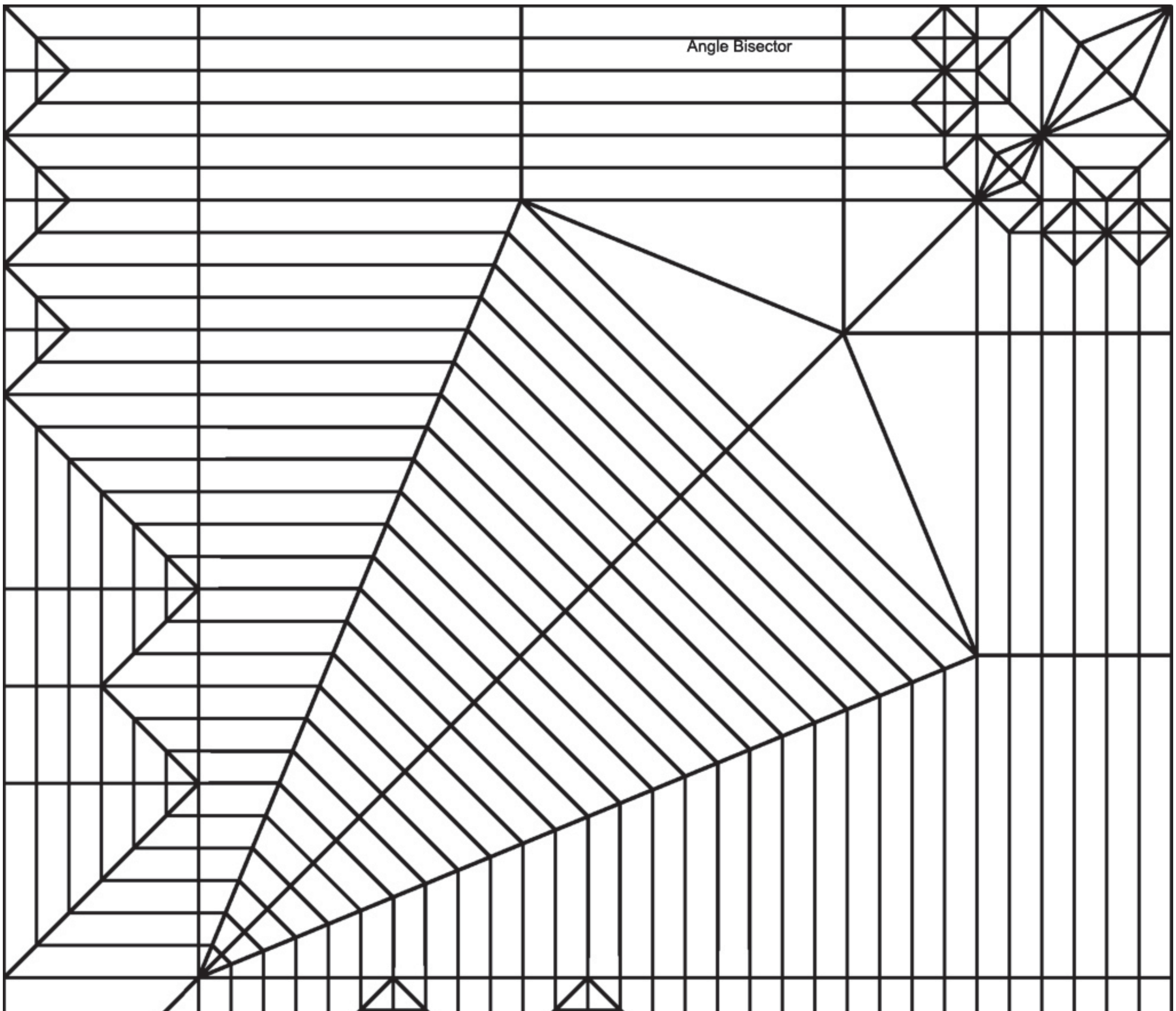
This activity may also be done in team form. In this case, have the incomplete words prepared on separate flash cards. Mount one of the cards on the chalkboard. When you say "Go," the first player from each team must rush to the chalkboard and write the sight word for it - adding all of the missing letters. Repeat until all players have participated.

