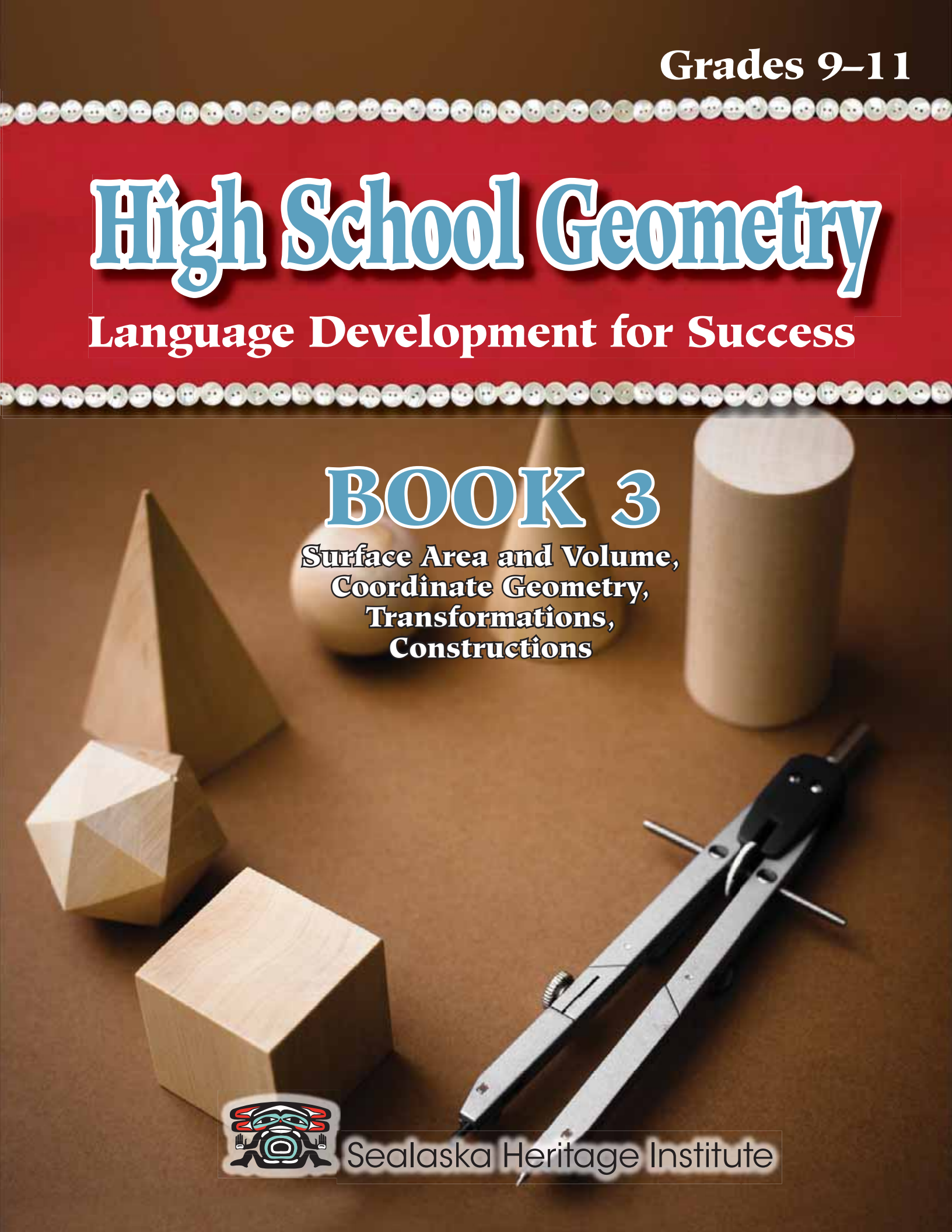
Grades 9–11

High School Geometry

Language Development for Success

BOOK 3

Surface Area and Volume, Coordinate Geometry, Transformations, Constructions



Sealaska Heritage Institute

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2009

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

DEVELOPED BY
Stephanie Hoage
Steve Morley
Jim MacDiarmid

Unit Assessments
Bev Williams

LAYOUT & FORMATTING
Matt Knutson

PRINTERS
Capital Copy, Juneau, Alaska

PROJECT ASSISTANT
Tiffany LaRue

2009

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BOOK 3

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.

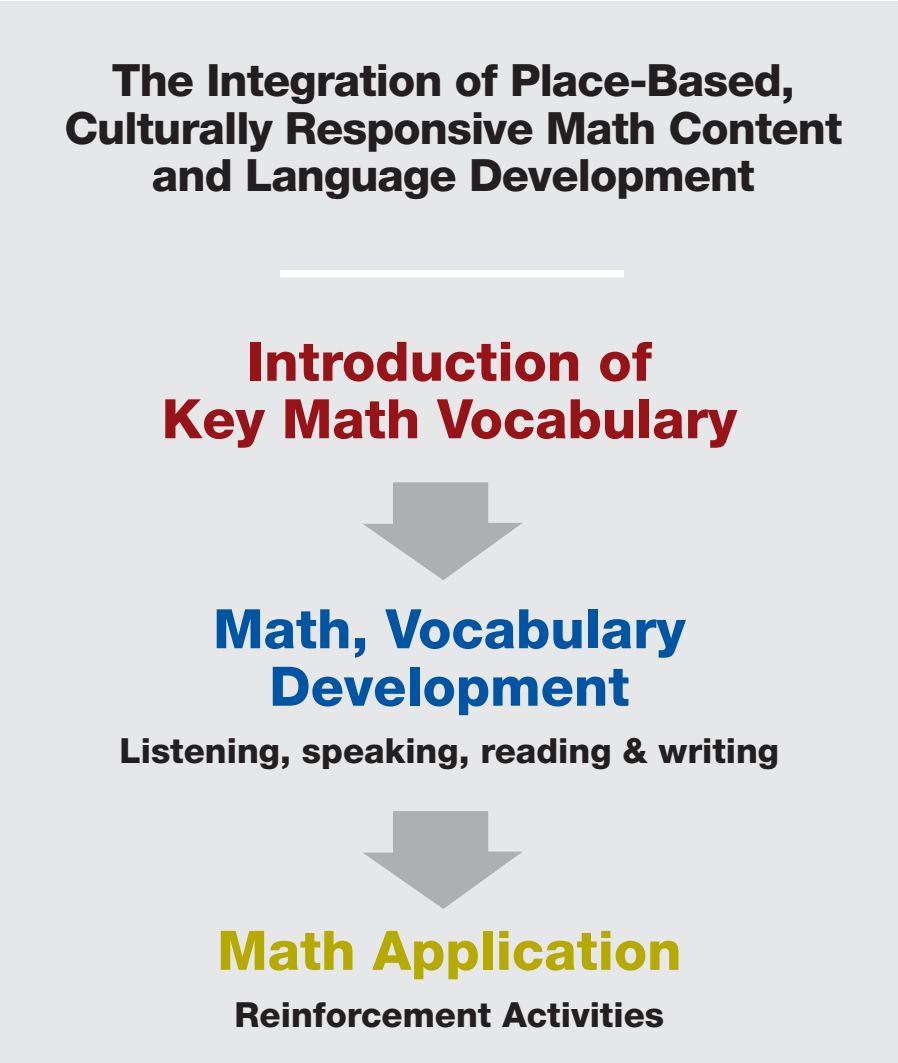
This program is designed to meet the academic realities, faced by high school students every day, using a developmental process that integrates *culture* with *skills* development. The values of *Haa Aaní* and *Haa Shagóon* are reinforced through the various activities in the program.

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 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:

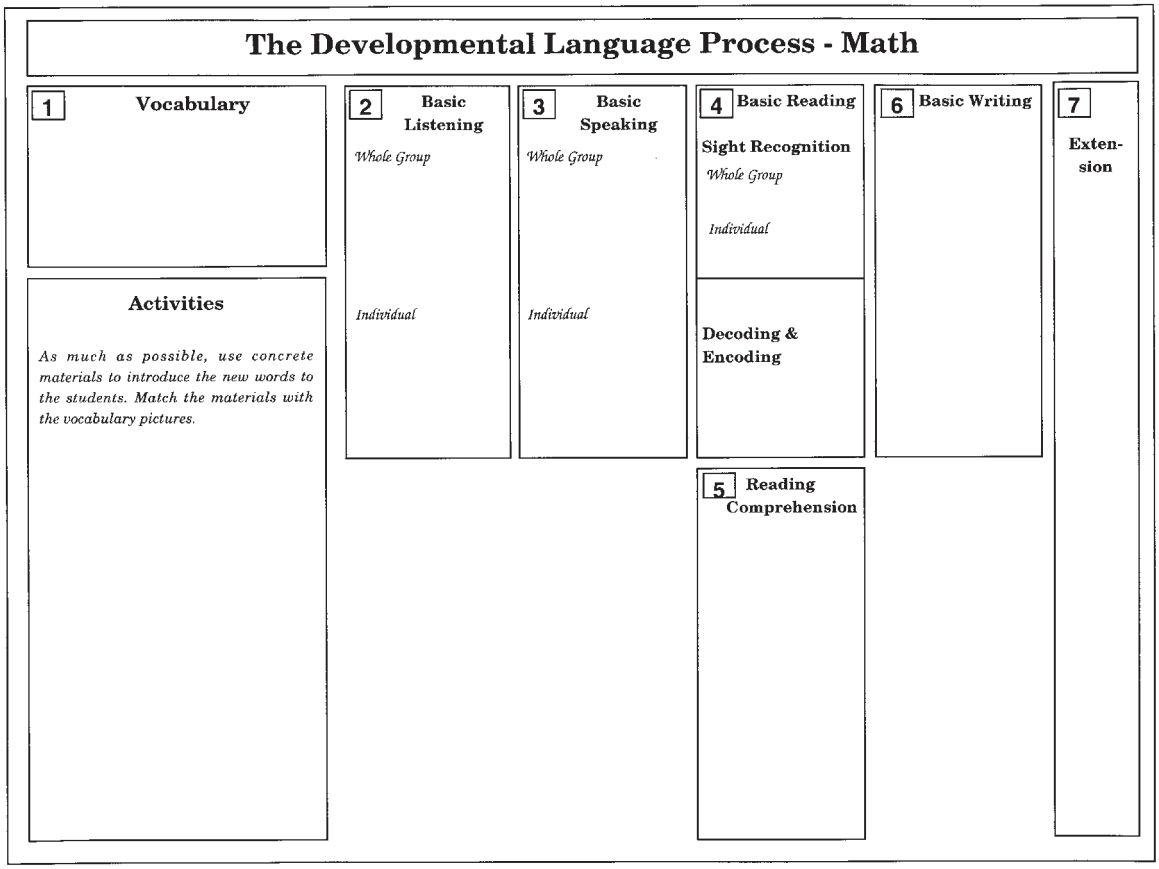
At the end of the Process, the students participate in enrichment activities based on recognized and reasearch-based *best practices*. By this time the information and vocabulary will be familiar, adding to the students'feelings of confidence and success.

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

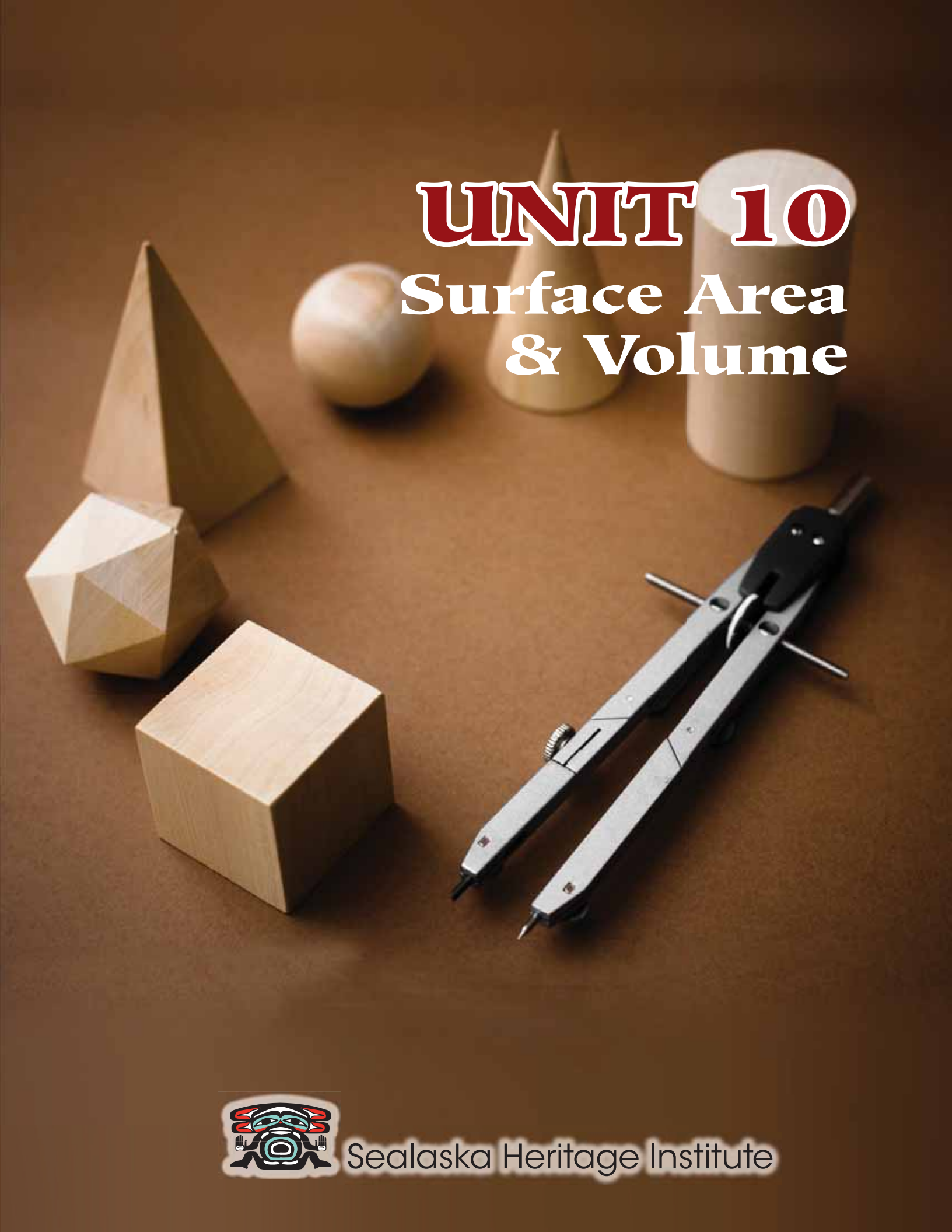
The Developmental Language Process can be applied effectively in the development of math concepts and their vocabulary. Not all math vocabulary lend themselves well to listening comprehension, creative speaking, and creative writing activities and therefore the Process can be adapted to create a *fast 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 10

Surface Area & Volume

Sealaska Heritage Institute

Unit 10 Surface Area and Volume
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 solves problems (including real-world situations) by

[9] G-4 determining the volume or surface area of prisms, cylinders, cones or pyramids

The student solves problems (including real-world situations) by

[10] G-5 determining the volume or surface area of spheres or compound solids

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

Grade Level Expectations for Unit 10

Unit 10—Surface Area and Volume

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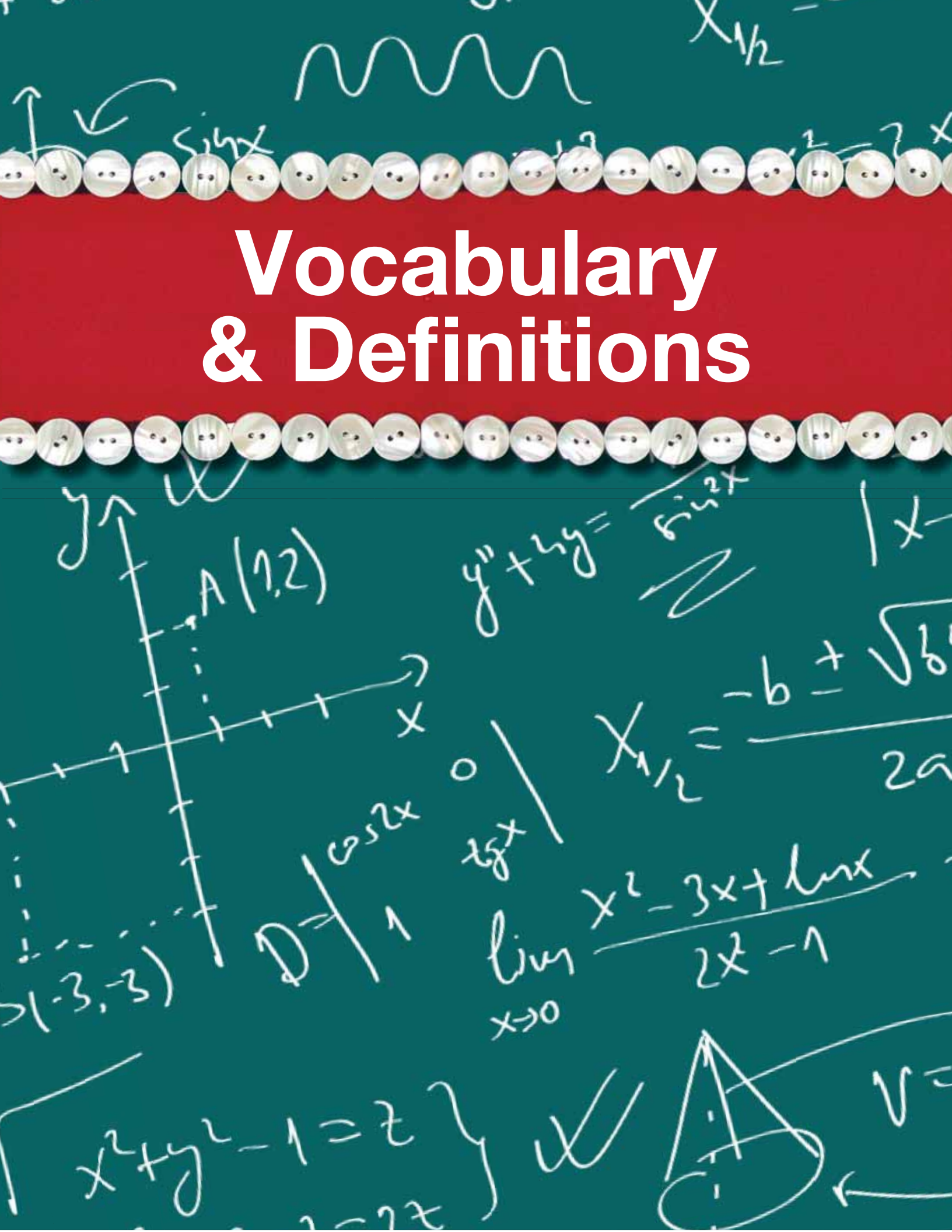

Vocabulary
& Definitions

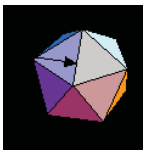
Introduction of Math Vocabulary

Face

You might have heard the word “face” used to describe the flat, steep side of a mountain, a cliff, or a glacier. On a polyhedron, a face is any flat polygonal surface.

Edge

“edge” is a word used to describe a border or a line where a surface terminates. We say “the edge of the road” or “the edge of the cliff”. In geometry, an edge of a polyhedron is a segment where two of its faces intersect.

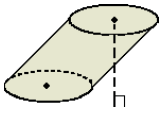


The ridgeline of this roof is one of the edges of a building.

Base (of polyhedron)

The word “base” can refer to the bottom support of something, or that on which something stands or rests. Polyhedra can “stand” on their flat surfaces. The base of a prism or cylinder is either of the faces that are congruent and parallel. For a cone, the base is its circular face, and for a pyramid it is the polygonal face that does not contain the apex.

Height - the height, or altitude, of a polyhedron is the length of the segment from the plane of one base to the plane of the other base, for prisms and cylinders. For pyramids and cones it is the length of the segment from the plane of one base to the apex.



Introduction of Math Vocabulary

Cross section

A cross section is a particular type of cut across an object. When a geometric solid is intersected by a plane that is parallel to its base(s), the intersection is called a cross section. Here is a cross section of a log.

Lateral face

Lateral means “of or pertaining to the side”. A lateral face is any of the faces of a polyhedron that is not a base. On this octagon, the green faces are the lateral faces.

Lateral surface

the surface of a cylinder that connects one base with another base or the surface of a cone that connects the base with the apex.

The paper forms the lateral surface of this cylindrical roll:

Lateral area

the lateral area of a geometric solid is the combined area of all of the faces except the base(s). The lateral area of a can of salmon would be the area that is covered by the label.

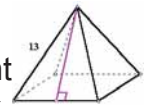
Introduction of Math Vocabulary

Lateral edge

A segment formed by the intersection of two lateral faces of a polyhedron. The posts of this tower used for logging at Edna Bay would form the lateral edges of a pyramid

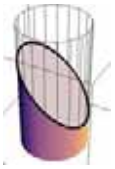
Slant height

The slant height is the height along a slanted side. For a pyramid, the slant height is the height of a lateral face, and for a cone the slant height is the length of any segment that connects the circular base to the apex.



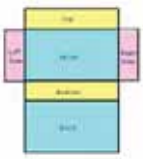
Slice

A slice of a solid is a straight cut formed by the intersection of a plane with a geometric figure.



Surface area

It is important in many situations to know the size of an object's surface. An animal with a large surface area has a harder time keeping warm in a cold climate. In sports, such as kayaking or skiing, the surface area of equipment makes a difference in your speed. For three-dimensional solids, the surface area is the sum of the areas of all of the faces, bases, and/or lateral surfaces.

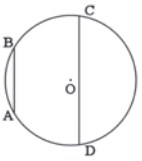


Radius

The radius of a cylinder or cone is the distance from the center of its circular base to its edge, and the radius of a sphere is the distance from its center to its surface. How would you define the diameter of a cylinder, a cone, or a sphere? (Twice the radius - a segment that passes through the center and has both endpoints on the surface.

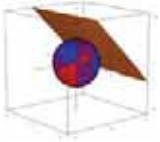
Introduction of Math Vocabulary

Chord (of a sphere)



a chord of a sphere is any segment whose endpoints are points on the sphere.

Tangent (of a sphere) is a line or plane that intersects the sphere in exactly one point.

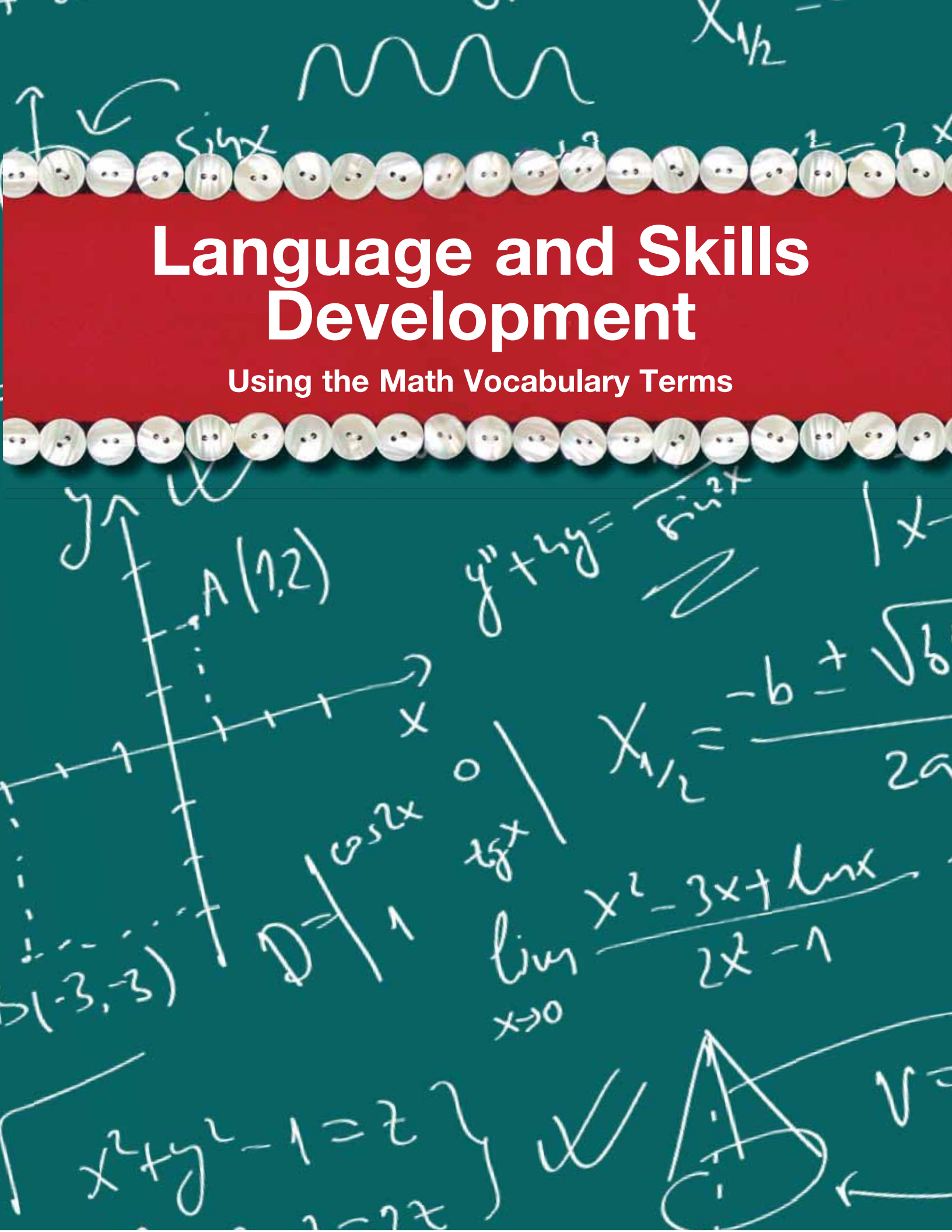


Volume

The word volume is sometimes used when referring to sound level, but in geometry volume is the amount of space enclosed by a three-dimensional figure. Volume is measured in cubic units, and there are many reasons to calculate volume for people working in construction, shipping, medicine, mining, and a wide variety of other fields. Ask students if they can think of some examples of situations where they might need to know volume.

Compound Solid

A compound solid is made by combining two or more solids. For example, a cone on top of a cylinder or a hemisphere would be a compound solid, as would a square attached to an oblique prism. This water tank is made up of a cylinder, a hemisphere, and a cone.



Language and Skills Development

Using the Math Vocabulary Terms

Language & Skills Development

LISTENING

Use the activity pages from the Student Support Materials.

Definition Match

Provide each student with three blank flashcards. Each student should then write the numbers I to 3 on his/her cards - one number per card. When the students' number cards are ready, mount the vocabulary illustrations on the chalkboard. Point to one of the illustrations and say three definitions for it. The students should listen carefully to the three definitions you say - only one of the definitions should be correct for the illustration you pointed to. The students should then hold up their number cards to indicate which definition goes with the illustration. Repeat this process with other illustrations and sets of definitions.

Use the mini-illustrations, from the Student Support Materials.

SPEAKING

Calendar Bingo

Before the activity begins, prepare a page that contains a calendar page (complete with days and dates). Provide each student with a copy of the calendar page. Also, provide each student with 10 small markers. Each student should place the markers on different dates on his/her calendar page. Mount the vocabulary illustrations on the chalkboard. Call a student's name and say a date in the month. If a marker is not on the date you named, he/she should say a complete sentence about a vocabulary illustration you point to. However, if a marker is on the date you called, he/she may "pass" to the next player. Repeat this process until all students have participated. You may wish to provide each student with more than one marker for this activity.

READING

Use the activity pages from the Student Support Materials.

Illustrated Sentences

Before the activity begins, prepare a number of sentences on sentence strips related to the concept being studied. Mount the sentences on the chalkboard. Provide each student with illustrating paper and supplies. Each student should then select ONE of the sentences to illustrate. The students should attempt to illustrate the contents of the sentences clearly. When the illustrations are completed, collect and mix them together. Give two students each an illustration (not the ones they did). When you say "Go," the students should attempt to match the illustrations with the sentences on the chalkboard.

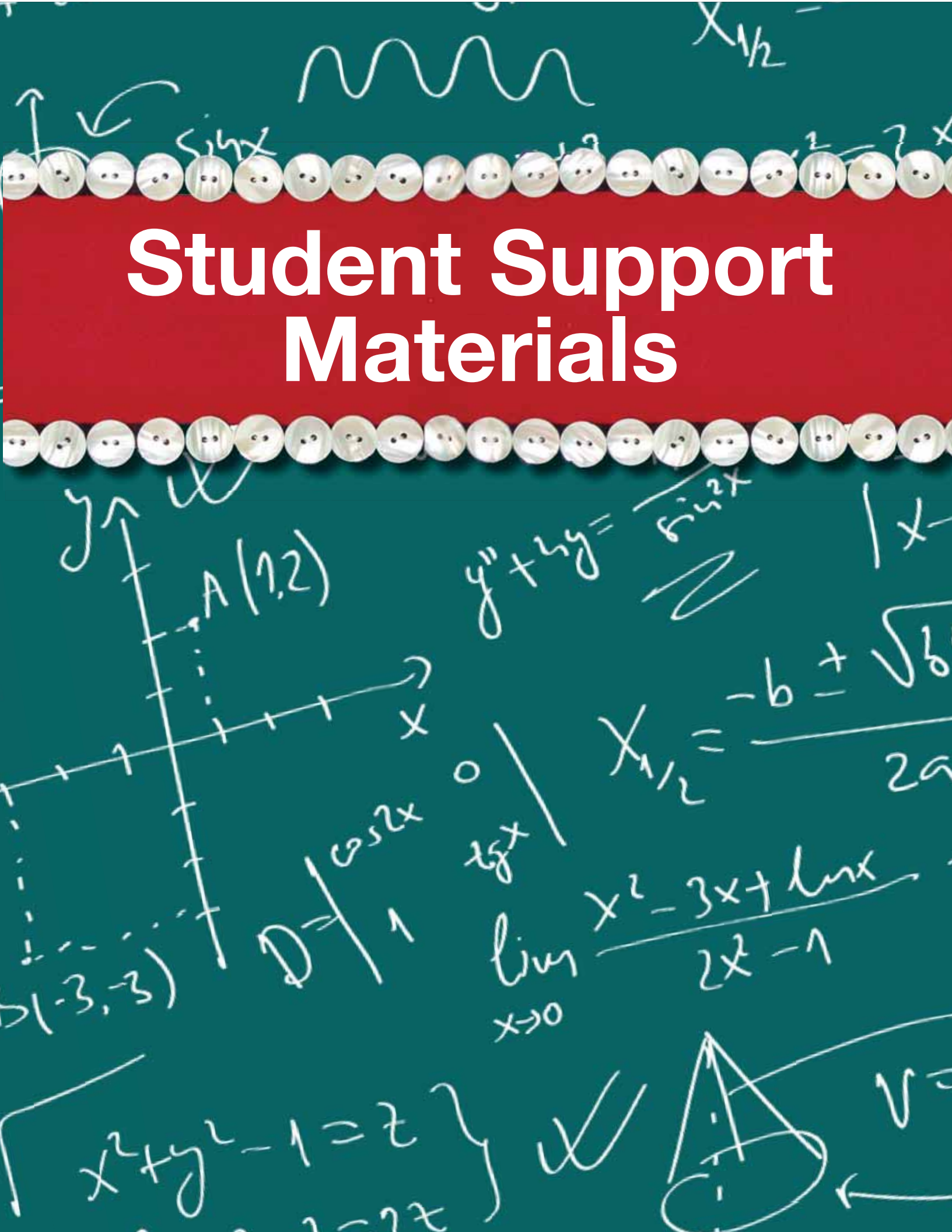
WRITING

Use the activity pages from the Student Support Materials.

Sentence Build

Group the students into two teams. Give each team a long strip of writing paper and a felt pen. When you say "Go," the first player in each team must write the first word of a sentence (any word), for example, "The." The second player must add another word, for example, "characteristics." The players should continue in this way until a complete sentence has been created, word by word, using as many words as possible from this unit. Repeat.

Student Support Materials

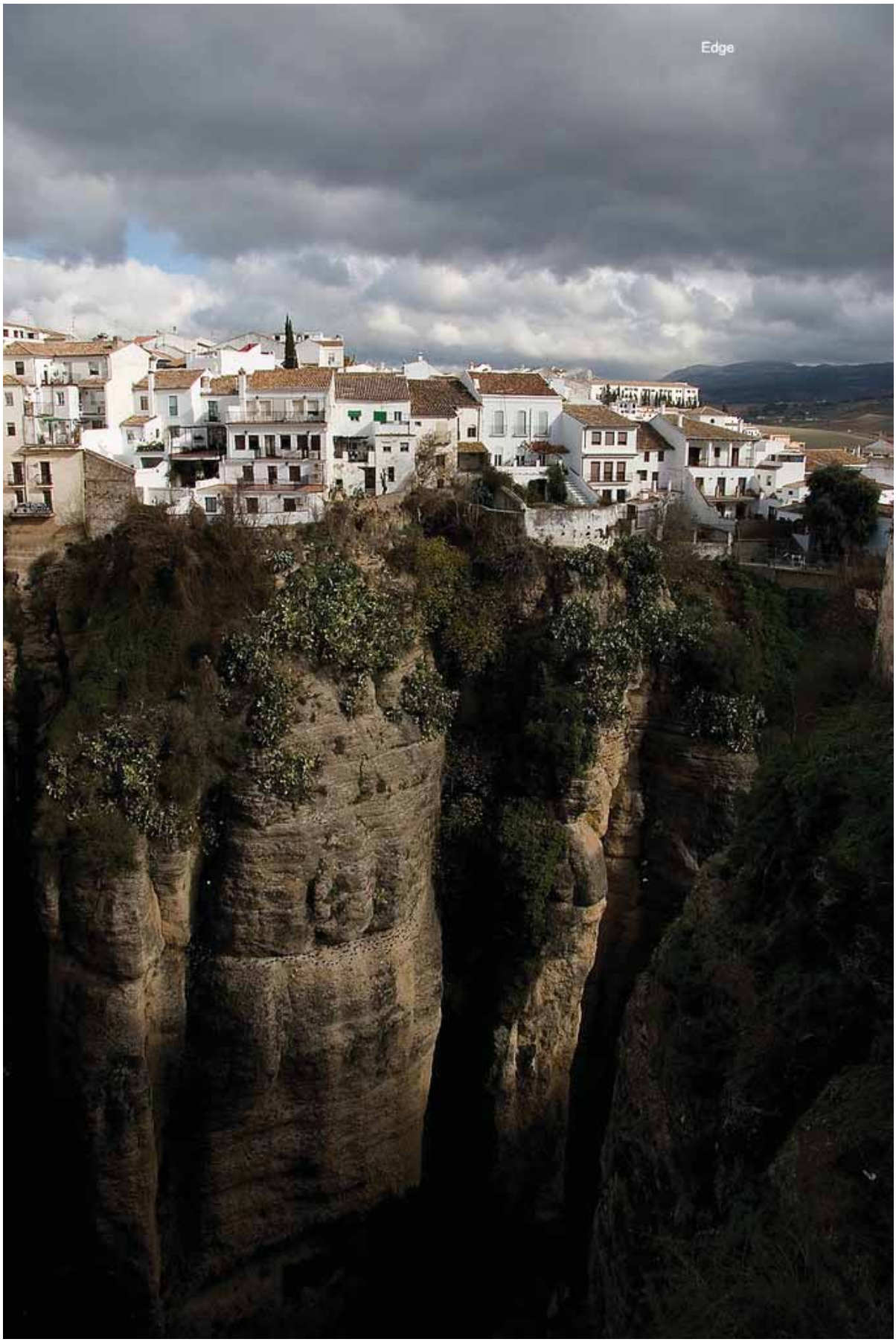



Base

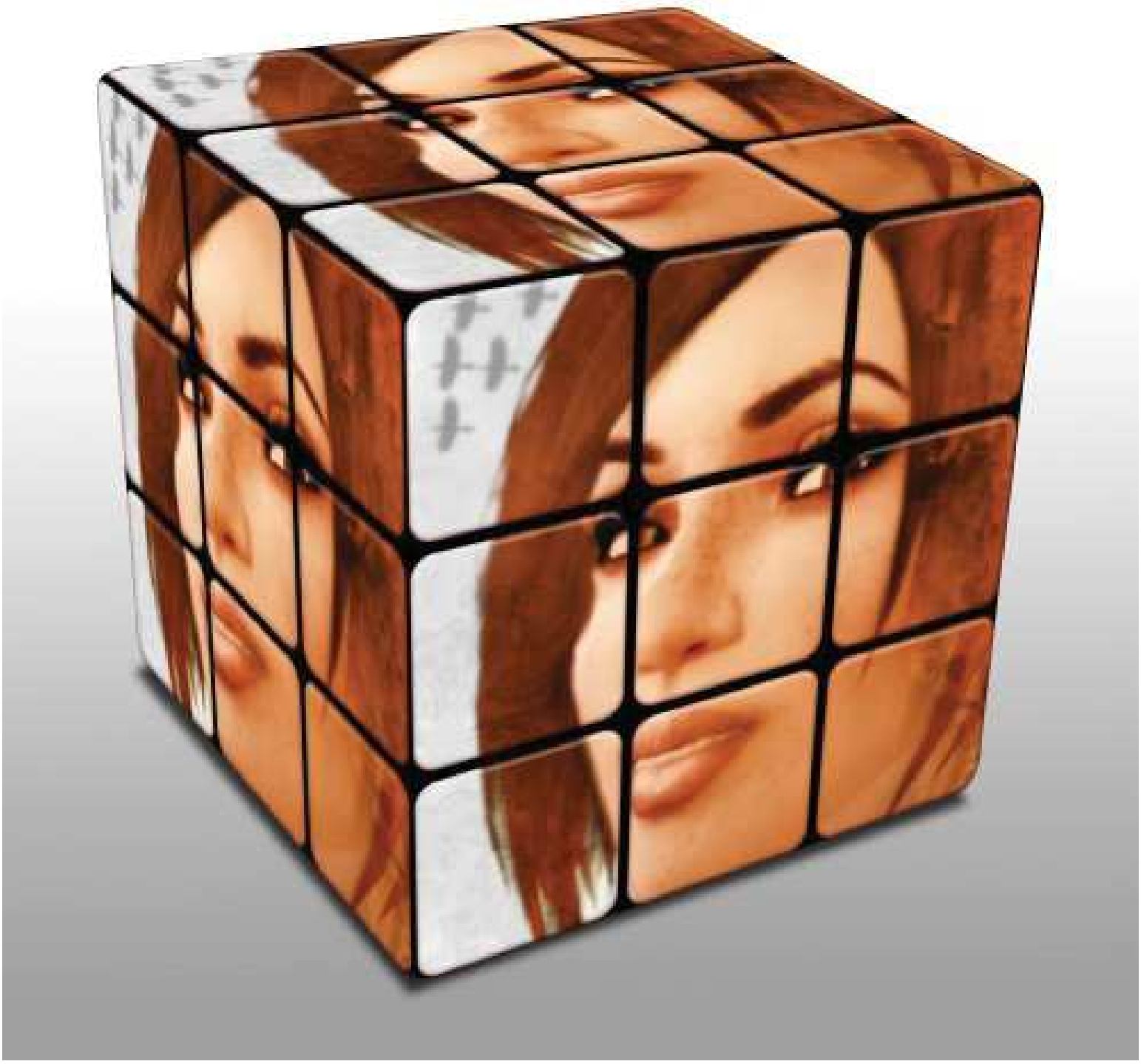

Chords


BAG-MOR
INC.