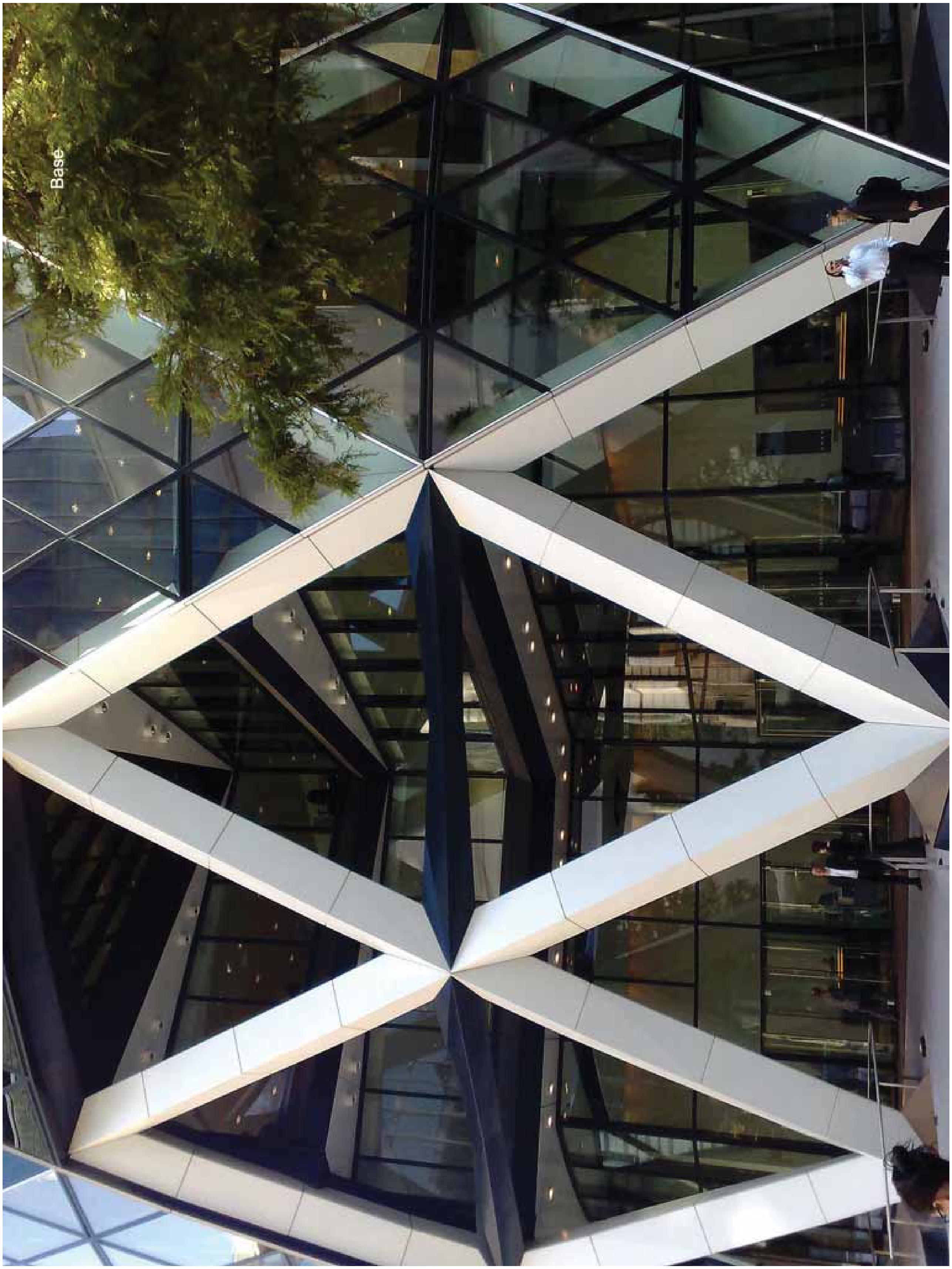
Student Support Materials

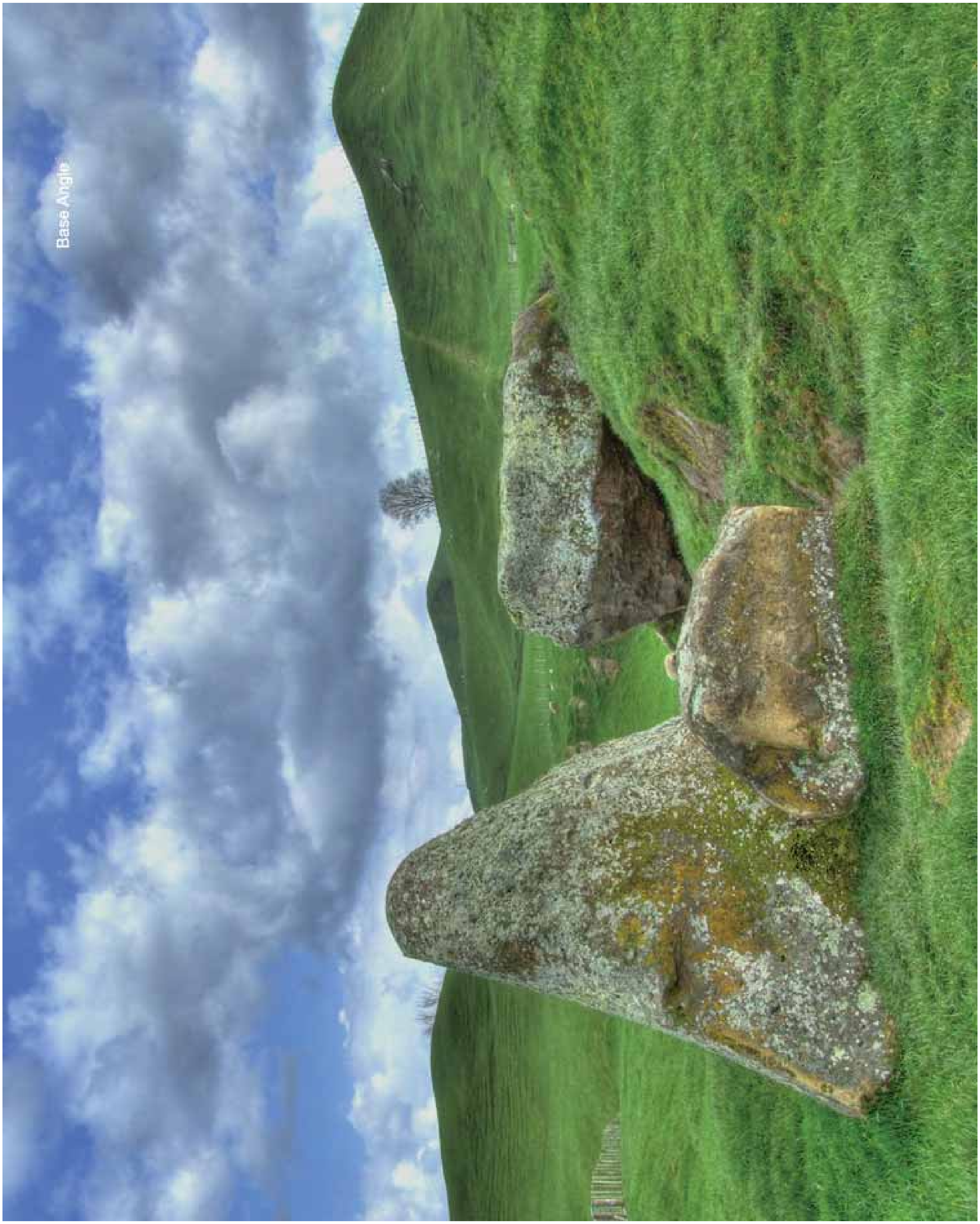



Acute
© Eric Bégin


Computer Data
Altitude Graph
Acceleration Graph
Integrated Airspeed Graph
Integrated Altitude Graph
Flight Information
Flight Summary
Flight Configuration
Overlay Graph
Altitude
Barometric Altitude (Miles)
Acceleration (Feet /Sec. /Sec. | G's)
Vertical Speed (1st Integral) (Miles /Hour)
Movement
Launch
Stage
AltUp
Landed
Mach
Cont.
BWire
PyroOn
Not_Launched
Burnout
Apogee
AltDn
Time
ASC
BaroApogee
OVERRUN
PyroOff