Cross Section


Edge

Face




Height
Chris
Dec. 98
Kelsey 01
Chris 96
Derek 95
Trev 95
Kelsey 96
Kelsey 95


Organic
Low Sodium
Chicken
Broth
S&W
PREMIUM
KIDNEY BEANS
50% Less Sodium
Premium Quality & Taste
Dole
juice
MUIR GLEN
Organic
bestlife
Tastes OF INDIA
PATAK'S
Original
ORGANIC
SOUPS
TOMATO BISQUE
ORGANIC
VALLEY
100% NATURAL
Hunt's
PETITE
DICED
NET WT
14.5 OZ
(411g)
El Paso

Lateral Edge


Lateral Surface

Radius


Slant Height

Slice


Surface Area
PREMIUM GRANNY SMITH
OATS
100% WHOLE GRAIN
100% NATURAL
QUICK & EASY!

Tangent


Volume
SUGAR
FLOUR
COFFEE

True-False Sentences

(Listening and/or Reading Comprehension)

1. There are as many **faces** on a prism as there are bases.
2. The number of **edges** on a polyhedron is always the same as the number of sides.
3. The **base** of a cone is its circular face.
4. The **height** of a pyramid is measured by finding the length of an edge.
5. A **cross section** is parallel to the bases of a solid.
6. A **lateral face** of a prism is different from a base.
7. A cone's **lateral surface** includes all of its surfaces except the base.
8. **Lateral area** and surface area are always the same.
9. The **lateral edges** of a prism are the edges that connect the two bases.
10. The **slant height** is measured from the edge of the base to the apex of a pyramid or cone.
11. A **slice** must always be parallel to an edge.
12. It is only possible to find the **surface area** if all of the surfaces are flat.
13. If the center of a cone's base is 3 cm. from its edge, the **radius** of the cone is 3 cm.
14. Every **chord** of a sphere has the same length.
15. A **tangent** intersects a curve or a sphere at exactly one point.
16. The **volume** of a box is a measure of the space inside of it.
17. **Compound solids** can only be made up of regular polyhedrons.

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

1. A cube has six **faces**.
2. Two faces of a polyhedron intersect at an **edge**.
3. Every geometric solid has a **base**.
4. The **height** of a right prism is the length of a segment that connects its bases.
5. Any cut across an object is its **cross section**.
6. The base of a pyramid is also one of its **lateral faces**.
7. A cylinder has three **lateral surfaces**.
8. The **lateral area** of a polyhedron is the area of all of the surfaces except the base(s).
9. All of the edges of a pyramid are **lateral edges**.
10. The **slant height** of a pyramid is always the same length as one of its edges.
11. A cross section is one type of **slice**.
12. **Surface area** is found by adding the areas of all of the surfaces of a solid.
13. The **radius** of a sphere is the same as the radius of any circular slice through the sphere.
14. The longest **chord** of a sphere passes through its center.
15. A sphere has only six possible **tangents**.
16. There are some closed solids that do not have **volume**.
17. An example of a **compound solid** could be an ice cream cone with a hemispherical scoop of ice cream on top.

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

Match the Halves

1. The area of all the walls of a flat-roofed house is	A. eight faces
2. When you open a can of soup you remove	B. at only one point.
3. A slice is the intersection of any plane	C. is its surface area.
4. A cross section is a slice that is	D. the height of a pyramid.
5. Slant height is measured on	E. five lateral faces.
6. The volume of a milk carton	F. with a solid, at more than one point.
7. An octahedron has	G. is the amount of space inside.
8. The radius of a sphere	H. parallel to the base(s).
9. The length from the center of the base to its apex is	I. is the chord of a sphere.
10. The sum of the areas of the four sides of a tetrahedron	J. its base.
11. A pentagonal prism has	K. its tangent.
12. One example of a compound solid is	L. its lateral area.
13. A lateral edge intersects a base	M. intersects its center.
14. If you removed both ends of a can, the part left over would be	N. pyramids and cones
15. A segment that intersects its surface at two points	O. its lateral surface
16. The edge of a polyhedron is an intersection of	P. a pyramid attached to a cube
17. A line or plane that intersects a sphere at one point is	Q. two faces.

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

Definitions

Face - any flat polygonal surface on a polyhedron.

Edge - the segment where two faces of a polyhedron intersect.

Base (of polyhedron) - either of the faces of a prism or cylinder that are congruent and parallel, or the circular face of a cone, or the polygonal face of a pyramid that does not contain the apex.

Height - the altitude, or length, of the segment from the plane of one base to the plane of the other base or to the apex.

Cross section - the intersection of a solid with a plane parallel to its base(s).

Lateral face - any of the faces of a polyhedron that is not a base.

Lateral surface - the surface of a cone or cylinder that is not part of the base(s)

Lateral area - the combined area of all of the faces except the base(s).

Lateral edge - a segment formed by the intersection of two lateral faces of a polyhedron.

Slant height - the height of a lateral face or a pyramid, or the length of any segment that connects the edge of a cone's base to its apex.

Slice - a straight cut across a solid.

Surface area - the sum of the areas of all of the faces, bases, and/or lateral surfaces of a three-dimensional figure.

Radius (of a solid) - the distance from the center to the edge of the base of a cone or cylinder, or the distance from the center to the surface of a sphere.

Chord (of a sphere) - any segment whose endpoints are points on the sphere.

Tangent (of a sphere) - a line or plane that intersects the sphere in exactly one point.

Volume - the amount of space enclosed by a three-dimensional figure.

Which Belongs

1. A ball sitting on the floor touches it at exactly one point, so the floor is a (chord, tangent, base) of the ball.
2. A(n) (edge, radius, slice) of a pyramid is found where a lateral face intersects the base.
3. (Lateral area, surface area, volume) is measured in cubic units.
4. A sphere's (chord, tangent, radius) is the distance from its center to its surface.
5. The (height, edge, face) of a polyhedron is always perpendicular to the plane of its base.
6. A surface of a prism that is not a base would be a (face, cross section, lateral face).
7. A (cross section, slice, chord) of a cylinder is parallel to its bases.
8. Any flat surface of a polyhedron is called a (face, edge, base).
9. The (lateral face, lateral surface, lateral edge) makes up all of a cone excluding its base.
10. If you found the (lateral area, surface area, volume) of a cylinder, you would be finding the area its surface not including the circular bases.
11. A plane that cuts through a solid object at any angle forms (an edge, a cross section, a slice).
12. The (base, chord, lateral face) of a prism is always parallel to its opposite face.
13. To find the amount of paint needed to cover all the sides of a cube, you would need to know its (volume, surface area, lateral area).
14. A sphere does not have a (chord, surface area, slant height).
15. A (radius, chord, tangent) connects any two points on a sphere.
16. A house is shaped like a parallelepiped with a triangular prism for a roof, so it represents a (lateral edge, cross section, compound solid).
17. The (lateral face, lateral edge, lateral surface) of a prism connects corresponding vertices of its bases.

1. Tangent
2. Edge
3. Volume
4. Radius
5. Height
6. Lateral face
7. Cross section
8. Face
9. Lateral surface
10. Lateral area
11. Slice
12. Base
13. Surface area
14. Slant height
15. Chord
16. Compound solid
17. Lateral edge

Multiple Choice

1. Two points on the surface on a sphere are connected by a(n):
    a) edge
    b) chord
    c) radius
    d) tangent

2. A cylindrical birdhouse with a conical roof is an example of a
    a) chord
    b) polyhedron
    c) compound solid
    d) right prism

3. Each of the surfaces of a pyramid is called a
    a) face
    b) base
    c) lateral face
    d) lateral surface

4. The circular part of a cone is its
    a) lateral surface
    b) edge
    c) tangent
    d) base

5. Joan wants to make a shipping crate for her television set and is trying to decide how much plywood to buy. She needs to know the crate's
    a) volume
    b) lateral area
    c) weight
    d) surface area

6. The altitude of a solid is measured from the plane of its base to its highest point and is also called its
    a) height
    b) edge
    c) slice
    d) width

7. The wall of a flat-roofed house would represent a(n)
    a) base
    b) lateral face
    c) edge
    d) cross section

8. A segment that connects the apex of a pyramid with a corner of its base is
    a) a chord
    b) an edge
    c) a radius
    d) a height

9. The side of a cylindrical water tower is its
    a) lateral face
    b) lateral surface
    c) edge
    d) lateral edge

10. To find the amount of siding needed for a flat-roofed square house, you would need to know its
    a) lateral area
    b) volume
    c) lateral volume
    d) surface area

11. A corner post on a shed would represent a
    a) radius
    b) chord
    c) base
    d) lateral edge

12. On which of the following could you find the slant height?
    a) a cube
    b) a sphere
    c) a pyramid
    d) a parallelepiped

13. A cone, a cylinder, or a sphere has a(n)
    a) radius
    b) edge
    c) slant height
    d) lateral edge

14. A line or plane that touched a sphere at one point is its
    a) edge
    b) tangent
    c) chord
    d) radius

15. If a forester cuts a tree trunk parallel to the ground, he is making a
    a) chord
    b) edge
    c) cross section
    d) lateral face

16. Which of the following is a measure of the space contained by a solid?
    a) surface area
    b) lateral area
    c) height
    d) volume

17. When Allen cuts through his drinking straw at a slant, he is making a
    a) slant height
    b) slice
    c) cross section
    d) none of the above

Answers: 1B, 2C, 3A, 4D, 5D, 6A, 7C, 8B, 9B, 10A, 11D, 12C, 13A, 14B, 15C, 16D, 17B

Complete the Sentence

1. A surface that is not flat and not a base is a(n)_____.

2. To find the volume of a sphere you would need to know its _____.

3. A(n) _____ is a segment that connects two vertices of a polyhedron.

4. Any plane that cuts through a solid forms a _____.

5. On a pyramid, a _____is a face that does not intersect the apex.

6. A slice that is also a _____ is parallel to the base.

7. If the face of a parallelepiped is not a base, it is a _____.

8. The distance from the apex of a cone to the plane of its base is its _____.

9. The _____ of a polyhedron is an edge that is not part of the base.

10. For a pyramid, the _____ is the shortest distance from the apex to the edge of a base.

11. The _____ of a solid is the sum of the areas of all of its faces and/or surfaces.

12. On a sphere, there are many different _____ of different lengths.

13. A _____ is made up of two or more connected solids.

14. The _____ of a solid does not include the area of its base(s).

15. _____ is a three-dimensional measurement.

16. Any surface of a polyhedron is called a _____.

17. If a plane touches a sphere at only one point, it is _____ to the sphere.

Answers:

1. Lateral surface
2. Radius
3. Edge
4. Slice
5. Base
6. Cross section
7. Lateral face
8. Height
9. Lateral edge
10. Slant height
11. Surface area
12. Chords
13. Compound solid
14. Lateral area
15. Volume
16. Face
17. Tangent

Creative Writing

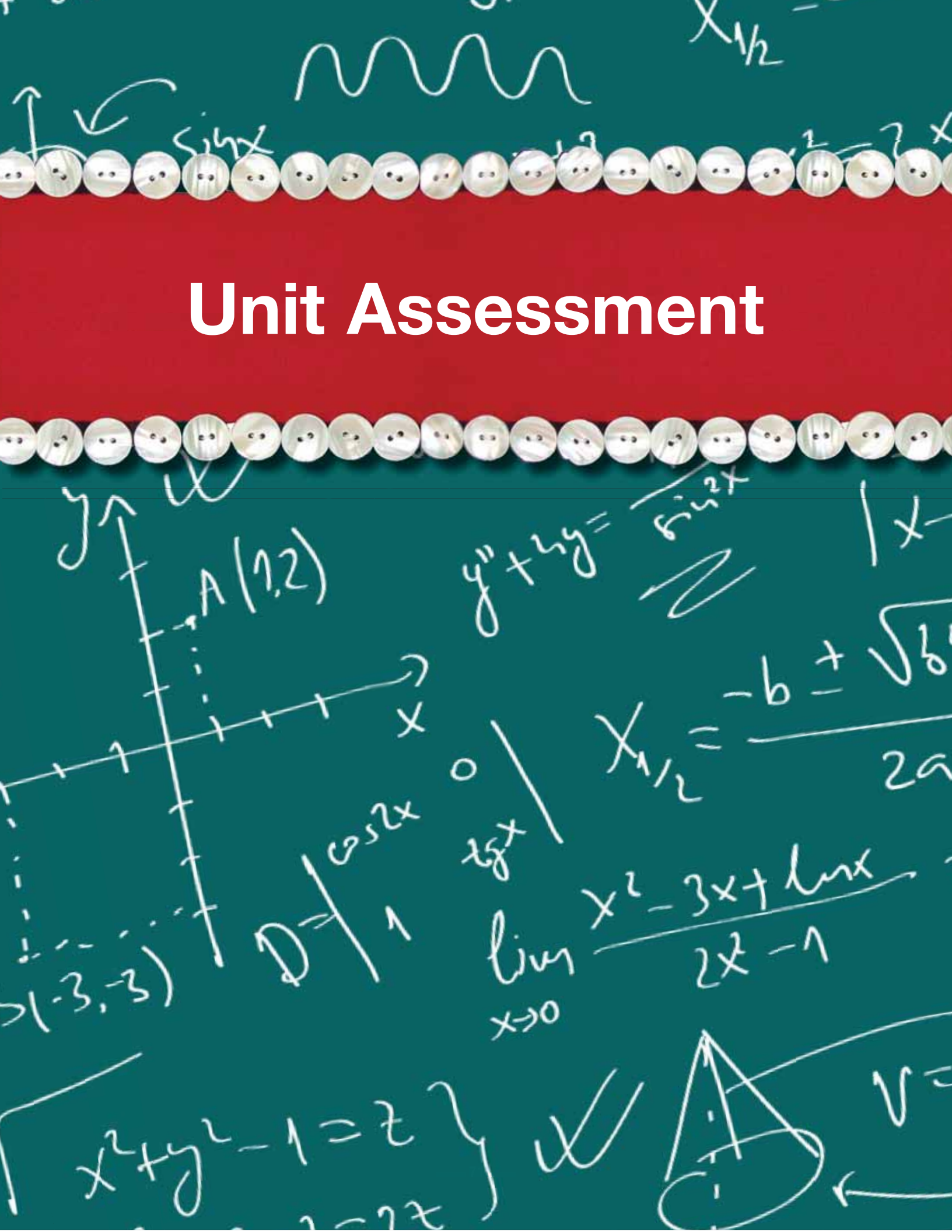
This picture was taken in Anchorage after the 1964 Earthquake. Use the words from this unit to write about the solids in the picture.

Anchorage Museum of History & Art. Library & Archives.

Place-Based Practice Activity

Ask students to find and interview at least two people in the community who need to understand surface areas and/or volume for their work or hobbies (examples might be painters, contractors, cooks, engineers, builders, drillers, truckers, nurses or health aides, athletes, etc.). Students can use the words from the unit as they share examples that they found. Options for sharing might be brief presentations, or photos with explanations attached that can be posted on the wall, on a computer, or in a book.

Students can also use their findings to write real-life surface area and volume problems that their classmates can solve.


Unit Assessment

Geometry: Unit 10-Surface Area and Volume

Name: _____
Date: _____

Matching: Math the key vocabulary on the left with a definition on the right. The words used are common key vocabulary words, but in this quiz they refer to geometry concepts. Place the letter of the definition in front of the word it matches

1) _____ face
2) _____ edge
3) _____ height
4) _____ slice
5) _____ volume

a. altitude, the length of the segment from the plane of one base to the plane of the other base
b. a straight cut formed by the intersection of a plane with a geometric figure
c. the amount of space enclosed by a three-dimensional figure
d. a polyhedron is a segment where two of its faces intersect
e. a face is any flat polygonal surface.

Multiple Choice: Read the statement carefully and select the word that best fits. Circle the letter of the correct answer.

6) The word _____ refers to the bottom support of something or it refers to the part where something stands or rests.

a) base
b) height
c) cross section
d) slice

7) A _____ is a particular type of cut across an object and with a geometric solid it's the part or intersection that is cut/intersected by a plane parallel to its base(s),

a) base

b) height

c) cross section

d) slice

8) A _____ of a solid is a straight cut formed by the intersection of a plane with a geometric figure.

a) base

b) height

c) cross section

d) slice

Illustrations: Label the illustrations below correctly. Select the labels/words from the Word Bank.

Word Bank		
chord	compound solid	lateral area
lateral area	lateral edge	lateral face
lateral surface	radius	tangent

9) Look at the illustration below and label it, choosing one of the words in the Word Bank.

_____

10) Look at the illustration below and label it, choosing one of the words in the Word Bank.

_____

11) Look at the illustration below and label it, choosing one of the words in the Word Bank.

_____

12) Look at the illustration below and label it, choosing one of the words in the Word Bank.

_____

13) Look at the illustration below and label it, choosing one of the words in the Word Bank.

_____

Fill in the Blank: Complete each statement below with the word that fits best. Choose your word from the Word Bank above.

14) A _____ of a sphere is any segment whose endpoints are points on the sphere.

15) The _____ (of a sphere) is a line or plane that intersects it in exactly one point.

16) A cone on top of a cylinder or a hemisphere would be a _____, as would a square attached to an oblique prism, and is made by combining two or more solids.

17) The _____ of a cylinder or cone is the distance from the center of its circular base to its edge, and with a sphere, it is the distance from its center to its surface.

Geometry: Unit 10-Surface Area and Volume

Name: _____
Date: _____

Matching: Math the key vocabulary on the left with a definition on the right. The words used are common key vocabulary words, but in this quiz they refer to geometry concepts. Place the letter of the definition in front of the word it matches

1) **e** face
2) **d** edge
3) **a** height
4) **b** slice
5) **c** volume

a. altitude, the length of the segment from the plane of one base to the plane of the other base
b. a straight cut formed by the intersection of a plane with a geometric figure
c. the amount of space enclosed by a three-dimensional figure
d. a polyhedron is a segment where two of its faces intersect
e. a face is any flat polygonal surface.

Multiple Choice: Read the statement carefully and select the word that best fits. Circle the letter of the correct answer.

6) The word _____ refers to the bottom support of something or it refers to the part where something stands or rests.

a) base
b) height
c) cross section
d) slice

7) A _____ is a particular type of cut across an object and with a geometric solid it's the part or intersection that is cut/intersected by a plane parallel to its base(s),

a) base
b) height
c) cross section
d) slice

8) A _____ of a solid is a straight cut formed by the intersection of a plane with a geometric figure.

a) base

b) height

c) cross section

d) slice

Illustrations: Label the illustrations below correctly. Select the labels/words from the Word Bank.

Word Bank		
chord	compound solid	lateral area
lateral area	lateral edge	lateral face
lateral surface	radius	tangent

9) Look at the illustration below and label it, choosing one of the words in the Word Bank.

lateral surface

10) Look at the illustration below and label it, choosing one of the words in the Word Bank.

lateral area

11) Look at the illustration below and label it, choosing one of the words in the Word Bank.

Matt...insert illustration for lateral area

12) Look at the illustration below and label it, choosing one of the words in the Word Bank.

lateral edge

13) Look at the illustration below and label it, choosing one of the words in the Word Bank.

lateral face

Fill in the Blank: Complete each statement below with the word that fits best. Choose your word from the Word Bank above.

14) A chord of a sphere is any segment whose endpoints are points on the sphere.

15) The tangent (of a sphere) is a line or plane that intersects it in exactly one point.

16) A cone on top of a cylinder or a hemisphere would be a compound solid, as would a square attached to an oblique prism, and is made by combining two or more solids.

17) The radius of a cylinder or cone is the distance from the center of its circular base to its edge, and with a sphere, it is the distance from its center to its surface.

UNIT 11
Coordinate Geometry

Sealaska Heritage Institute

Grade Level Expectations for Unit 11

Unit 11—Coordinate Geometry

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 conceptual understanding of similarity, congruence, symmetry, or transformations of shapes by

[9] G-2 using a coordinate plane to solve problems involving congruent or similar shapes

The student demonstrates conceptual understanding of similarity, congruence, symmetry, or transformations of shapes by

[10] G-3 identifying congruent and similar figures using Euclidean geometry (e.g., [constructions L], coordinate geometry)

The student demonstrates understanding of position and direction when solving problems (including real-world situations) by

[9] G-5 graphing or identifying (using equations or formulas to determine the slope of line segments) on a coordinate plane

The student demonstrates understanding of position and direction when solving problems (including real-world situations) by

[10] G-6 graphing a line segment on a coordinate grid and/or identifying its length or midpoint by using formulas

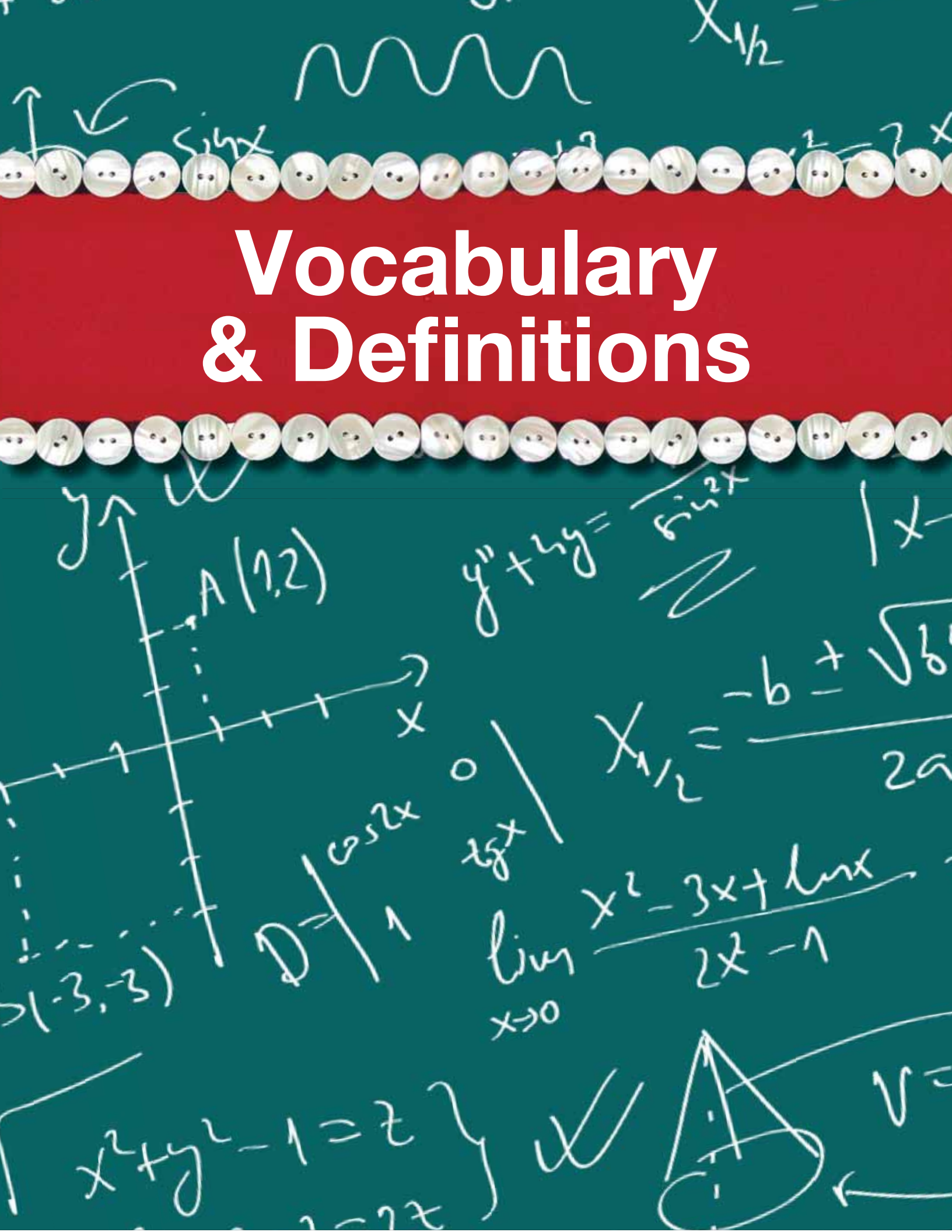
The student demonstrates understanding of position and direction when solving problems (including real-world situations) by

[10] G-7 graphing a system of equations on a coordinate grid, identifying a solution, or determining their relationship (intersecting, parallel, perpendicular)

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

Coordinates

Coordinates are numbers that give the location of a point. Coordinates such as latitude and longitude are used in geography and in navigation to pinpoint locations. In mathematics, a point may be located on a plane with an x-axis and a y-axis, and have its location given by an ordered pair of coordinates (x, y). Or, the point may be located in three dimensional spaces with the location given by a triple (x, y, z).

Ordered pair

An ordered pair is two numbers written in the form (*x, y*) to represent the position of a point on a coordinate plane.

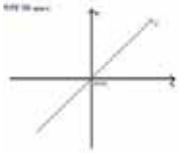
Ordered triple

An ordered triple is three numbers written in the form *(x, y, z)* to represent the position of a point in space.

$\mathbf{P} = (x, y, z)$

Origin

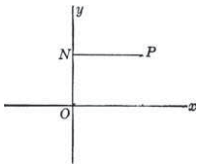
The origin is the zero point. On a number line it is the point 0. On a coordinate plane it is the point x=0, y=0, and in three dimensional space the origin is the point (0,0,0)



Introduction of Math Vocabulary

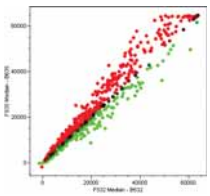
Abscissa

The abscissa is the *x*-coordinate or the first number in an ordered pair.



Scatter Plot

A scatter plot is a graph on which data is plotted as coordinate points.



Linear equation

A linear equation is an equation with two variables that each have a power of one. Its graph is a straight line.

Slope

Slope is a number that indicates the steepness of a line, and also tells which way the line is tilted. Road engineers, roof designers, and avalanche forecasters all need to calculate slopes.

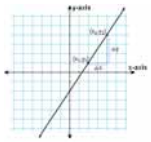
Introduction of Math Vocabulary

Slope-Intercept form

The slope-intercept form is a form for an equation of a line written as $y=mx+b$ where m is the slope, and b is the y intercept.

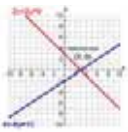
Point-slope form

The point-slope form is a form for the equation of a line written as $y-y_1=m(x-x_1)$ *where* m is the slope and (x_1, y_1) is a point on the line.



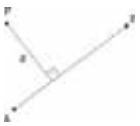
Standard form

The standard form is a form for an equation of a line written as $Ax+By+C = 0$, where A, B, and C are real numbers. It is used as part of the formula for finding the distance from a point to a line.



Distance (from a point to a line)

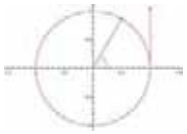
The distance from a point to a line is the length of the shortest segment from a given point to a given line.



Introduction of Math Vocabulary

Unit circle

A unit circle is a circle with a radius of one, centered on the origin on an *x-y* plane.



Scalar

A scalar is a quantity that has only magnitude, and does not depend on direction. Time, length, temperature, density, and mass are examples of scalar quantities.

Vector

In mathematics a vector is a quantity that has both a magnitude and a direction, such as displacement, velocity, acceleration, or force.

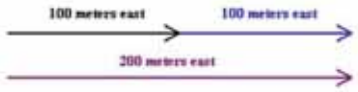
These arrows give both the amount of distance and the direction to various places, so they are expressing vector quantities.

On graphs, vectors are also represented by arrows.

Introduction of Math Vocabulary

Magnitude

The magnitude is the size or the extent or the amount of something. The magnitude of a vector is represented by the length of the vector or the arrow that represents it.



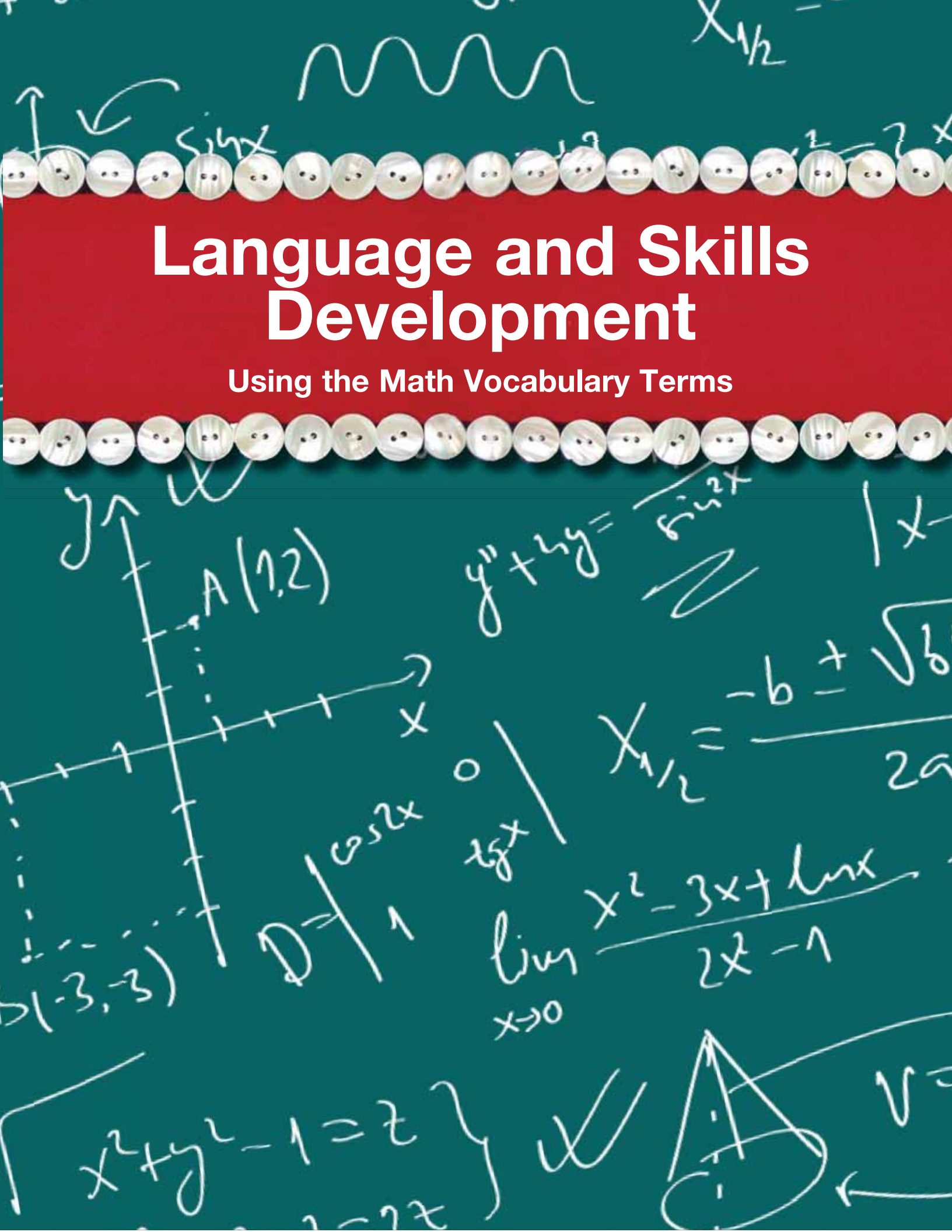
This road sign shows the extent of the distance, or the magnitude of "displacement", involved in a trip to some places in the Yukon.

Direction of a vector

The direction of a vector is the line along which it moves. It is often described as the counterclockwise angle between its arrow and the positive x-axis.

This sign in Skagway shows direction only.

Introduction of Math Vocabulary



Language and Skills Development

Using the Math Vocabulary Terms

Language & Skills Development

LISTENING

Use the activity pages from the Student Support Materials.

Locomotive

Have the students stand in a straight line in the center of the room. Each student should place his hands on the shoulders of the student in front of him/her. Mount an illustration on each of the four walls in the classroom. Tell the students that when they hear one of the four vocabulary words (for the four illustrations on the walls), they should step in that direction - while still holding onto the shoulders of the players in front of them. Say the four words a number of times; the students should step towards the illustrations as they are named.

SPEAKING

Visual Memory

Mount the vocabulary illustrations on the chalkboard. The students should look carefully at the illustrations. Then, have the students close their eyes. Remove one of the illustrations from the chalkboard and place it to the side. The students should then open their eyes and identify the "missing illustration." Continue in this way until all of the illustrations have been removed. Another way to conduct this activity is to do the reverse In this case, prepare two or three extra sets of vocabulary illustrations. Mount a number of illustrations on the chalkboard. The students should look carefully at the illustrations. Then, have the students close their eyes. Add another illustration to the chalkboard. The students should open their eyes and identify the "new illustration." This activity (and the previous form of the activity) may be done in team form. In this case, the first player to identify the new or missing illustration wins the round.

READING

Use the activity pages from the Student Support Materials.

Choose Your Side

Make a long masking tape line on the floor. Have the students stand on the line in single file, facing you. Prepare *true* and *false* sentences on sentence strips, related to the concept being studied. Designate one side of the line for "true" and the other side for "false." Hold up a sentence strip. The students should read the sentence silently and then hop to the appropriate side of the line. For example, if the statement is "false," they should hop to the "false" side of the line. Repeat until the students have responded to all of the sentences.

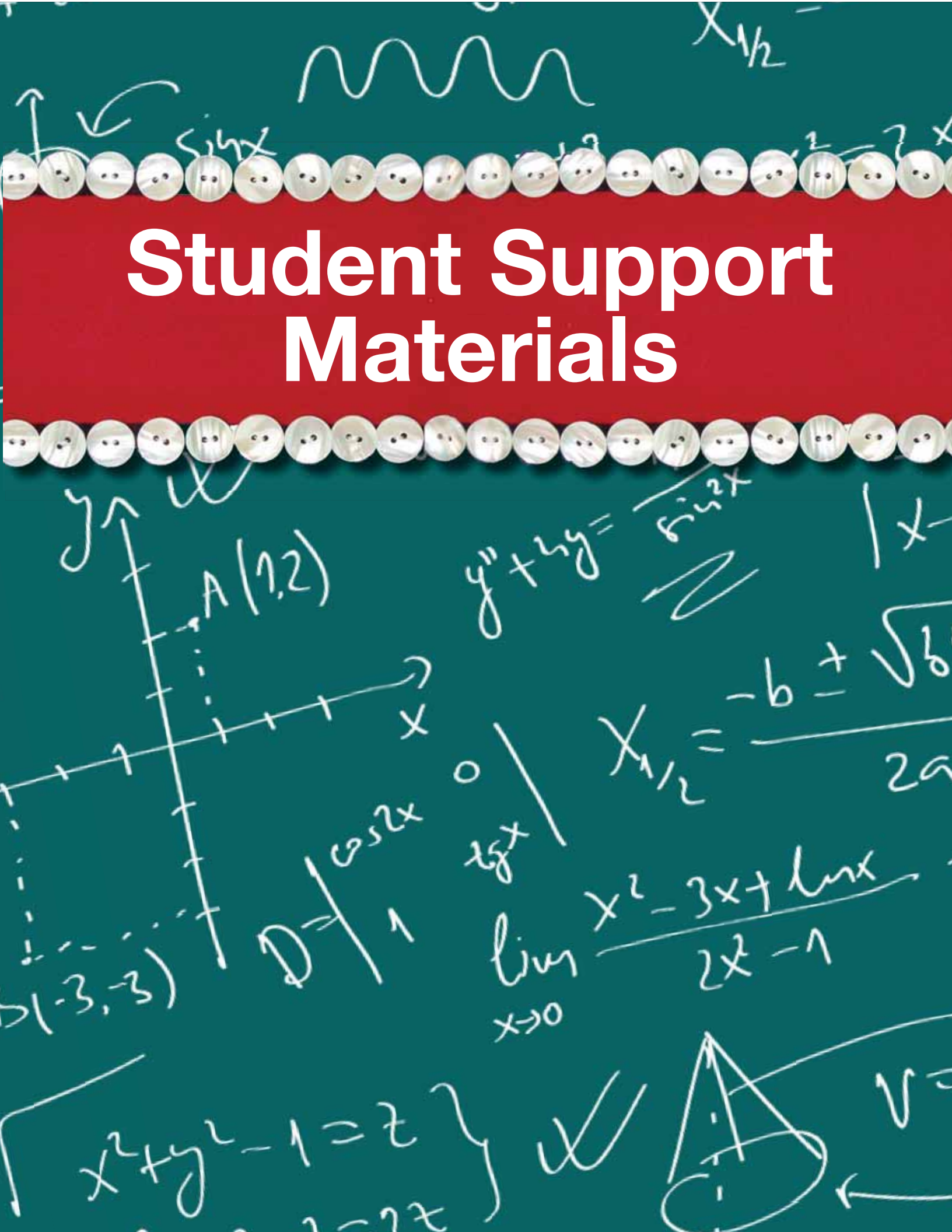
WRITING

Use the activity pages from the Student Support Materials.