Angle Bisector


Base


Base Angle

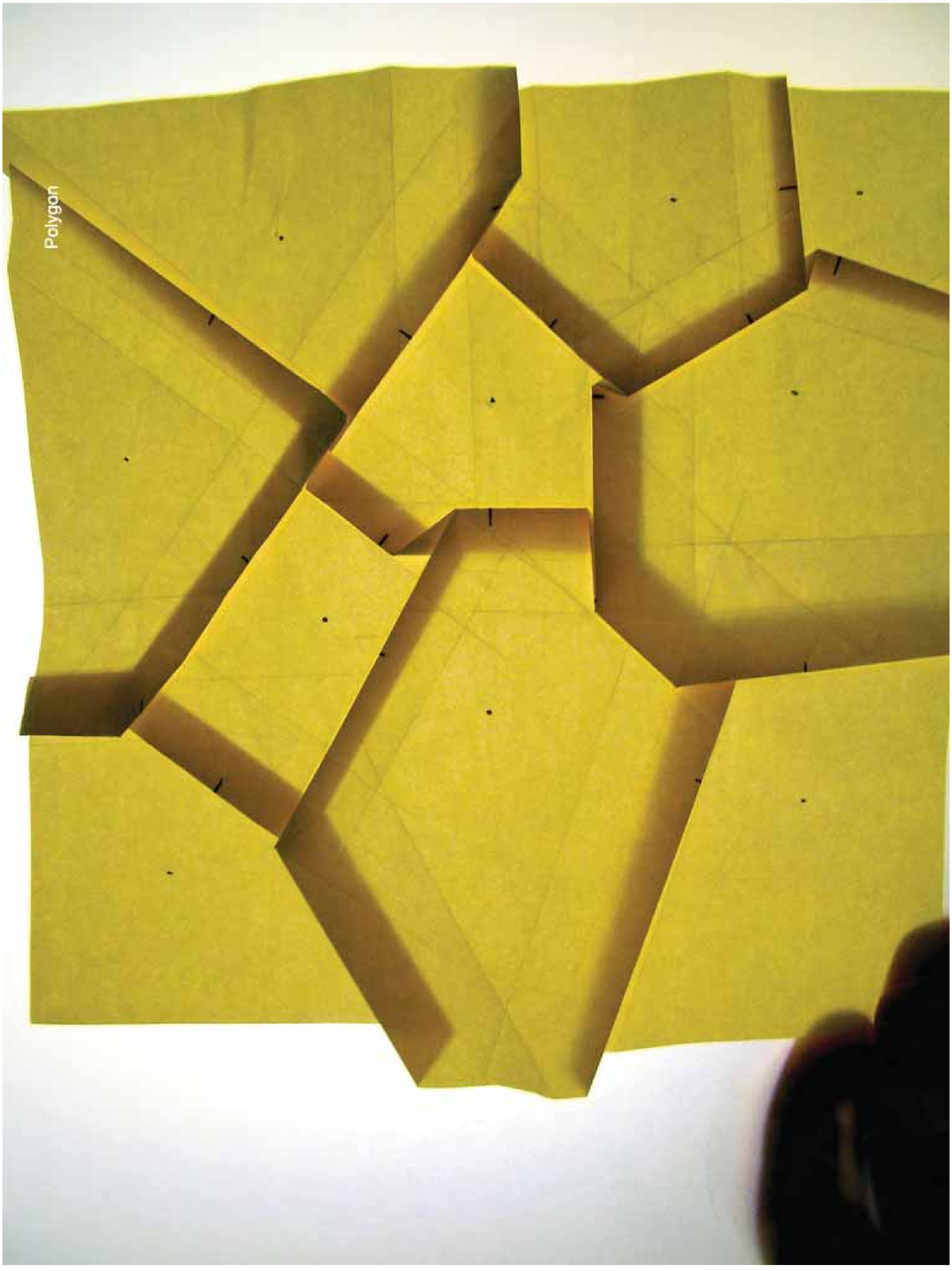
Equilateral Triangle

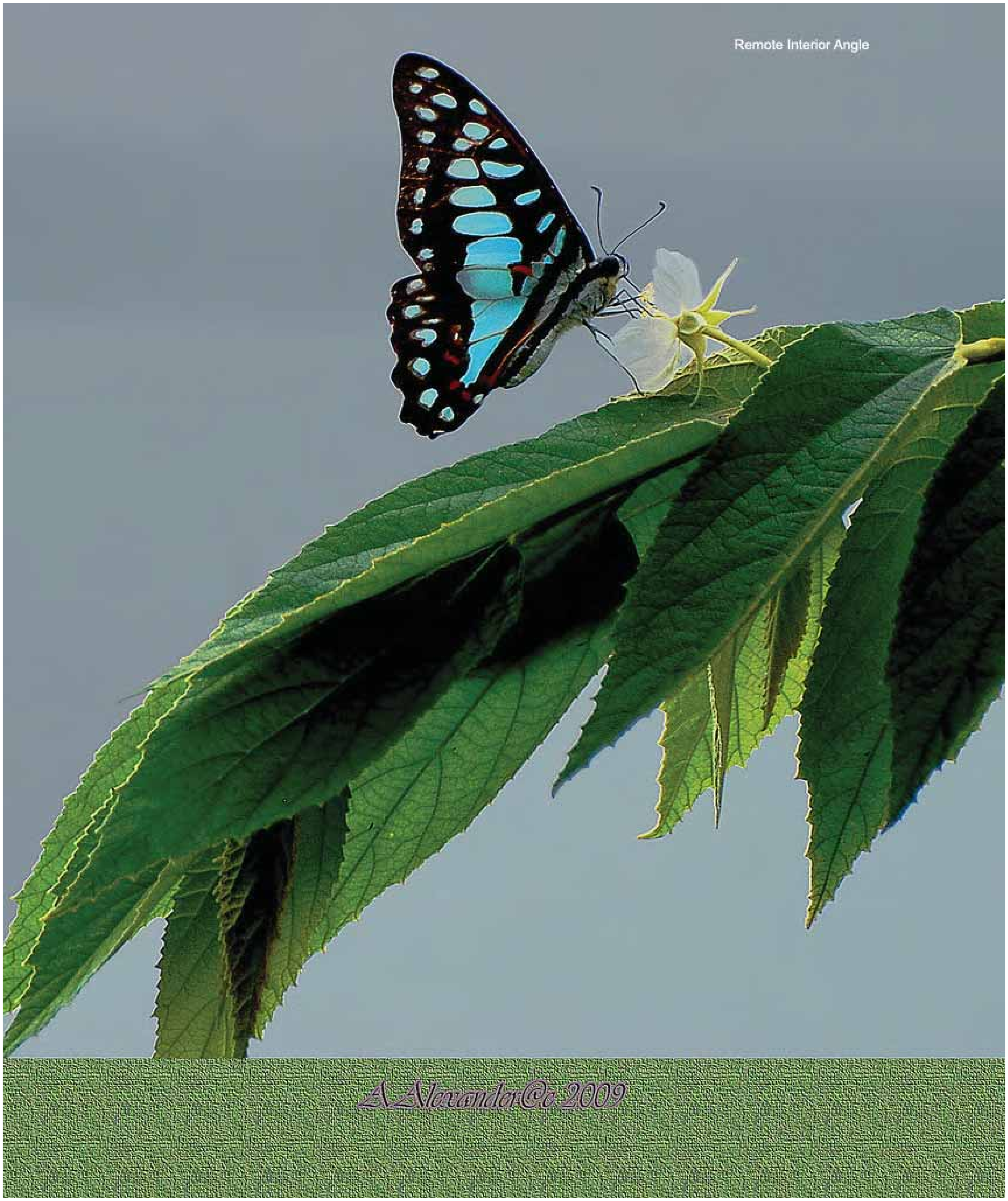

Exterior Angle

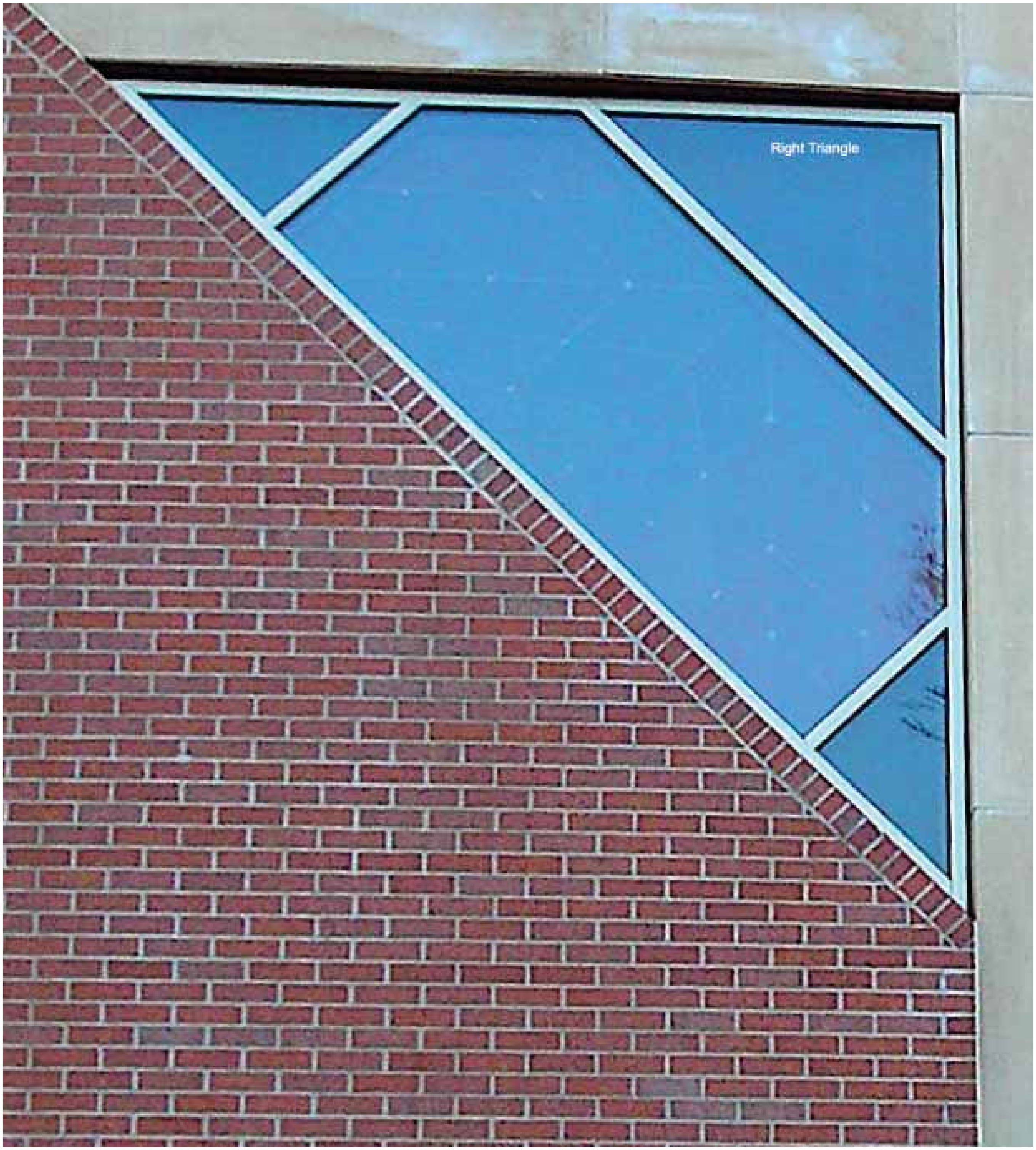

Isosceles


Median


Obtuse

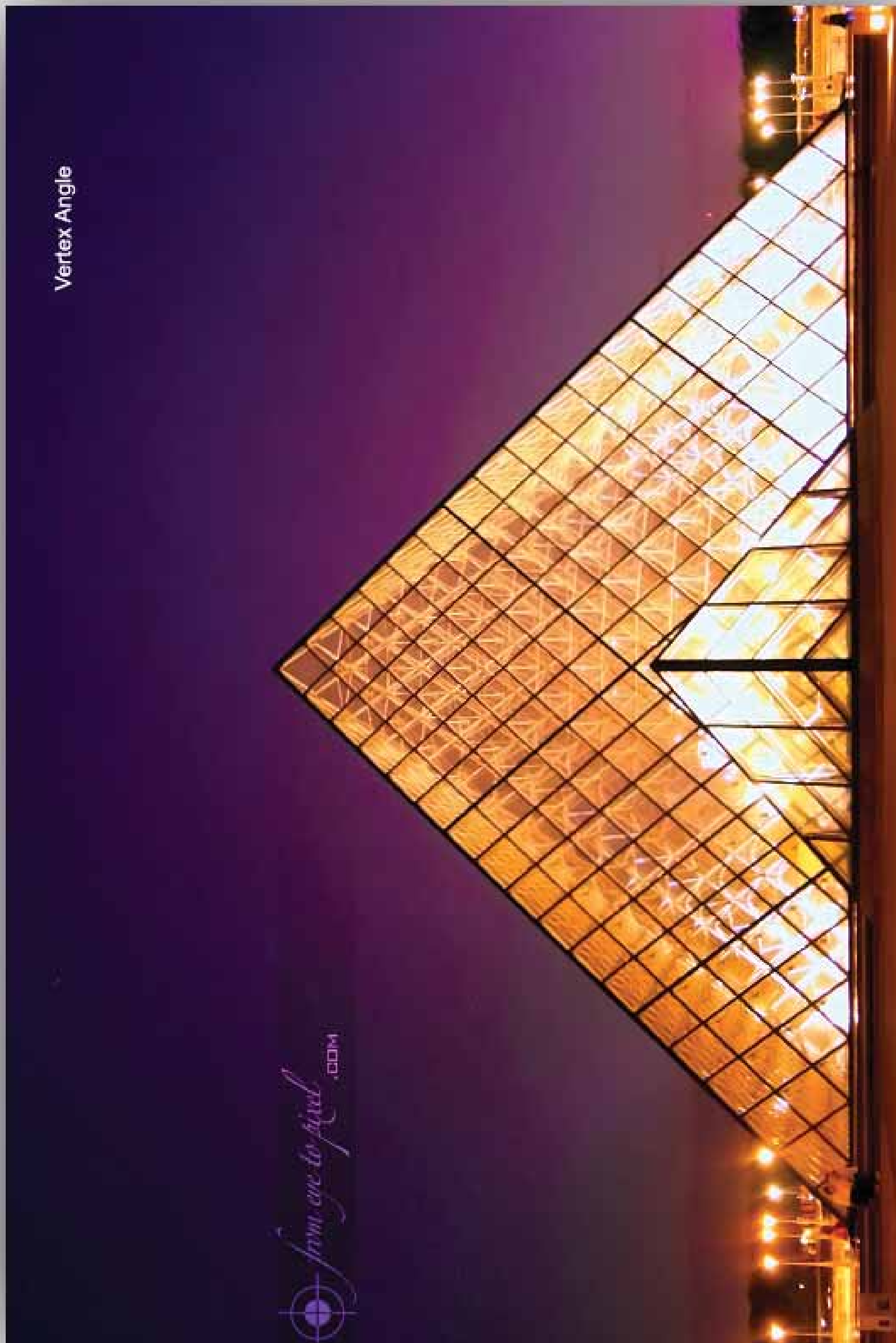

Polygan


Remote Interior Angle
A Alexander©c 2009


Right Triangle


Scaleno

Triangle


Vertex Angle
from eye to pixel
.COM

True-False Sentences

(Listening and/or Reading Comprehension)

1. A polygon always has straight sides.
2. The three sides of a triangle are always the same length.
3. Sides and vertices are part of the interior of a geometric figure.
4. In an acute triangle, all three angles must be acute.
5. In an obtuse triangle, all three angles are greater than 90°.
6. In a right triangle, two sides are perpendicular.
7. In a scalene triangle, the base is always the same length as the altitude.
8. A right triangle cannot also be an isosceles triangle.
9. Equiangular triangles have three angles that are the same size.