Morse Code

Prepare a copy of the "Morse Code" for each student. Spell a sight word, using the dots and dashes for the letters of the word. The students should write the dots and dashes that you say on their sheets of paper. After a letter has been said in this way, the students should make slashes on their papers to separate the letters. When the word has been completely spelled using the Morse Code, the students should use their charts to determine the word you spelled. Rather than saying the words "dot/dash," you may wish to use the light of a flashlight or sound effects for this process.

Student Support Materials



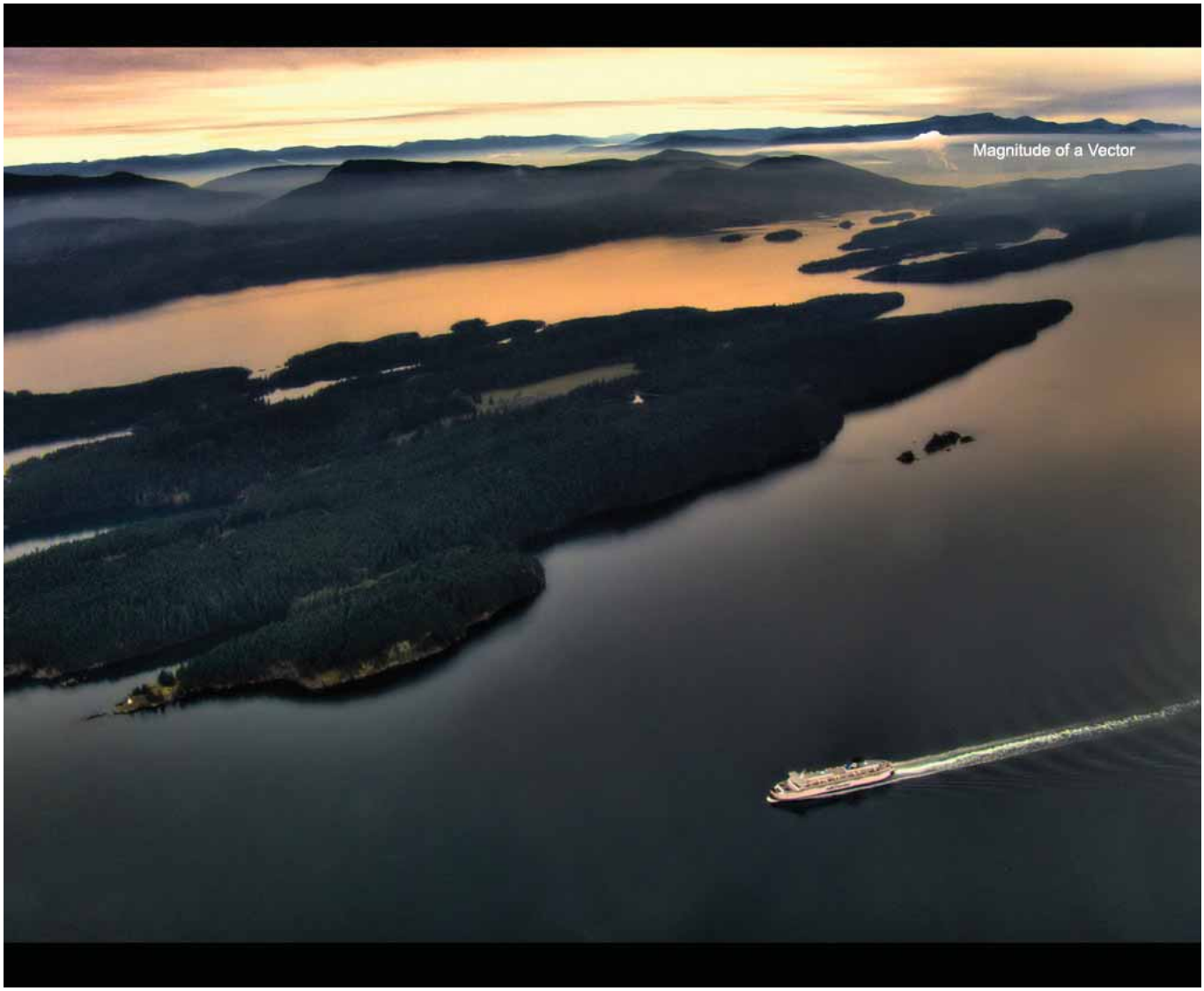
Abscissa


Coordinates
My Current Location
Coordinates:
S 26°12'56.4" E028°52'56.7"
Elevation:
1551m
Back
Show Map
Save
GARMIN nüvi


ROMA
SORRENTO
BARI

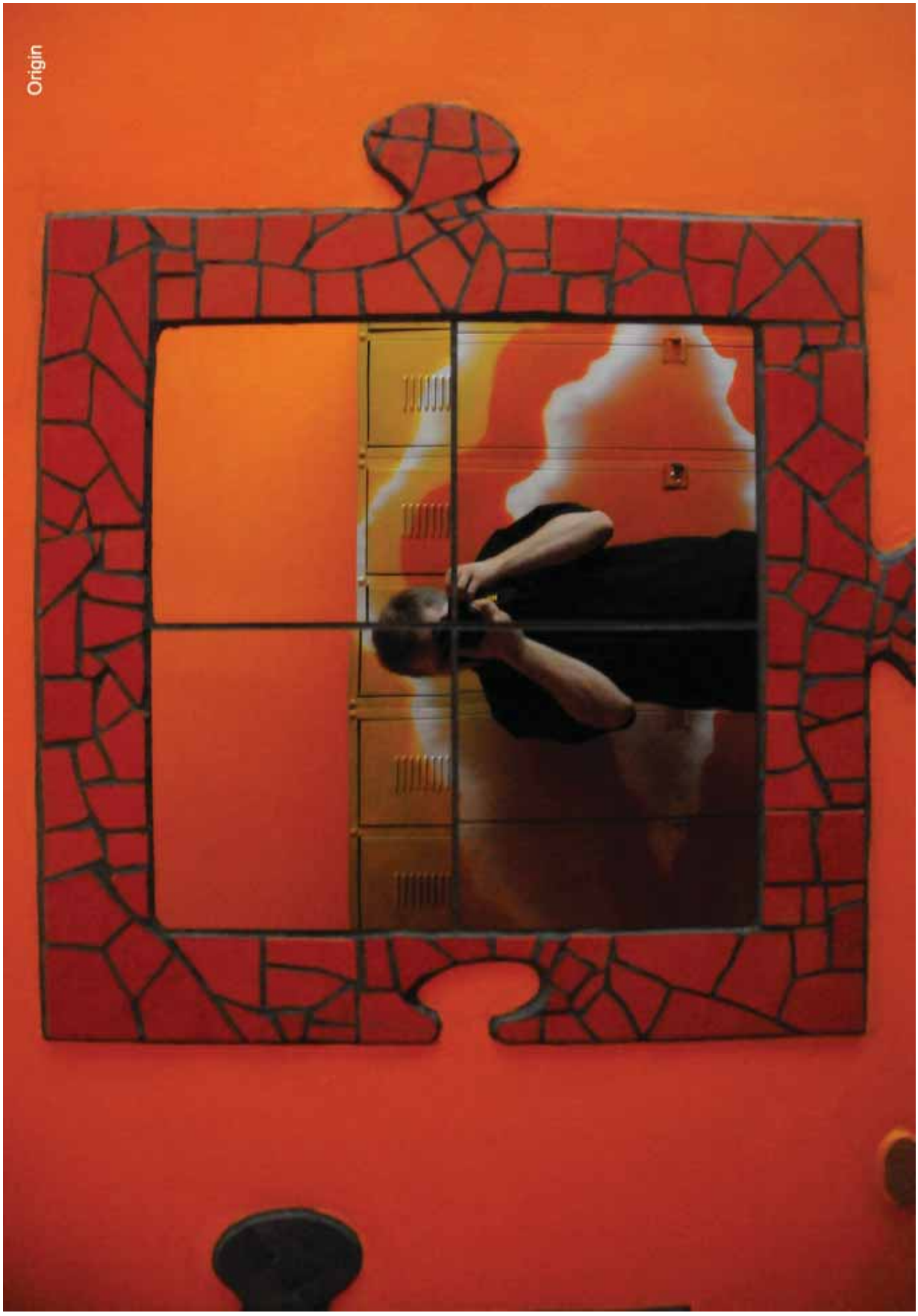

44
Distance
لهباب ٦٩ كم
دبي ١١٥ كم
جبل علي ١٢٥ كم
ابو ظبي ٢٢١ كم
Lahbab 69 km
Dubai 115 km
Jebel Ali 125 km
Abu Dhabi 221 km

Linear Equation

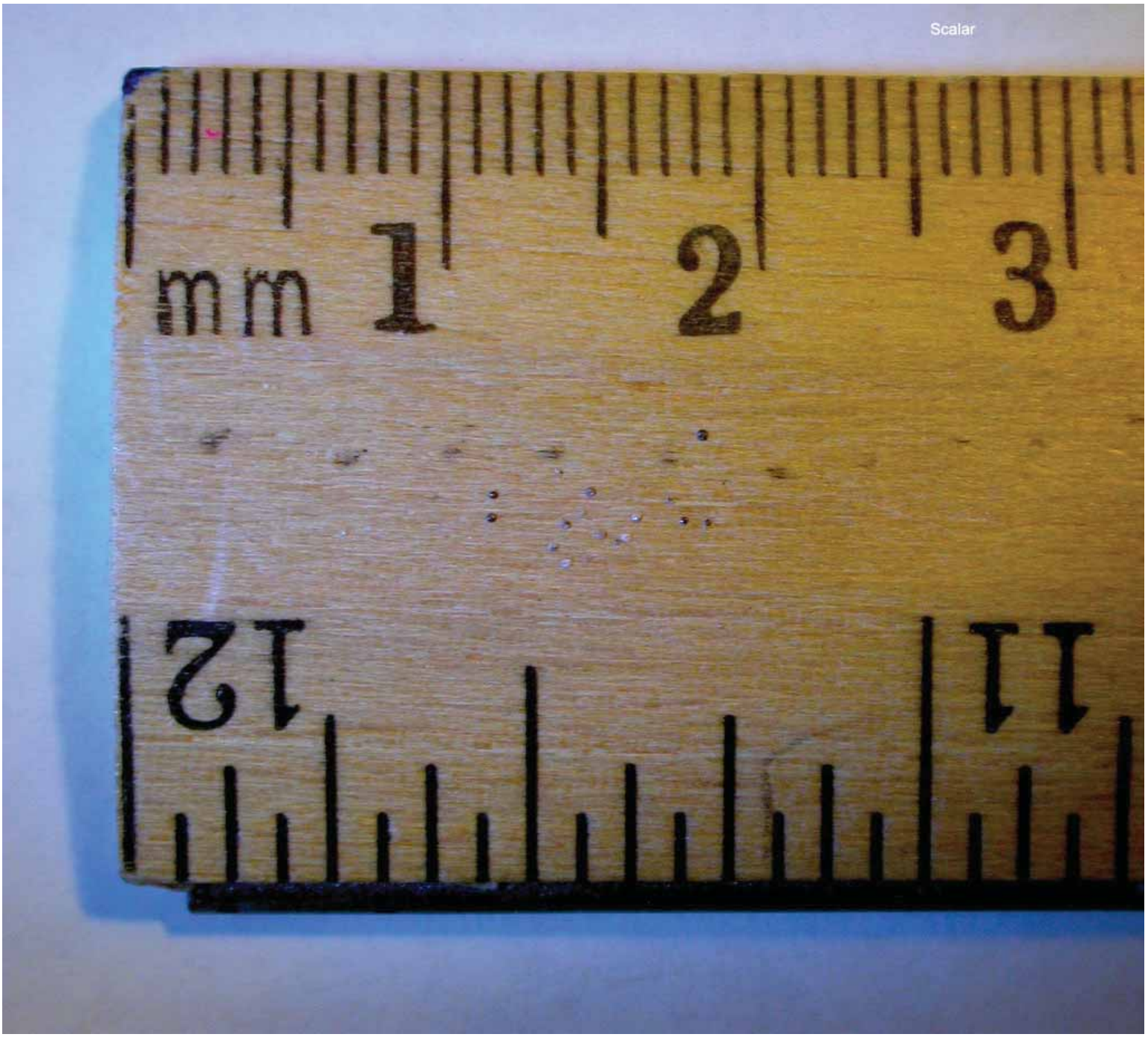

Magnitude of a Vector


Ordered Pair

Ordered
Triplet




Point-Slope Form


Scalar
mm
1
2
3
12
11

Scatter
Plot

Slope-Intercept Form

Standard Form


Unit Circle


Vector
CLEVELAND WAY
WHITE HORSE 1ml

True-False Sentences

(Listening and/or Reading Comprehension)

1. Coordinates are used to locate points in space.
2. An ordered pair represents the position of a point on a plane.
3. Three numbers on the same plane make up an ordered triple.
4. The origin is the point where all coordinates equal zero.
5. An abscissa is also a y-coordinate.
6. A scatter plot is made up of lines.
7. A linear equation has two variables.
8. The slope of a line indicates its steepness.
9. The slope-intercept form is one way to write a linear equation.
10. To use the point-slope form of a linear equation, it is necessary to know where the line crosses the x axis.
11. The number in front of the y indicates the slope, in the standard form of a linear equation.
12. The distance from a point to a line is the length of the shortest segment connecting them.
13. The center of a unit circle is located anywhere on the x axis.
14. Height is a scalar quantity.
15. Mass is a vector quantity.
16. All vectors going in the same direction have the same magnitude.
17. The direction of a vector is the line along which it moves.

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

1. To locate something in three-dimensional space, two coordinates are needed.
2. In an ordered pair, the first number is always bigger than the second.
3. An ordered triple includes x-, y-, and z-coordinates.
4. Every line crosses an axis at the origin.
5. The first number of an ordered pair is the abscissa.
6. On a scatter plot, data is plotted as points on a graph.
7. In a linear equation, a variable might be squared or cubed.
8. The slope of a line is always a positive number.
9. When an equation is written in slope-intercept form, y is always larger than x.
10. The point-slope form of a linear equation uses the coordinates of a point on the line.
11. In the standard form of an equation for a line, three real numbers are used.
12. There can be several different distances from any given point to any given line.
13. A unit circle always has a radius of one.
14. Acceleration is a scalar quantity.
15. Vectors have both magnitude and direction.
16. The magnitude of a vector indicates its size or extent.
17. A vector's direction must always be from east to west.

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

Match the Halves

1. A position in three-dimensional space is given by	A. on a scatter plot.
2. In the standard form of a linear equation,	B. of a point.
3. The distance from a point to a line	C. a radius of one unit.
4. The point “0” on a number line is	D. the abscissa.
5. Data is represented by points	E. A, B, and C represent real numbers.
6. In the point-slope form of a linear equation	F. is the line along which it moves.
7. Coordinates show the position	G. magnitude and direction.
8. The x-coordinate is also called	H. magnitude.
9. The steepness of a line is	I. an ordered triple.
10. A linear equation always has	J. can be expressed by one number.
11. The direction of a vector	K. its slope.
12. A unit circle always has	L. it is easy to tell where a line crosses the y axis.
13. A vector has both	M. the origin
14. In the slope-intercept form of a linear equation	N. two variables.
15. The x- and y- coordinates are given	O. is the length of the shortest segment connecting them.
16. A scalar quantity	P. (x_1, y_1) represents a point on the line.
17. The length of an arrow expresses a vector’s	Q. by an ordered pair

Answers:

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

Definitions

Coordinates - A pair or triple of numbers that give the location of a point.

Ordered pair - Two numbers written in the form (*x, y*) to represent the position of a point on a coordinate plane.

Ordered triple - Three numbers written in the form *(x, y, z*) to represent the position of a point in space.

Origin - The zero point.

Abscissa - The *x*-coordinate or the first number in an ordered pair.

Scatter Plot - A graph on which data is plotted as coordinate points.

Linear equation - An equation with two variables that each have a power of one, and whose graph is a straight line.

Slope - A number that indicates the steepness of a line, and also tells which way the line is tilted.

Slope-Intercept form - A form for an equation of a line written as $y=mx+b$ where *m* is the slope, and *b* is the y intercept.

Point-slope form - A form for the equation of a line written as $y-y_1=m(x-x_1)$ where *m* is the slope and (x_1, y_1) is a point on the line.

Standard form - A form for an equation of a line written as $Ax+By+C = 0$, where *A, B*, and *C* are real numbers.

Distance (from a point to a line) - The length of the shortest segment from a given point to a given line.

Unit circle - A unit circle is a circle with a radius of one, centered on the origin on an *x-y* plane.

Scalar - A quantity that has only magnitude and does not depend on direction.

Vector - A quantity that has both a size and a direction.

Magnitude - The size, extent or amount of a quantity.

Direction of a vector - The line along which a vector moves.

Which Belongs

1. A straight line on a graph can be described by a (vector, linear equation, ordered triple)
2. Speed is a (vector, scalar, linear) quantity.
3. The position of a point on a plane is described by a(n) (ordered triple, scatter plot, ordered pair).
4. A vector represented by a long arrow has a greater (magnitude, direction, distance) than a vector represented by a short arrow.
5. In the (standard, slope-intercept, point-slope) form of a linear equation, a line is defined by its slope and the coordinates of one of its points.
6. Another name for the first member of an ordered pair is (abscissa, apex, origin).
7. Data on a (unit circle, line graph, scatter plot) is represented by points on a coordinate plan.
8. A (vector, scalar, linear) quantity such as a population is one that can be measured by a single number.
9. In the (standard, slope-intercept, point-slope) form of a linear equation, a line is defined by its slope and the point where is crosses the y axis.
10. The shortest length of a segment from a point to a line is the (direction, distance, slope.)
11. A point in space can be located using a(n) (ordered pair, ordered triple, vector).
12. In the (standard, slope-intercept, point-slope) form of a linear equation, a line is described using three real numbers and two variables.
13. The (slope, y-intercept, direction) of a line describes its tilt and steepness.
14. The point (0,0) is the center of a (vector, unit circle, abscissa).
15. (Vectors, slopes, coordinates) are numbers that describe a location on a plane or in space.
16. The (direction, magnitude, length) of a vector is often described as an angle.
17. In three-dimensional space, the (unit circle, abscissa, origin) has the coordinates (0,0,0).

1. Linear equation
2. Vector
3. Ordered pair
4. Magnitude
5. Point-slope form
6. Abscissa
7. Scatter plot
8. Scalar
9. Slope-intercept form
10. Distance
11. Ordered triple
12. Standard form
13. Slope
14. Unit circle
15. Coordinates
16. Direction of a vector
17. Origin

Multiple Choice

1. In the ordered pair (4, 3), the 4 is the
   a) x coordinate
   b) abscissa
   c) first number
   d) all of the above

2. Which of the following is a linear equation written in point-slope form?
   a) $y - 3 = 2(x + 5)$
   b) $y = 7x + 12$
   c) $2x + 3y + 4 = 0$
   d) all of the above

3. A location on a map can be pinpointed using its
   a) y-intercept
   b) linear equation
   c) coordinates
   d) direction

4. A vector describing a plane's flight shows that it went due East at 150 miles per hour. 150 describes the vector's
   a) direction
   b) magnitude
   c) distance
   d) none of the above

5. Which of the following is an ordered triple?
   a) cheap, fast, good
   b) (12, -5, 8)
   c) (1, 3)
   d) Baby Bear, Mama Bear, Papa Bear

6. Which of the following is a linear equation?
   a) $5x + 4y + 3 = 0$
   b) $12 = x - 3$
   c) $6x^2 + 2x + 8 = 0$
   d) $y + 10 = 7$

7. If Susie found the shoe size (x) and the height (y) of 50 people and wanted to show her data on a graph, she would use a
   a) bar graph
   b) slope-intercept form
   c) unit circle
   d) scatter plot

8. Which of the following is a linear equation in standard form:
   a) $y = \frac{1}{2}x + 3$
   b) $y + 6 = 2(x + 1)$
   c) $7x - 2y - 1 = 0$
   d) $2y = y - 4$

9. For a linear function where y = 3 when x= 0, you know that the line will cross the y axis at 3. The equation would be y=mx + 3 if it is written in
   a) point-slope form
   b) standard form
   c) quadratic form
   d) slope-intercept form

10. The distance from a point to line is the same as
   a) the abscissa
   b) the length of the shortest segment that intersects both of them
   c) the magnitude of the line
   d) the point's ordered pair

11. A unit circle always has
   a) a radius of one unit
   b) a center on the origin
   c) both of the above
   d) neither of the above

12. Which of the following is a vector quantity?
   a) force
   b) calories
   c) temperature
   d) miles

13. A set of two numbers that represent x and y on a coordinate plane is called a(n):
   a) origin
   b) ordered double
   c) ordered pair
   d) ordered triple

14. The steepness of a line is described by its
   a) length
   b) slope
   c) vector
   d) direction

15. Which of the following is a scalar quantity?
   a) a missile's flight
   b) acceleration
   c) displacement
   d) volume

16. A vector quantity depends on
   a) distance
   b) direction
   c) slope
   d) all of the above

17. The point at which all coordinates are zero is known as the
   a) abscissa
   b) unit circle
   c) origin
   d) none of the above

Answers: 1D, 2A, 3C, 4B, 5B, 6A, 7D, 8C, 9D, 10B, 11C, 12A, 13C, 14B, 15D, 16B, 17C

Complete the Sentence

1. Money is a scalar quantity because it has magnitude but not _____.
2. In the _____of a linear equation, “b” stands for the y-intercept.
3. The _____ from a point to a line must be the shortest length possible.
4. A quantity that does not depend on direction is a(n) _____quantity.
5. The position of a point in 3-dimensional space is given by a(n)_____.
6. The center of a unit circle is always the _____.
7. A straight line results when a _____is graphed.
8. An architect needs to calculate _____ when designing a roof.
9. The first number of an _____ is the abscissa.
10. _____ is used to describe both scalar and vector quantities.
11. The x coordinate of a point is the same as its _____.
12. Ax + By + C is the _____of a linear equation.
13. A _____always has a radius of one.
14. The location of points in space, on planes, and on maps is described using _____.
15. The _____of a linear equation might be written as y+12 = x + 3.
16. When data represented by a set of points is graphed, the result is a(n)_____.
17. Velocity is a _____quantity because it depends on both magnitude and direction.

Answers:

1. Direction
2. Slope-intercept form
3. Distance
4. Scalar
5. Ordered triple
6. Origin
7. Linear equation
8. Slope
9. Ordered pair
10. Magnitude of a vector
11. Abscissa
12. Standard form
13. Unit circle
14. Coordinates
15. Point-slope form
16. Scatter Plot
17. Vector

Creative Writing

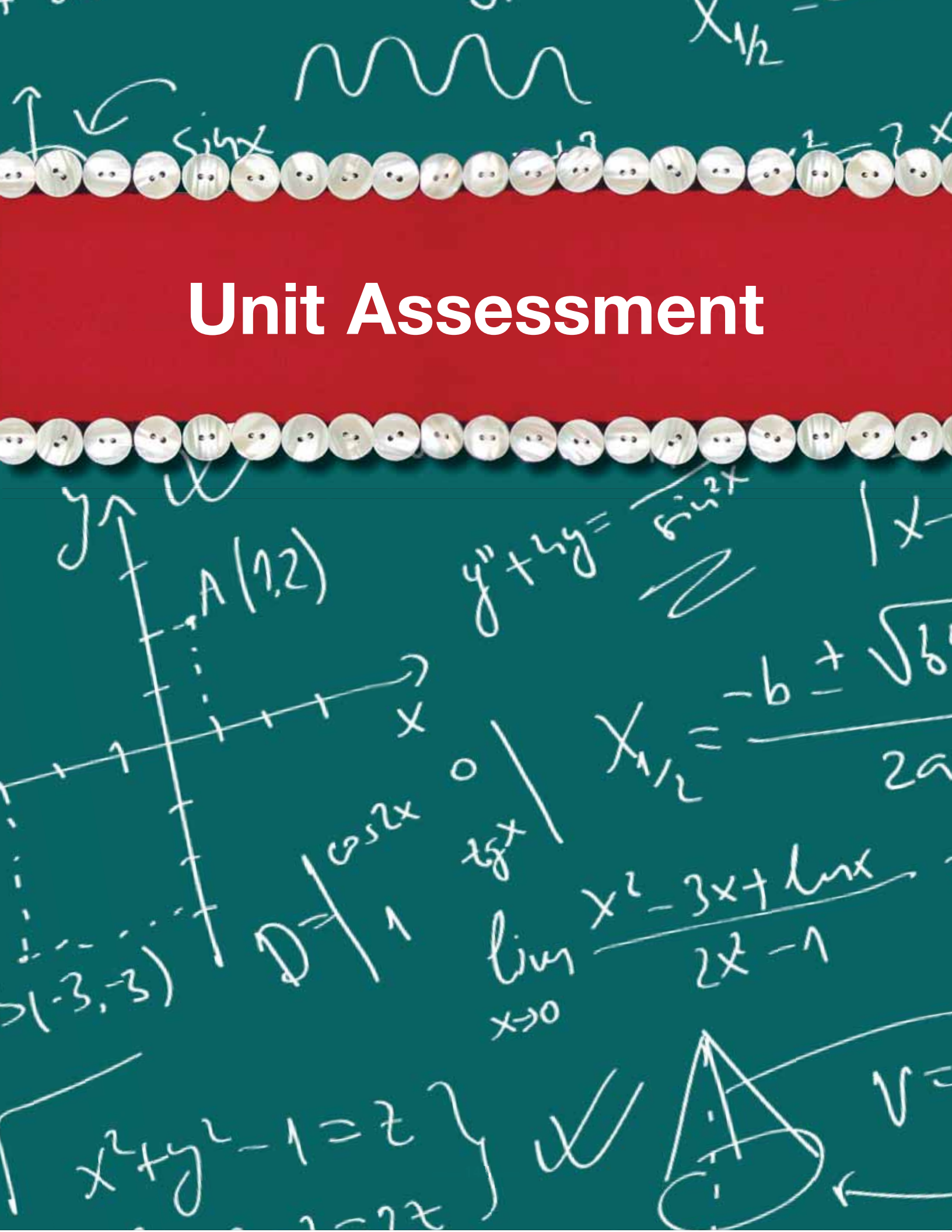
Use words from this unit to write about this map. You may draw a coordinate system on the map, if desired.

Place-Based Practice Activity

Divide students into groups and have them work cooperatively, using coordinate geometry to make a map or even a 3-D model of a familiar building or outdoor location.

They will designate x and y axes and go from there to find locations, distances, and directions of important points.

Have them present their map or model to the class or another audience, using the terms from the unit. The presentations might be oral or written.


Unit Assessment

Geometry: Unit 11-Coordinate Geometry

Name: _____
Date: _____

Illustrations: Look at the illustrations for the items 1-4. Label the illustration and write the definition for the key vocabulary word that matches the definition in the space provided.

1) Look at the illustration below. Label the illustration and write the definition below the label.

1. label _____
2. definition _____

2) Look at the illustration below. Label the illustration and write the definition below the label.

1. label _____
2. definition _____

3) Look at the illustration below. Label the illustration and write the definition below the label.

1. label _____
2. definition _____

4) Look at the illustration below. Label the illustration and write the definition below the label.

1. label _____
2. definition _____

Matching: match the key vocabulary word on the left with the definition on the right. Place the letter of the definition in front of the word it matches.

5) _____ coordinates

6) _____ ordered pair

7) _____ ordered triple

8) _____ origin

9) _____ abscissa

10) _____ linear equation

a. numbers that give the location of a point

b. an equation with two variables that each have a power of one.

c. two numbers written in the form (x, y) to represent the position of a point on a coordinate plane.

d. the x-coordinate or the first number in an ordered pair

e. the zero point number line and is the point 0

f. three numbers written in the form (x, y, z) to represent the position of a point in space.

Illustrate OR define: In the space provided, you may choose to illustrate the key vocabulary word OR you may choose to write the definition on the lines provided.

11) Illustrate OR write the definition for the concept **Unit Circle.**

12) Illustrate OR write the definition for the concept **Direction of a vector.**

Multiple Choice: Read each item carefully. Select the word that best completes the sentence, Circle the letter in front of the correct word.

13) In mathematics a _____ is a quantity that has both a magnitude and a direction, such as displacement, velocity, acceleration, or force.

a) scalar

b) vector

c) magnitude

d) distance

14) The _____ is the size or the extent or the amount of something.

a) scalar

b) vector

c) magnitude

d) distance

15) A _____ is a quantity that has only magnitude, and does not depend on direction. Time, length, temperature, density, and mass are examples.

a) scalar

b) vector

c) magnitude

d) distance

16) The _____ from a point to a line is the length of the shortest segment from a given point to a given line.

a) scalar

b) vector

c) magnitude

d) distance

Geometry: Unit 11-Coordinate Geometry

Name: _____
Date: _____

Illustrations: Look at the illustrations for the items 1-4. Label the illustration and write the definition for the key vocabulary word that matches the definition in the space provided.

1) Look at the illustration below. Label the illustration and write the definition below the label.

1. label **slope**
2. definition **Slope is a number that indicates the steepness of a line, and also tells which way the line is tilted.** _____

2) Look at the illustration below. Label the illustration and write the definition below the label.

1. label **slope-intercept form**
2. definition **The slope-intercept form is a form for an equation of a line written as y=mx b where m is the slope, and b is the y intercept.** _____

3) Look at the illustration below. Label the illustration and write the definition below the label.

1. label **point slope form**
2. definition **.The point-slope form is a form for the equation of a line written as y-y1=m(x-x1) where m is the slope and (x1, y1) is a point on the line.** _____

4) Look at the illustration below. Label the illustration and write the definition below the label.

1. label **scatter plot**
2. definition **A scatter plot is a graph on which data is plotted as coordinate points.** _____

Matching: match the key vocabulary word on the left with the definition on the right. Place the letter of the definition in front of the word it matches.

5) **a** coordinates

6) **c** ordered pair

7) **f** ordered triple

8) **e** origin

9) **d** abscissa

10) **b** linear equation

a. numbers that give the location of a point

b. an equation with two variables that each have a power of one.

c. two numbers written in the form (x, y) to represent the position of a point on a coordinate plane.

d. the x-coordinate or the first number in an ordered pair

e. the zero point number line and is the point 0

f. three numbers written in the form (x, y, z) to represent the position of a point in space.

Illustrate OR define: In the space provided, you may choose to illustrate the key vocabulary word OR you may choose to write the definition on the lines provided.

11) Illustrate OR write the definition for the concept **Unit Circle.**

OR

- A unit circle is a circle with a radius of one, centered on the origin on an x-y

12) Illustrate OR write the definition for the concept **Direction of a vector.**

OR

The direction of a vector is the line along which it moves. It is often described as the counterclockwise angle between its arrow and the positive x-axis.

Multiple Choice: Read each item carefully. Select the word that best completes the sentence, Circle the letter in front of the correct word.

13) In mathematics a _____ is a quantity that has both a magnitude and a direction, such as displacement, velocity, acceleration, or force.

a) scalar

b) vector

c) magnitude

d) distance

14) The _____ is the size or the extent or the amount of something.

a) scalar

b) vector

c) magnitude

d) distance

15) A _____ is a quantity that has only magnitude, and does not depend on direction. Time, length, temperature, density, and mass are examples.

a) scalar

b) vector

c) magnitude

d) distance

16) The _____ from a point to a line is the length of the shortest segment from a given point to a given line.

a) scalar

b) vector

c) magnitude

d) distance

UNIT 12
Transformations

Sealaska Heritage Institute

Grade Level Expectations for Unit 12

Unit 12—Transformations

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 conceptual understanding of similarity, congruence, symmetry, or transformations of shapes by

[9] G-3 drawing or describing the results of applying transformations (translations, rotations, reflections, or dilations) to figures on a coordinate plane (L)

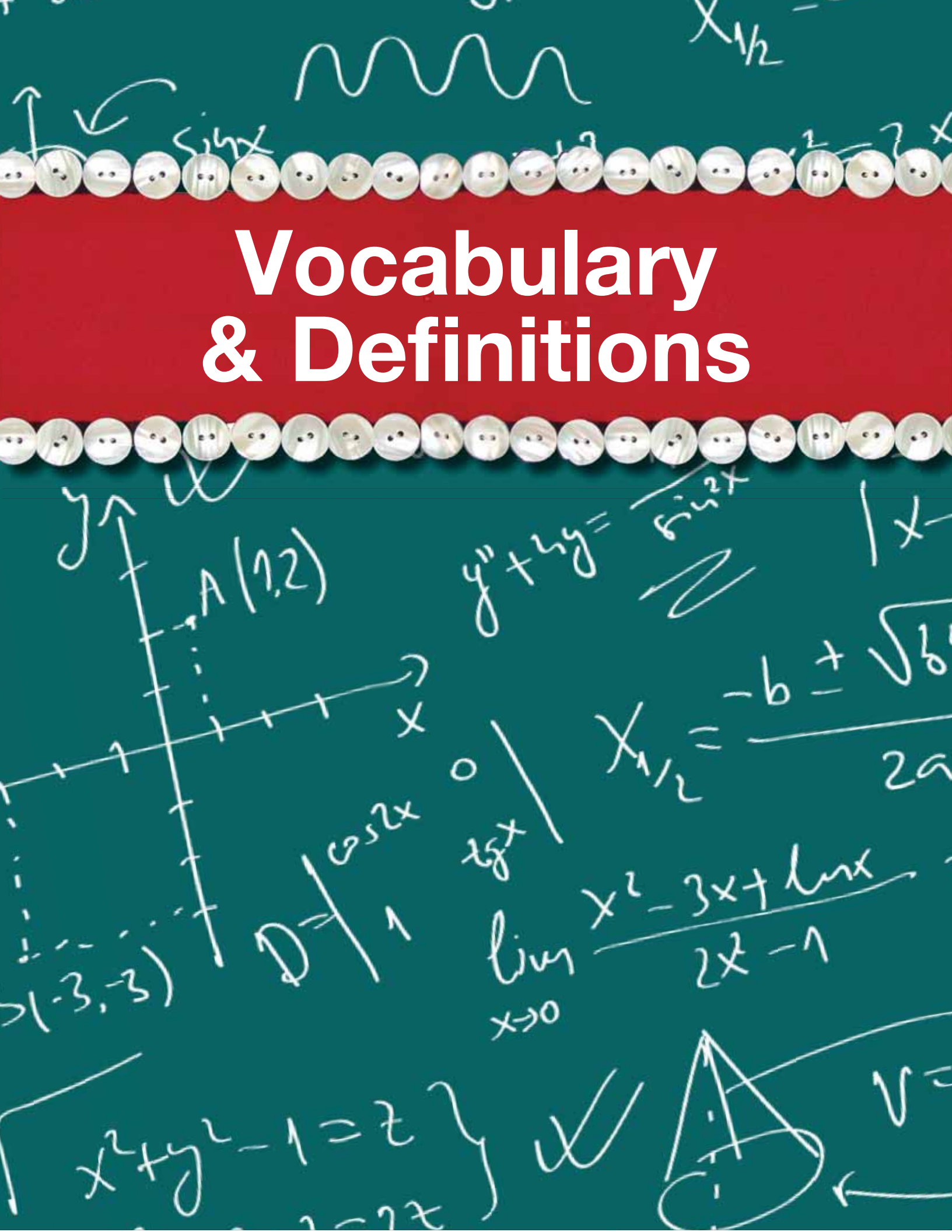
The student demonstrates conceptual understanding of similarity, congruence, symmetry, or transformations of shapes by

[10] G-4 using transformations to show congruence or similarity of figures on a coordinate plane

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

Transformation

Transformations are operations that alter the form or position of a figure without substantially changing it.

Symmetry

Symmetry means the correspondence in size, form, and arrangement on opposite sides of a plane, a line, or a point. Symmetry brings to mind words like balance, harmony, equally proportioned and symmetrical designs are usually pleasing to the eye. Symmetry is found commonly in nature, in plants, animals, and rock crystals. Symmetry is also very important in Native art forms.

Reflection

The replacement of a point on each side of a line or plane with a symmetric point on the other side of the line or plane. In a reflection, a mirror image of a figure is created.

Mirror symmetry

A type of symmetry that involves a reflection of a mirror image.

Introduction of Math Vocabulary

Line of symmetry

The line about which a figure is reflected. It is also called the line of reflection or the axis of reflection, or the axis of symmetry.

Point of symmetry

The point of symmetry is a center point for some kinds of symmetry. If a figure can be rotated 180^0 around a center point P and end up looking identical to the original, the P is the point of symmetry.

Horizontal

The word horizontal is based on the word “horizon”. It means flat and level, parallel to flat ground. A floor is horizontal, and the edge of a table top is horizontal.

Introduction of Math Vocabulary

Vertical

Vertical means straight up and down, or perpendicular to flat ground. Horizontal and vertical are opposite in meaning.

Translation

A translation is a transformation in which a figure is “picked up” and moved to another location, without any change in its size or orientation. It is also called a “shift” or a “glide”.

Rotation

A rotation is a transformation in which a plane figure turns around a fixed center point.

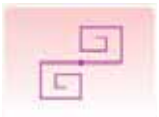
Angle of rotation

The angle of rotation is a measure of how far a figure has turned around its center of rotation.

Introduction of Math Vocabulary

Center of rotation

The center of rotation is the point that does not move when the figure is rotated. The figure rotates around that point.



Isometry

On this basket, the “z” pattern has been reflected, and also translated, or moved to a new location. It is still the same size and shape. It has undergone an isometry: a transformation in which the distance between any two points of a figure does not change. Reflections, rotations, and translations are isometries.

Dilation

When the pupils of your eyes are dilated, they get very big.

Dilation is a stretch or an expansion; a transformation in which a figure grows larger while keeping its shape.

Note: In some books the word “dilation” refers to any change in size (stretching or shrinking). In others, the word “compression” or the word “contraction” is used when a figure shrinks or gets smaller.