10. If the three sides of a triangle are congruent, it is an equilateral triangle.
11. The base of a triangle forms a right angle with the altitude.
12. The longest side of a triangle is also known as its altitude.
13. A base angle of a triangle has the base of the triangle as one of its sides.
14. The angle of a triangle opposite its base is called the vertex angle.
15. Most triangles have two legs.
16. Every triangle has a hypotenuse.
17. An exterior angle of a triangle is complementary to its adjacent interior angle.
18. For every exterior angle, there are two remote interior angles
19. A median is always perpendicular to the side that it bisects.
20. In a triangle, the angle bisector also bisects the side opposite that angle.

Answers: 1T, 2F, 3F, 4T, 5F, 6T, 7F, 8F, 9T, 10T, 11T, 12F, 13T, 14T, 15F, 16F, 17F, 18T, 19F, 20F

1. Any figure with three or more straight lines is a polygon.
2. A triangle has three sides and three angles.
3. The interior of a shape or figure includes all of the points enclosed by it.
4. You might have a right angle in an acute triangle.
5. An obtuse triangle has one obtuse angle.
6. All of the angles in a right triangle are right angles.
7. All three sides of a scalene triangle are different lengths.
8. Isosceles triangles have two legs that are the same length.
9. An obtuse triangle could also be an equiangular triangle.
10. All isosceles triangles are equilateral.
11. The base of a triangle is always the side toward the bottom of the page.
12. The altitude of a triangle is the shortest segment that can be drawn from a vertex to the opposite side.
13. The base angle of a triangle is opposite its base.
14. A triangle can have only one vertex angle.
15. The side of a triangle is also the leg of a triangle.
16. The side opposite the right angle is the hypotenuse of a right triangle.
17. An exterior angle of a triangle is formed by extending one side of the triangle.
18. A remote interior angle is adjacent to another remote interior angle.
19. In a triangle, a median bisects one of the sides.
20. The angle bisector of a triangle divides one of the interior angles in half.