Introduction of Math Vocabulary

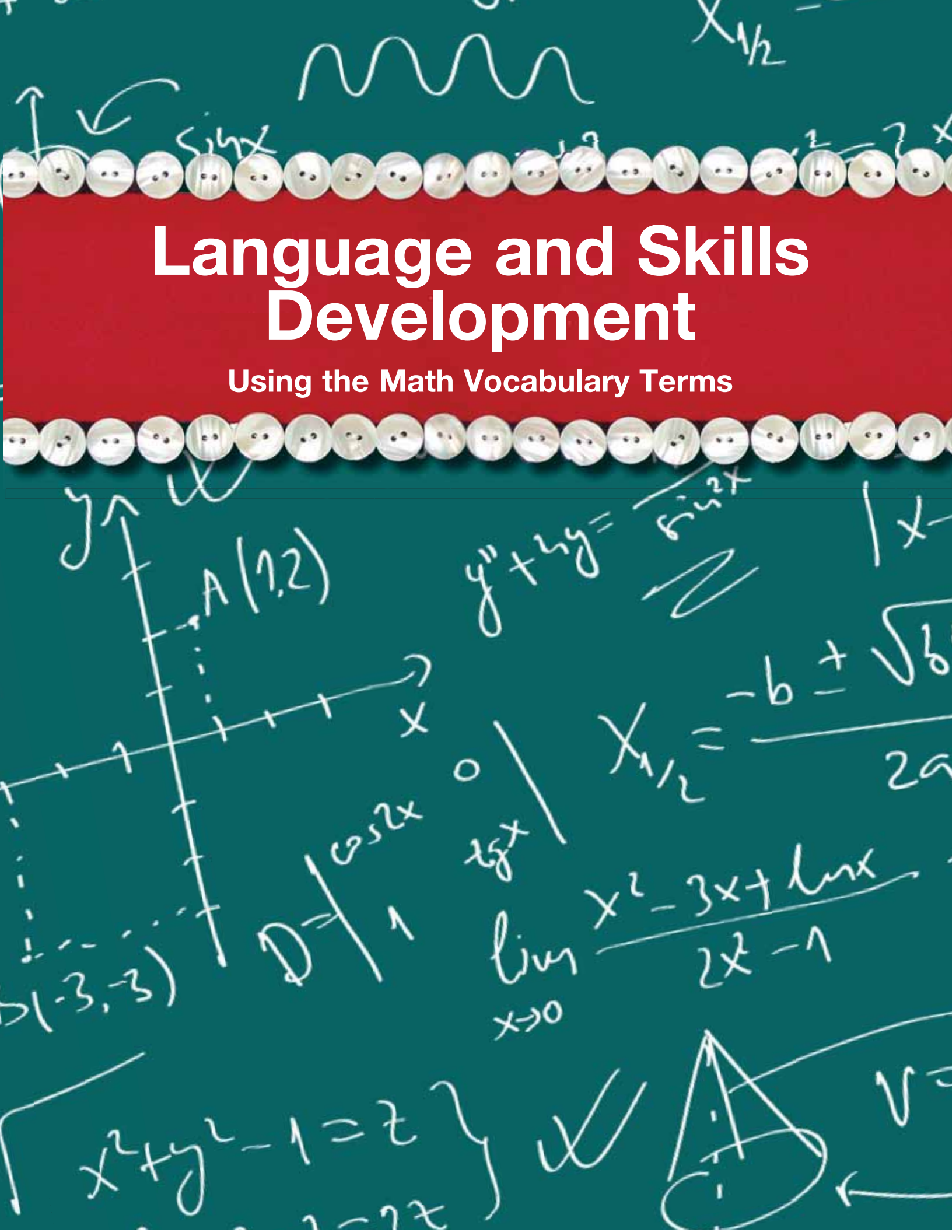
Locus

A locus is a set of all the points, lines, or surfaces that satisfies a given requirement. For example, the locus of points that are all the same distance from a given point would be a circle.

Tessellation

a tessellation is the use of identically shaped pieces which do not overlap to cover a plane. There cannot be any blank spaces in a tessellation. The pieces can be oriented any way, and 1, 2, 3, or any finite number of different shapes may be used.

Introduction of Math Vocabulary



Language and Skills Development

Using the Math Vocabulary Terms

Language & Skills Development

LISTENING

Use the activity pages from the Student Support Materials.

Flashlight Find

Mount the vocabulary illustrations on the walls, chalkboard, windows, etc. Have a student stand in the center of the classroom with a flashlight. Say one of the vocabulary words and the student must find the illustration for the vocabulary word you said using the light of the flashlight. This activity may also be conducted in team form. In this case, have two flashlights available. Have a player from each team stand in the center of the classroom. When you say the vocabulary word, each player must attempt to find the correct illustration with the light of his/her flashlight. The first player to correctly identify the illustration for the vocabulary word you said wins the round. Repeat until all players have played.

SPEAKING

Illustration Bingo

Before the activity begins, prepare a page that contains a small version of each vocabulary illustration. Provide each student with a copy of the small illustrations. Each student should cut out the illustrations from his/her copy. When the students' illustrations are cut out, each student should place them on his/her desk, face down. Then, have each student turn one illustration face up. Say a vocabulary word. Any student or students who have the illustration for that word face up must say a complete sentence, using that vocabulary word. Those illustrations should then be put to the side and other illustrations turned over. Continue in this way until a student or students have no illustrations left on their desks.

READING

Use the activity pages from the Student Support Materials.

Find the Parts

Before the activity begins, prepare a page that contains the sight words. Provide each student with a copy of the page. Each student should then cut out the letter/syllables of the sight words. When a student has cut out all of the letter/syllables, he/she should lay them on his/her desk, in a scattered form. Say one of the sight words. The students should then find the necessary letters/syllables to create the sight word you said. Continue until all of the sight words have been developed in this way. Later, the students can glue their encoded sight words on blank sheets of paper.

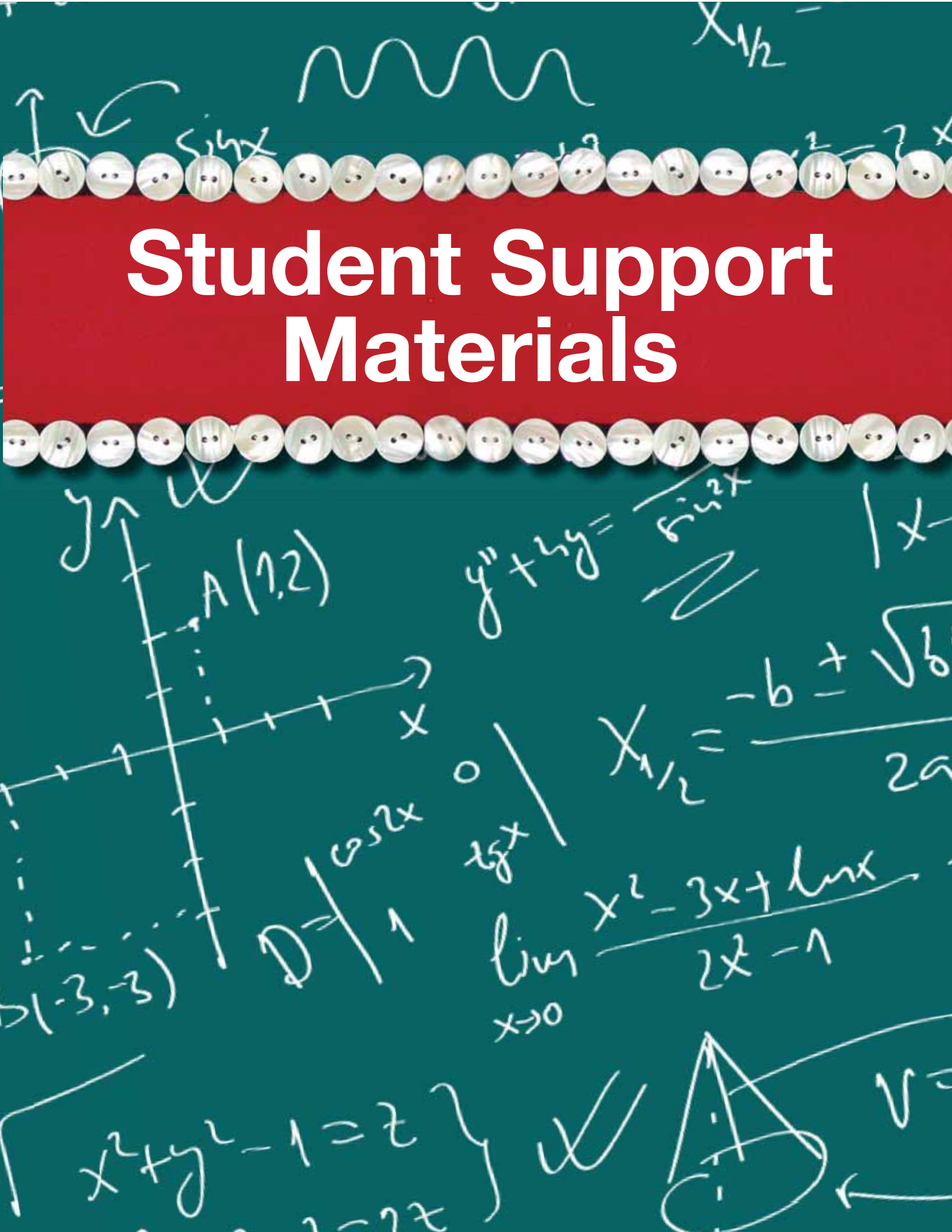
WRITING

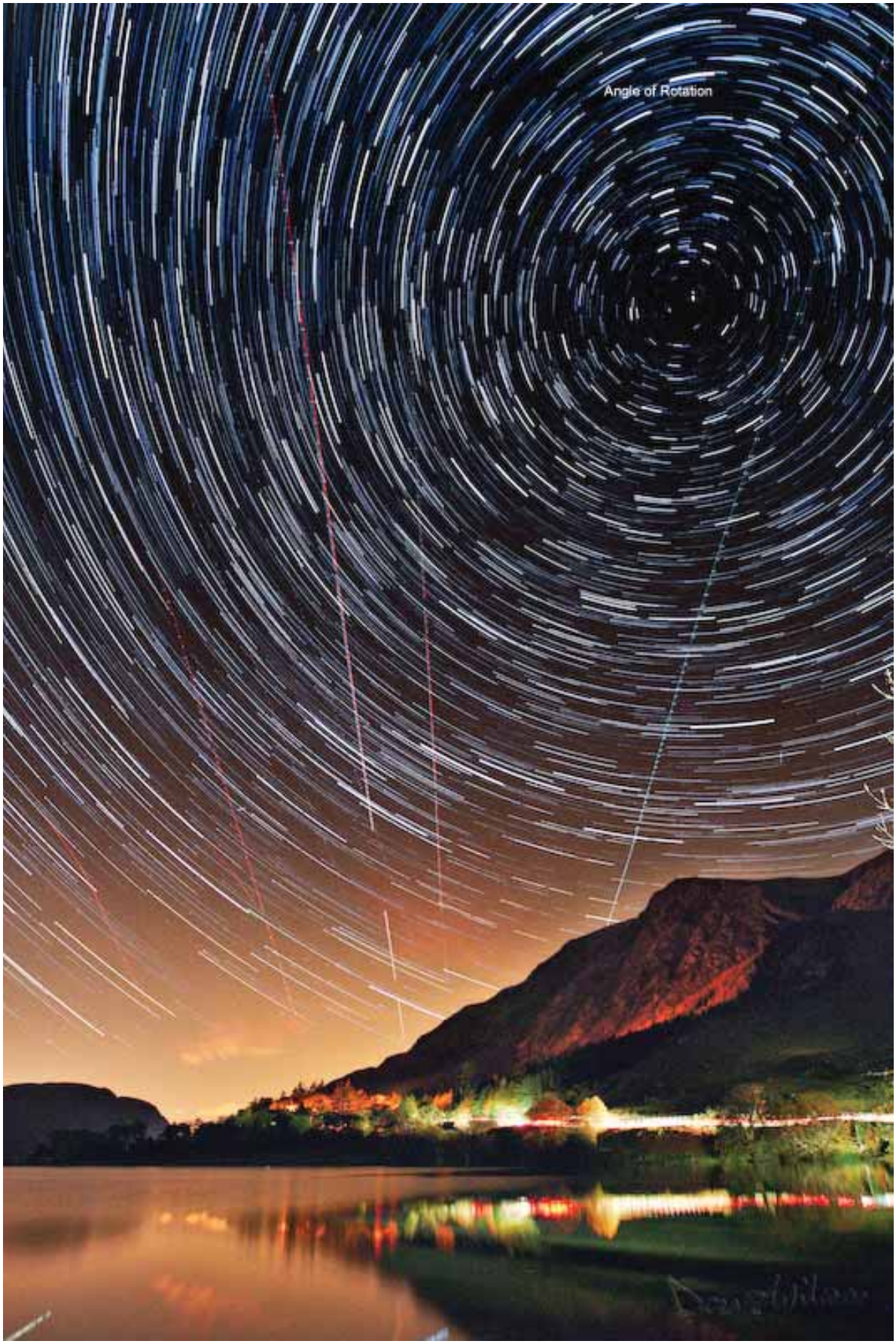
Use the activity pages from the Student Support Materials.

Numbered Illustrations

Mount the vocabulary illustrations on the chalkboard and number each illustration. Provide each student with writing paper and a pen. Call the number of an illustration. Each student should write the vocabulary word for the illustration represented by that number. Repeat until all vocabulary words for the illustrations have been written. Review the students' responses.

Student Support Materials

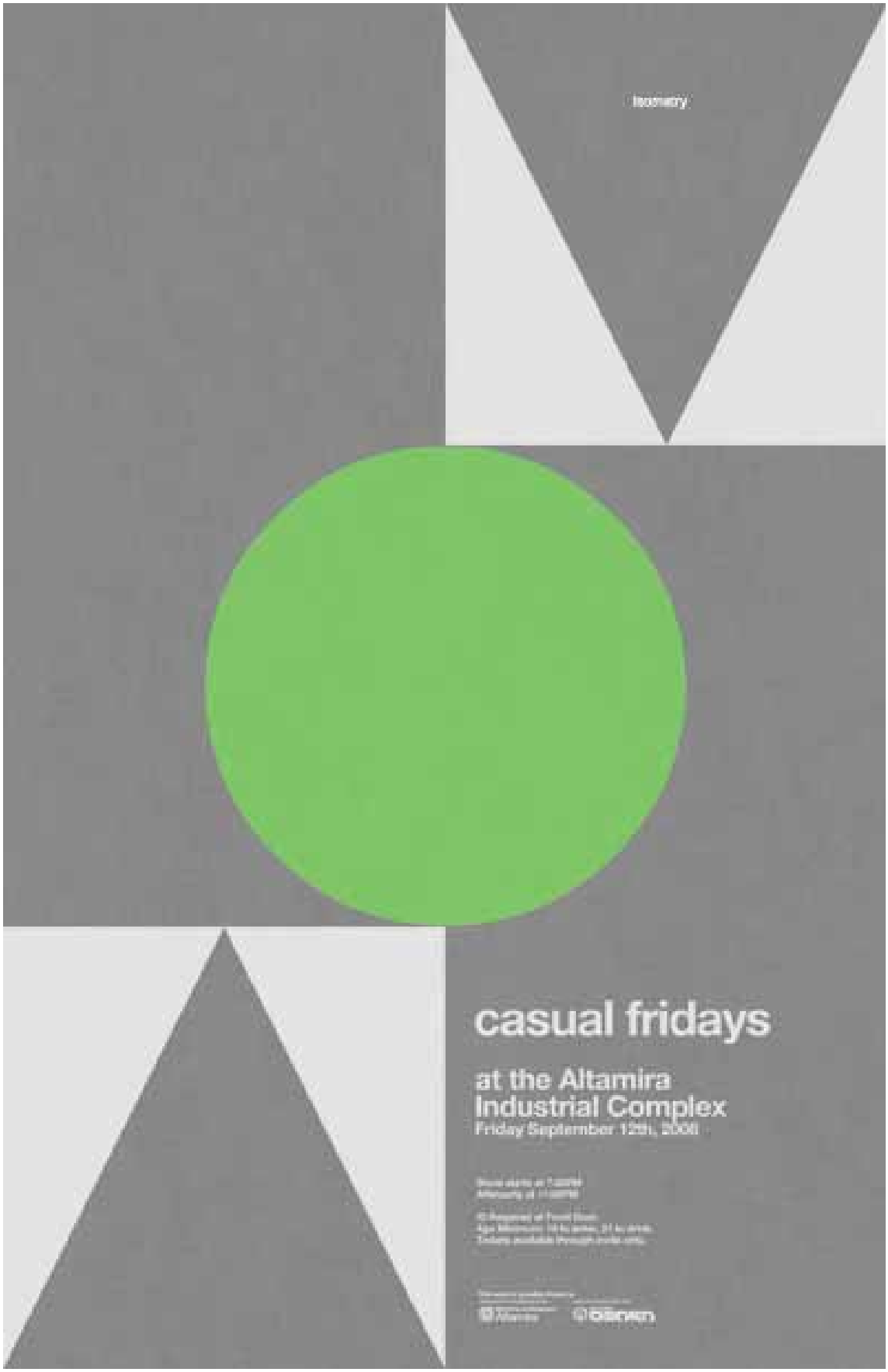



Angle of Rotation

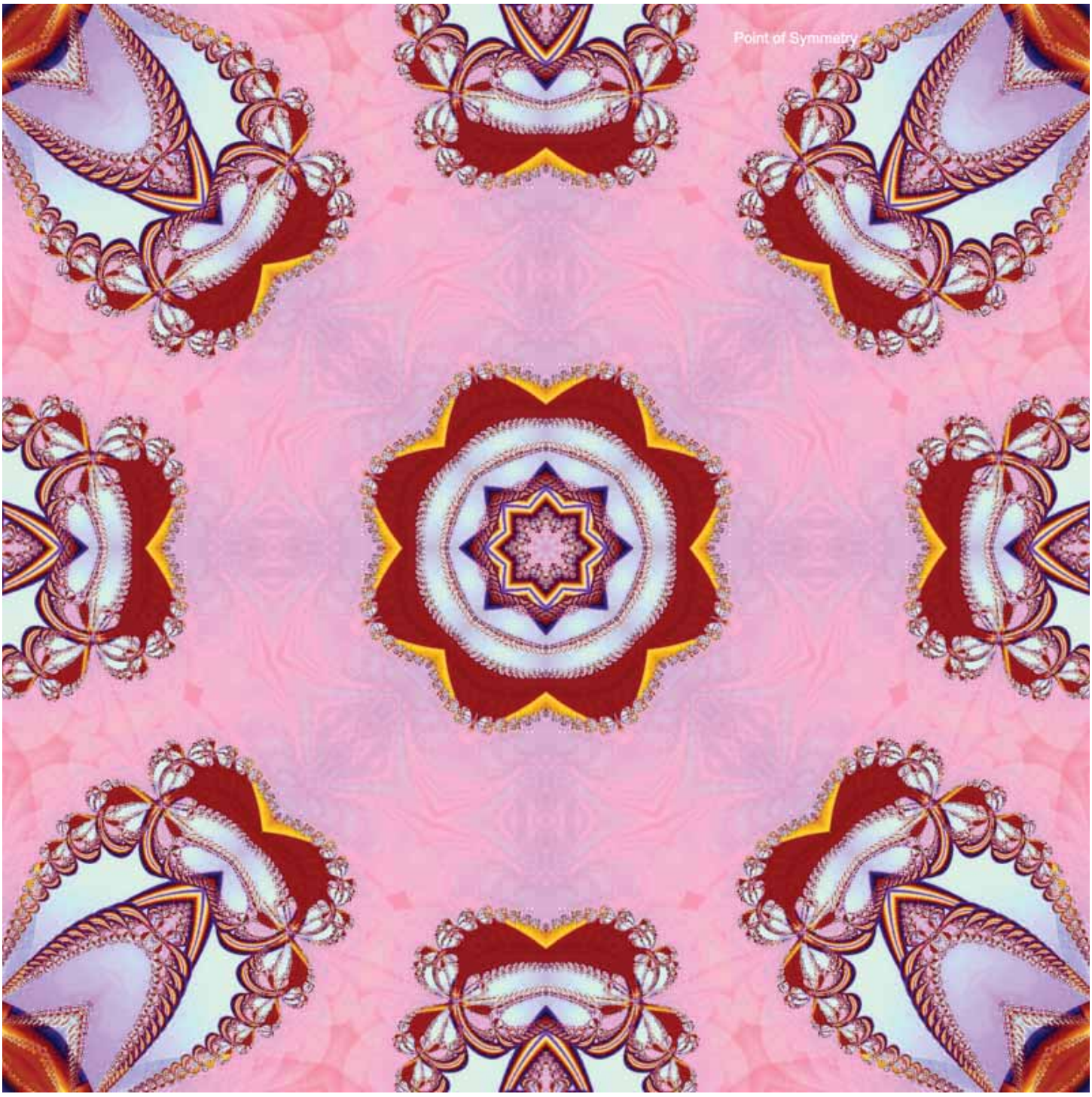

Angle of Rotation

Dilation

Horizontal


isometry
casual fridays
at the Altamira
Industrial Complex
Friday September 12th, 2008