Answers: 1F, 2T, 3T, 4F, 5T, 6F, 7T, 8T, 9F, 10F, 11F, 12T, 13F, 14F, 15T, 16T, 17T, 18F, 19T, 20T

Match the Halves

1. Squares and rectangles are types of	A. An acute triangle.
2. Any polygon with three sides	B. Equiangular.
3. The interior of a triangle does not include	C. A base angle.
4. If none of the angles of a triangle measure more than 90^o it is	D. A leg of the triangle.
5. A triangle with a wide angle greater than 90^o is	E. Has a hypotenuse.
6. If two sides of a triangle are perpendicular, it is	F. Has to be a triangle.
7. In a scalene triangle	G. An exterior angle is formed.
8. If two sides of a triangle are equal in length, it is	H. None of the sides are the same length.
9. If all three angles of a triangle have the same measure, it is	I. Opposite the base of a triangle.
10. In an equilateral triangle	J. Polygons.
11. The base of a triangle	K. Into two equal parts.
12. The altitude of a triangle is the shortest segment from	L. A median.
13. An angle for which the base of a triangle forms one side is	M. All of the sides are the same length.
14. A vertex angle is	N. Is perpendicular to its altitude.
15. Any side of a scalene triangle is	O. The sides and the vertices.
16. A right triangle is the only type of triangle that	P. An obtuse triangle.
17. When a side of a triangle is extended,	Q. Not adjacent to the exterior angle.
18. A remote exterior angle is	R. An isosceles triangle.
19. A side of a triangle is bisected by	S. A vertex to the opposite side.
20. An angle bisector divides an angle	T. A right triangle.

Answers: 1J, 2F, 3O, 4A, 5P, 6T, 7H, 8R, 9B, 10M, 11N, 12S, 13C, 14I, 15D, 16E, 17G, 18Q, 19L, 20K

Definitions

polygon - a plane shape with three or more straight sides.

triangle - any polygon with three sides.

interior - the set of points enclosed by a geometric figure.

acute (triangle) - a triangle in which all of the interior angles are acute, or less than 90^{o}.

obtuse (triangle) - a triangle that has an obtuse angle as one of its interior angles.

right (triangle) - a triangle which has a right (90°) interior angle.

scalene (triangle) - a triangle for which all three sides have different lengths.

isosceles (triangle) - a triangle with two sides that are the same length.

equilateral (triangle) - a triangle for which all three sides are the same length (congruent).

equiangular (triangle) - a triangle for which all three angles are congruent.

altitude - the distance between a vertex of a triangle and the opposite side.

base - the side of the triangle that is perpendicular to the altitude.

base angle - either of two angles of a triangle that have the base for a side.

vertex angle - the angle opposite the base of a triangle.

leg - one of the sides of a triangle.

hypotenuse - the side of a right triangle opposite the right angle.

exterior angle (of a triangle) - an angle formed outside a triangle when one side is extended.

remote interior angle (of a triangle) - an angle of a triangle that is not adjacent to an exterior angle.

median (of a triangle) - a line segment drawn from one vertex to the midpoint of the opposite side.

angle bisector - a line that divides an interior angle of a triangle in half.

Which Belongs

1. In a right triangle, the (base, hypotenuse, altitude) is opposite the vertex.
2. The capital letter “A” is (an isosceles, a scalene, a right) triangle.
3. An (interior, exterior, obtuse) angle includes points enclosed by a geometric figure.
4. When two legs of a triangle are perpendicular, it is a(n) (acute, obtuse, right) triangle.
5. The (vertex, leg, base) of a triangle intersects the altitude to form a right angle.
6. A segment that divides an angle into two equal parts is a(n) (altitude, angle bisector, median).
7. All of the sides of a (scalene, obtuse, acute) triangle have different lengths.
8. The three angles of an (acute, obtuse, equiangular) triangle are congruent.
9. A (right triangle, polygon, hypotenuse) might have six sides.
10. To form an (exterior, remote interior, vertex) angle, one of the sides of a triangle is extended.
11. The (median, altitude, angle bisector) is at a 90^{o} angle to the base of a triangle.
12. A(n) (acute, scalene, obtuse triangle) cannot have a 110^{o} angle.
13. In a triangle, a (remote interior angle, vertex angle, base angle) is not adjacent to the exterior angle.
14. Any polygon with three sides is a (triangle, median, vertex angle).
15. A(n) (obtuse, scalene, isosceles) triangle cannot be a right triangle.
16. The (leg, vertex angle, altitude) of a triangle is opposite the base.
17. If a triangle is (right, obtuse, equilateral) is cannot be a scalene triangle.
18. The base of a triangle forms one side of a(n) (altitude, angle bisector, base angle).
19. If a side of a right triangle is not the hypotenuse, it is called a (leg, median, vertex).
20. The base of a triangle could be divided into two equal parts by a (hypotenuse, median, angle bisector).

1. Base
2. Isosceles
3. Interior
4. Right
5. Base
6. Angle bisector
7. Scalene
8. Equiangular
9. Polygon
10. Exterior
11. Altitude
12. Acute
13. Remote interior angle
14. Triangle
15. Obtuse
16. Vertex angle
17. Equilateral
18. Base angle
19. Leg
20. Median

Multiple Choice

1. An enclosed figure made up of three segments is a
   a) scalene triangle
   b) triangle
   c) polygon

2. The longest side of a right triangle is its
   a) hypotenuse
   b) altitude
   c) base

3. The side of a triangle that is opposite the vertex angle is the
   a) hypotenuse
   b) base
   c) leg

4. A segment that divides an angle in half is
   a) a median
   b) an altitude
   c) an angle bisector

5. A right triangle cannot also be
   a) equiangular
   b) scalene
   c) isosceles

6. Which of these angles is opposite the base of a triangle
   a) vertex angle
   b) base angle
   c) exterior angle

7. All of the points enclosed by a geometric figure make up its
   a) exterior
   b) altitude
   c) interior

8. You might find a 135^o angle in an
   a) acute triangle
   b) right triangle
   c) obtuse triangle

9. A segment that divides one side of a triangle into two equal parts is called
   a) an angle bisector
   b) a median
   c) an isosceles

10. A triangle in which all of the angles are smaller than right angles is an
    a) acute triangle
    b) obtuse triangle
    c) isosceles triangle

11. A side of an isosceles triangle that is not the base is called a
    a) altitude
    b) vertex side
    c) leg

12. If a triangle has two sides that are perpendicular, it is
    a) an isosceles triangle
    b) a right triangle
    c) a scalene triangle

13. When at least two sides of a triangle are congruent, the triangle is
    a) isosceles
    b) equilateral
    c) equiangular

14. If all three sides of a triangle are the same, it is
    a) equiangular
    b) isosceles
    c) equilateral

15. The height of a triangle from its base is called its
    a) altitude
    b) median
    c) hypotenuse

16. An enclosed figure with straight, coplanar sides is called a
    a) polygon
    b) exterior angle
    c) median

17. An angle of a triangle that is not a base angle would be the
    a) remote interior angle
    b) median angle
    c) vertex angle

18. An angle that formed by the extension of one of a triangle's sides is its
    a) vertex angle
    b) exterior angle
    c) base angle

19. If an angle does not form a linear pair with the exterior angle of a triangle, it would be a
    a) vertex angle
    b) remote interior angle
    c) base angle

20. If a triangle is not an isosceles triangle, it is
    a) scalene
    b) right
    c) equilateral

Answers:
1b 2a 3b 4c 5a 6a 7c 8c 9b 10a 11c 12b 13a 14c 15a 16a 17c 18b 19b 20a

Complete the Sentence

1. The set of points enclosed by a geometric figure is its _____________.
2. A triangle is a _____________________ if two of its sides are perpendicular.
3. Segment AD was the ____________________of triangle ABC because it divided angle A into two equal parts.
4. Any side of a triangle is a ____________, although that term is not usually used for a hypotenuse or a base.
5. Three sides of unequal lengths would make up a ______________triangle.
6. From the front of the house, the roof was shaped like a(n) ___________________triangle because the two sides were of equal lengths.
7. A coat hanger has (more or less) the shape of a(n) _____________triangle.
8. In a triangle, a ______________________ is not adjacent to its exterior angle.
9. All of the angles of that triangle have the same measure, so it is a(n) ______________ triangle.
10. Each side of a(n) ________________________ triangle had a length of 10 centimeters.
11. A triangle's three angles measure 80^{o}, 30^{o}, and 70^{o}, so it is a(n) __________triangle.
12. A _____________________ of a triangle bisects the base of the triangle.
13. When you find the altitude of a triangle, you measure perpendicular to the _______________________.
14. The shortest distance from the base of a triangle to the opposite vertex is the _______________.
15. An angle of a triangle must be the _________________if it is not a base angle.
16. A _____________________is a type of polygon with exactly three sides.
17. In a right triangle, the ___________________ is not perpendicular to any other side.
18. If a side of an triangle is extended, a(n) ______________________is created.
19. A ___________________________ might have eleven sides.
20. If the base of a triangle forms one side of an angle, that angle is called a_____________.

Answers:

1. interior
2. right triangle
3. angle bisector
4. leg
5. scalene
6. isosceles
7. obtuse
8. remote interior angle
9. equiangular
10. equilateral
11. acute
12. median
13. base
14. altitude
15. vertex angle
16. triangle
17. hypotenuse
18. exterior angle
19. polygon
20. base angle

Creative Writing

This picture was taken in the 1930's when the first bridge from Juneau to Douglas Island was under construction.

Archives, University of Alaska Fairbanks

Place-Based Practice Activity

1) Divide students into small groups and assign each group one type of tri angle:

Scalene
Isosceles
Equilateral
Acute
Obtuse
Right

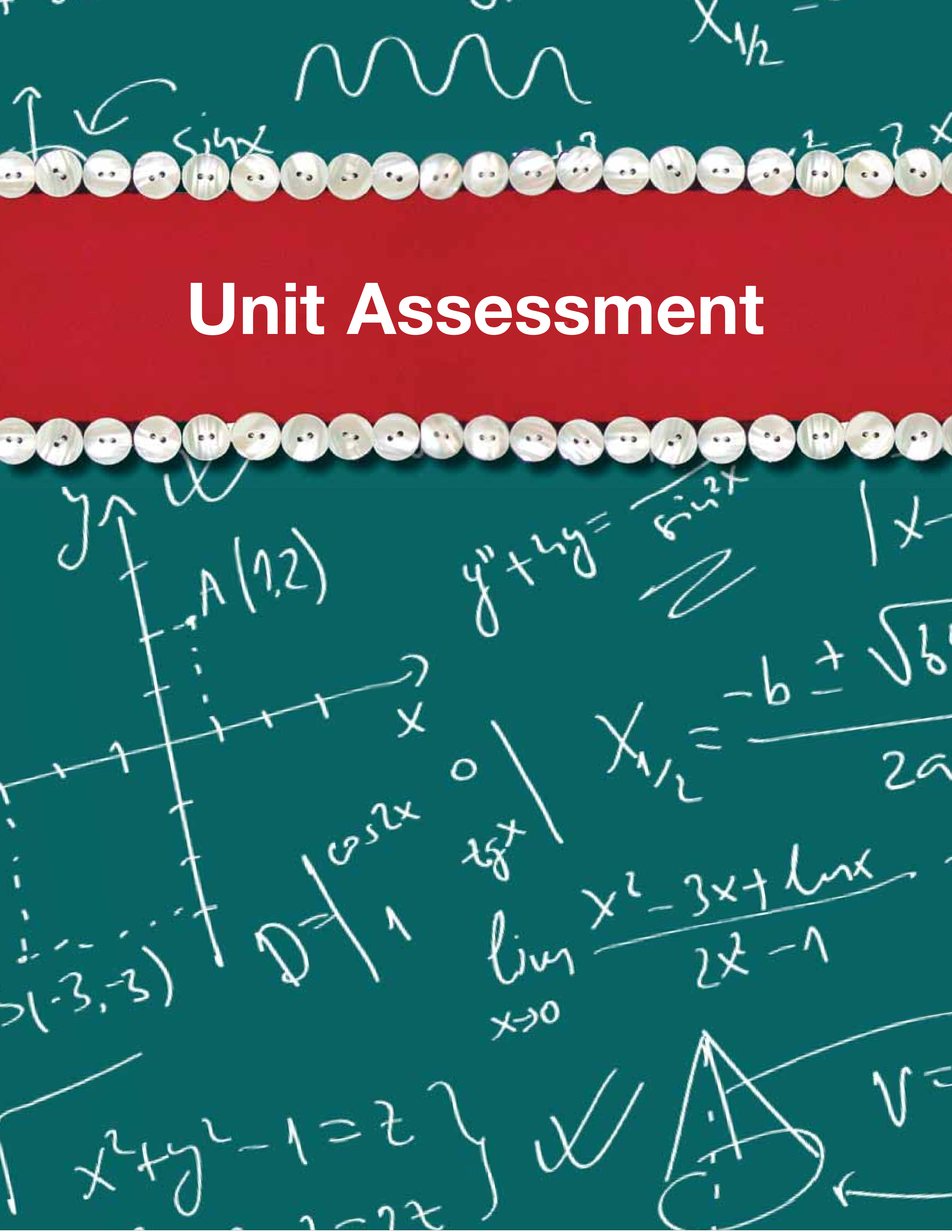
Each group should find a good example of their triangle somewhere in the school or community, and sketch or photograph it. Then they should label as many of the following as possible on their triangle:

Base
Altitude
Median
Base angle
Vertex angle
Exterior angle
Remote interior angle
Angle bisector
Leg

Each group should share their work with the class by making a poster, or a brief class presentation.

2) Ask students in small groups to choose one of these topics:
Art
Construction
Navigation

Ask each group to do research to find out how triangles are important or relevant to the topic they chose. As they research, they should identify the types and parts of triangles that they find out about.



Unit Assessment

Geometry: Unit 5-Triangles Quiz

Name: ____________________
Date: ____________________

Match the key vocabulary word on the left with correct shape on the right. Put the letter of the shape, in front of the word it matches.

1) ______ polygon
2) ______ acute triangle
3) ______ right triangle
4) ______ scalene triangle
5) ______ isosceles triangle
6) ______ equilateral triangle
7) ______ equiangular triangle

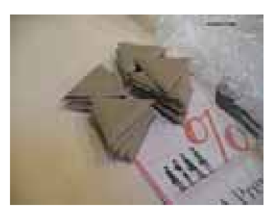
a. 

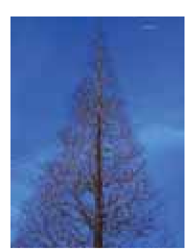
b. 

c. 

d. 

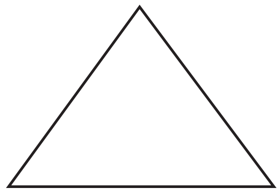
e. 

f. 

g. 

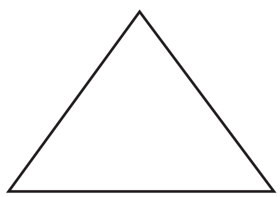
Illustrations: In the next three text items, follow the instructions for each item.

8) Look at the shape below and label it in the space provided.



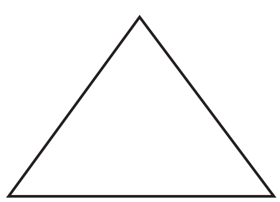
label the shape

9) In the illustration below, put an X on the **base** of the triangle.



10) in the space below, draw a picture showing an **angle bisector**.

11) In the illustration below, put an X on the **vertex** angle.



Fill in the blank: Complete each sentence with the word that fits best. Choose the word from the Word Bank.

Word Bank		
angle bisector	base	base
exterior	hypotenuse	leg
median	remote interior	vertex

12) The ________ of a triangle is the angle opposite the base.

13) A /an ________ I s the side of a right triangle opposite the right angle.

14) A/an ________ angle of a triangle is an angle formed outside a triangle when one line is extended.

15) ________ angles of a triangle are the two angles that are farthest from an exterior angle.

16) The ________ angle of a triangle is either of two angles that have the base for a side.

17) The ________ of a triangle is a line segment drawn from one vertex to the midpoint of the opposite side.

18) The ________ angle of a triangle is either of two angles that have the base for the side.

True/False: Read each item carefully and decide if the statement is true or false. Circle the correct answer.

19) The exterior is the set of points enclosed by a geometric figure.

a) True

b) False

20) Triangles, rectangles, trapezoids, pentagons, and octagons are all examples of polygons.

a) True

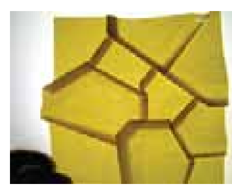
b) False

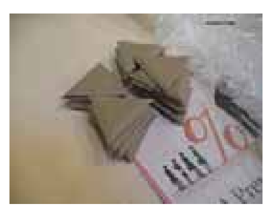
Geometry: Unit 5-Triangles Quiz

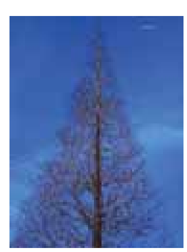
Name: ____________________
Date: ____________________

Match the key vocabulary word on the left with correct shape on the right. Put the letter of the shape, in front of the word it matches.

1) _e_ polygon
2) _b_ acute triangle
3) _c_ right triangle
4) _a_ scalene triangle
5) _g_ isosceles triangle
6) _f_ equilateral triangle
7) _d_ equiangular triangle







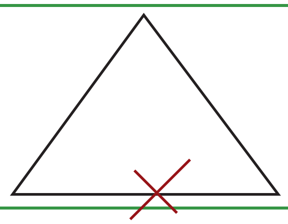
Illustrations: In the next three text items, follow the instructions for each item.

8) Look at the shape below and label it in the space below it.

____

Triangle

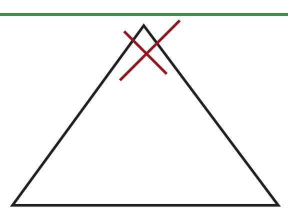
9) In the illustration below, put an X on the **base** of the triangle.



10) in the space below, draw a picture showing an angle bisector.

Show illustration of angle bisector.

11) In the illustration below, put an X on the **vertex** angle.



Fill in the blank: Complete each sentence with the word that fits best. Choose the word from the Word Bank.

Word Bank		
angle bisector	base	base
exterior	hypotenuse	leg
median	remote interior	vertex

12) The **leg** of a triangle is the angle opposite the base.

13) A /an **hypotenuse** is the side of a right triangle opposite the right angle.

14) A/an **exterior** angle of a triangle is an angle formed outside a triangle when one line is extended.

15) **remote interior** angles of a triangle are the two angles that are farthest from an exterior angle.

16) The **base** angle of a triangle is either of two angles that have the base for a side.

17) The **median** of a triangle is a line segment drawn from one vertex to the midpoint of the opposite side.

18) The **base** angle of a triangle is either of two angles that have the base for the side.

True/False: Read each item carefully and decide if the statement is true or false. Circle the correct answer.

19) The exterior is the set of points enclosed by a geometric figure.

a) True

b) False

20) Triangles, rectangles, trapezoids, pentagons, and octagons are all examples of polygons.

a) True

b) False