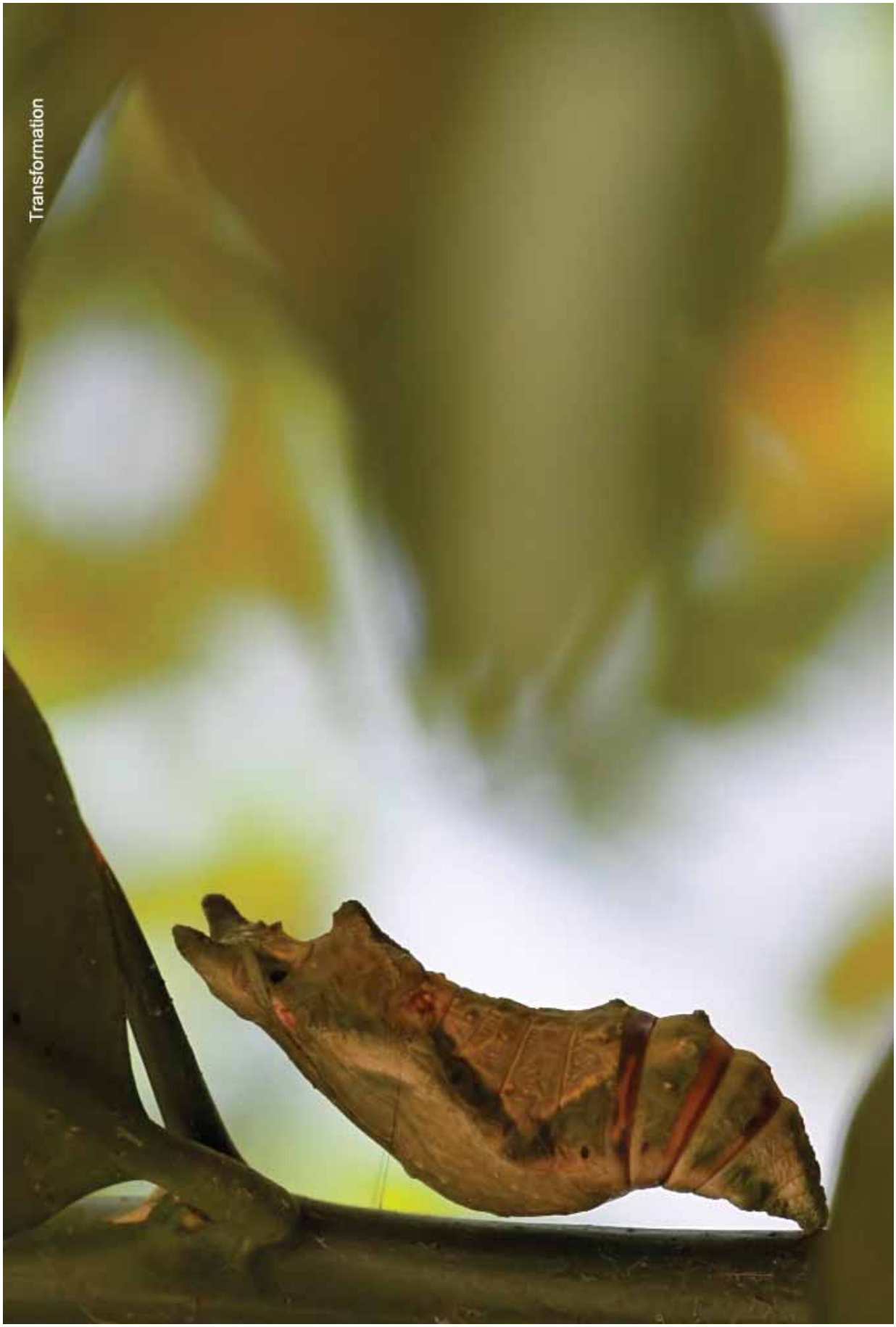
Locus


Point of Symmetry

Reflection


Symmetry


Tessellation


Transformation

Translation

Vertical

True-False Sentences

(Listening and/or Reading Comprehension)

1. When a figure undergoes a transformation, it is altered substantially.
2. Most rocks are symmetrical.
3. In a reflection, every point on one side of a line has a mirror image on the other side of the line.
4. In mirror symmetry, if an object is rotated 180^{o}, it is identical to its original.
5. A line of symmetry is the same as a line of reflection.
6. A figure looks just the same after it rotates 180^{o} around a point of symmetry.
7. Tree trunks grow in a horizontal direction.
8. When a person is lying on the ground, he or she is vertical.
9. After a translation, an object still has the same size and orientation.
10. In a rotation, a plane figure turns around a point.
11. An angle of rotation can never be more than 90^{o}.
12. The center of rotation does not move as a figure turns around it.
13. A figure does not change its size or shape if it undergoes an isometry.
14. When an object undergoes dilation, its size stays the same.
15. A locus might be the set of all points on a given line.
16. Figures in a tessellation must all be oriented the same way.

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

1. A transformation alters the position or form of a figure.
2. A bicycle wheel has symmetry.
3. In a reflection, a figure is shifted to a new location without changing its orientation.
4. Every reflection has mirror symmetry.
5. A curve might be a line of symmetry.
6. The apex of a symmetrical triangle is the point of symmetry.
7. A flat road is horizontal.
8. When a person is standing up straight, he or she is vertical.
9. A glide and a translation are two different things.
10. A figure always changes its size during a rotation.
11. If the angle of rotation is 180^{o}, a figure turns upside down.
12. The center of rotation is always in the middle of a figure.
13. Dilation is an example of an isometry.
14. A figure keeps its original shape after dilation.
15. A locus is always a circle
16. In a tessellation, a plane is covered by identically shaped figures.

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

Match the Halves

1. In a rotation, a figure	A. the 180° rotation of a figure.
2. A figure changes its size but not its shape	B. is a measure of how far something has turned.
3. A change of form or position	C. that satisfies a given condition.
4. A point of symmetry is related to	D. horizontal.
5. Mirror symmetry	E. is also an axis of reflection.
6. A figure with the same size, form, and arrangement on both sides of a line	F. turns around a fixed point.
7. A locus is a set of points	G. is a fixed point around which an object turns.
8. A mirror image of a figure is created	H. has symmetry.
9. The gym floor is	I. a plane is covered with pieces that have identical shapes.
10. A center of rotation	J. translations.
11. A mast on a boat is	K. when it undergoes dilation.
12. In a tessellation,	L. a figure does not change size.
13. The angle of rotation	M. is produced by a reflection.
14. A line of symmetry	N. by a reflection.
15. In an isometry,	O. is a transformation.
16. Shifts and glides are the same as	P. vertical.

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

Definitions

Transformation - operations that alter the form or position of a figure without substantially changing it.

Symmetry - correspondence in size, form, and arrangement on opposite sides of a plane, a line, or a point.

Reflection - the replacement of a point on each side of a line or plane with a symmetric point on the other side of the line or plane.

Mirror symmetry - symmetry that involves a reflection of a mirror image.

Line of symmetry - the line about which a figure is reflected.

Point of symmetry - If a figure can be rotated 180^0 around a center point and end up looking identical to the original, the center point is the point of symmetry.

Horizontal - flat and level, parallel to flat ground.

Vertical - straight up and down, or perpendicular to flat ground.

Translation - a transformation in which a figure moves to another location, without any change in its size or orientation.

Rotation - a transformation in which a plane figure turns around a fixed center point.

Angle of rotation - a measure of how far a figure has turned around its center of rotation.

Center of rotation - the point that does not move when the figure is rotated around it.

Isometry - a transformation in which the distance between any two points of a figure does not change.

Dilation - a transformation in which a figure changes size while keeping its shape.

Locus - a set of all the points, lines, or surfaces that satisfies a given requirement.

Tessellation - the use of identically shaped pieces to cover a plane.

Which Belongs

1. In a (rotation, translation, dilation), a figure's size is changed while its shape stays the same.
2. A measure of how far something has turned is its (line of symmetry, angle of rotation, center of rotation).
3. If a set of points is made up of all the points that satisfy a given condition, it is a (locus, linear equation, circle).
4. In a (reflection, rotation, dilation) there is a mirror image of the original on the other side of a line.
5. (Isometry, mirror symmetry, translation) occurs when an image has been reflected.
6. The floor of a room is (horizontal , symmetrical, vertical).
7. A utility pole is normally oriented in a (horizontal, vertical, rotated) direction.
8. In a (translation, reflection, rotation), a figure does not change its orientation.
9. If all the form and arrangement of parts in a figure corresponds on both sides of a line, the figure has (isometry, a locus, symmetry).
10. When a figure turns about a fixed point, it is called a (reflection, transformation, rotation).
11. (Transformations, dilations, rotations) might involve changes in size and orientation.
12. A figure that looks identical after it has rotated 180° around its (locus, point of symmetry, line of symmetry).
13. The (center of rotation, isometry, locus) is a fixed point.
14. Reflections, but not dilations, are types of (translation, symmetry, isometry).
15. If a figure on one side of a line corresponds exactly with a figure on the other side of a line, the line is a(n) (line of symmetry, center of rotation, horizontal line).
16. A floor covered with square tiles is an example of (translation, tessellation, transformation).

1. Dilation
2. Angle of rotation
3. Locus
4. Reflection
5. Mirror symmetry
6. Horizontal
7. Vertical
8. Translation
9. Symmetry
10. Rotation
11. Transformations
12. Point of symmetry
13. Center of rotation
14. Isometry
15. Line of symmetry
16. Tessellation

Multiple Choice

1. Which of the following is not vertical?
    a) a piling on a dock
    b) a countertop
    c) the face of a cliff
    d) the side of a building

2. Which of these is a type of transformation?
    a) a reflection
    b) a rotation
    c) a dilation
    d) all of the above

3. The side of a house is covered with identically-shaped bricks. This is an example of
    a) tessellation
    b) translation
    c) symmetry
    d) locus

4. The axle on a bicycle wheel is at its
    a) locus
    b) center of rotation
    c) angle of rotation
    d) horizontal point

5. In mirror symmetry,
    a) one side of a figure is a reflection of the other
    b) a mirror image is created
    c) both of the above
    d) neither of the above

6. A type of transformation in which size does not change is
    a) isometry
    b) symmetry
    c) dilation
    d) all of the above

7. A center of rotation might also be a
    a) line of symmetry
    b) angle of rotation
    c) dilation
    d) point of symmetry

8. Which of these is not horizontal?
    a) a flat roof
    b) a rug on the floor
    c) the calm surface of a pond
    d) a fence post

9. In a translation, which of the following is true?
    a) an object's orientation and position change
    b) an object's size and position change
    c) an object's position changes but not its size or orientation
    d) an object's size changes, but not its orientation or position

10. When an object turns around a fixed point it is called a
    a) rotation
    b) reflection
    c) translation
    d) dilation

11. When all the parts and arrangements of something correspond on both sides of a line or plane, the object is said to have:
    a) isometry
    b) reflection
    c) verticality
    d) symmetry

12. The hand of a clock moved 90^{o} as it went from 3 to 6. 90^{o} is its
    a) angle of symmetry
    b) complementary angle
    c) angle of rotation
    d) acute angle

13. A line of symmetry is the same as a
    a) axis of symmetry
    b) line of reflection
    c) axis of reflection
    d) all of the above

14. In a dilation, which of the following is true
    a) an object's orientation and position change
    b) an object's size and position change
    c) an object's size changes, but not its orientation or shape
    d) an object's position changes but not its size or orientation

15. All the points x and y that satisfy the equation x = 2y would form a line that might be called the equation's
    a) point of symmetry
    b) line of reflection
    c) line of symmetry
    d) locus

16. What type of isometry creates a mirror image?
    a) reflection
    b) rotation
    c) dilation
    d) compression

1B, 2D, 3A, 4B, 5C, 6A, 7D, 8D, 9C, 10A, 11D, 12C, 13D, 14C, 15D, 16A

Complete the Sentence

1. A square paved with identically shaped concrete blocks is a type of _____.
2. _____exists when corresponding parts are arranged identically on either side of a line or plane.
3. A mirror image is created by a _____.
4. In a reflection on the surface of a lake, it is possible to see a type of symmetry called _____.
5. When a photograph is enlarged, it undergoes a _____.
6. In a _____, something changes its position, size, or orientation.
7. In a _____, a figure is turned around a fixed point.
8. If an image turns 180° and ends up looking just the same as the original, it has a _____.
9. The opposite of horizontal is _____.
10. A figure that is shifted to the left without changing its size, shape, or orientation has undergone a _____.
11. The _____is a measure of the amount of turning.
12. A(n) _____ occurs without a change in size or shape.
13. A reflected object is the same on either side of its _____.
14. A set of points is the _____of a given requirement or equation.
15. The _____ is a fixed point about which an object turns.
16. A bookshelf is oriented in a _____direction.

Answers:

1. Tessellation
2. Symmetry
3. Reflection
4. Mirror symmetry
5. Dilation
6. Transformation
7. Rotation
8. Point of symmetry
9. Vertical
10. Translation
11. Angle of rotation
12. Isometry
13. Line of symmetry
14. Locus
15. Center of rotation
16. Horizontal

Creative Writing

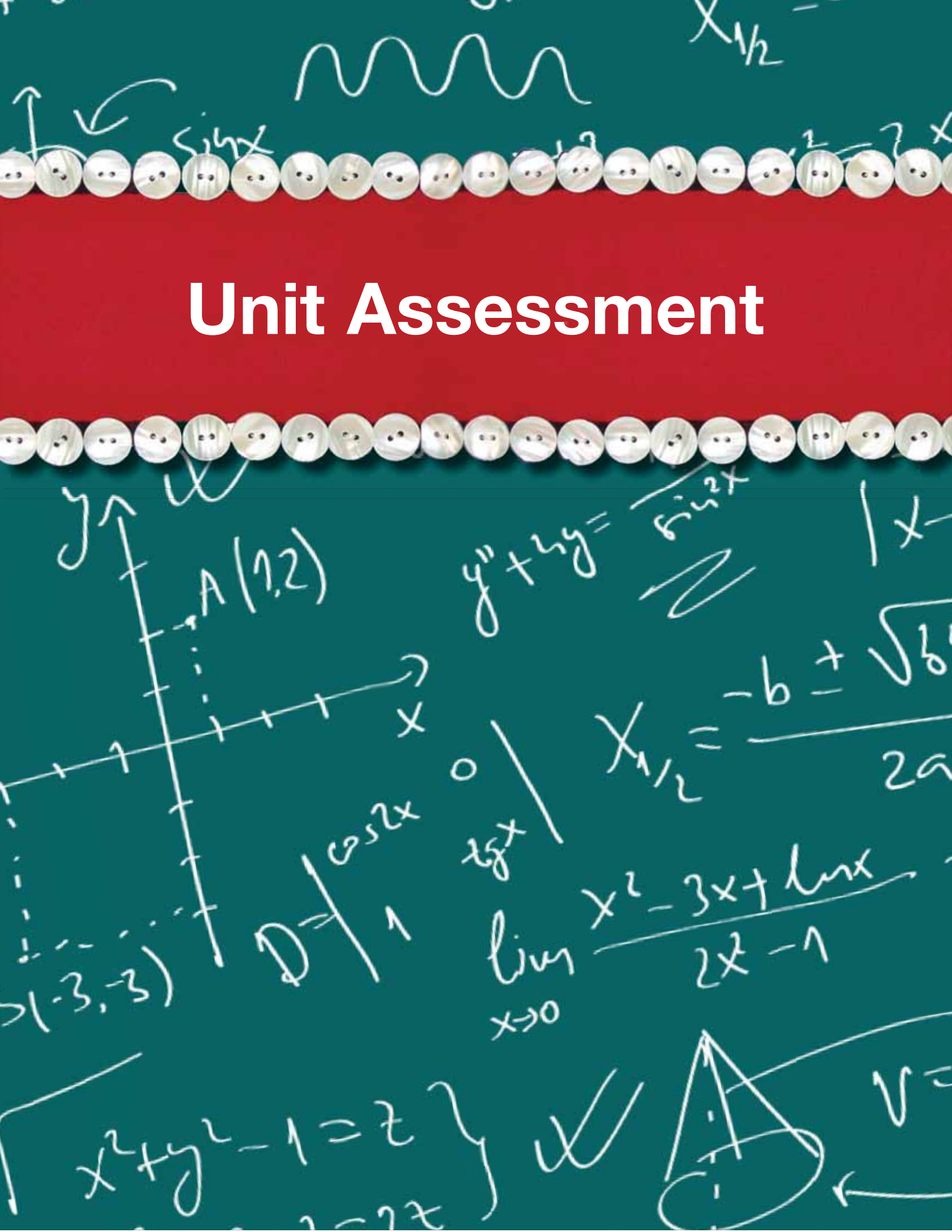
Write about the images below using as many vocabulary words from the unit as possible. You may draw lines and label the images as needed.

Place-Based Practice Activity

1. Identify examples of terms from the unit used in Native carvings, baskets, weavings, drawings and paintings:
    a) take a field trip to a museum
    b) provide pictures for students to work with in small groups
    c) have students find examples on the internet or in the community.

2. Invite a local artist to talk about the way that they use symmetry in their work.

3. Ask students in small groups to illustrate each of the terms using objects they can find around them. They can demonstrate their examples orally or by using photography.


Unit Assessment

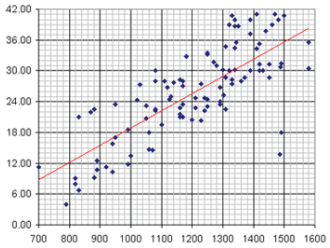
Geometry: Unit 12-Transformations

Name: _____
Date: _____

Illustrations: Look at each illustration below and write the write for the illustration on the line provided. You can choose the labels form the words in the Word Bank.

Word Bank		
horizontal	isometry	locus
reflection	rotation	scatter plot
tessellation	vertical	

1) Label the illustration below:



_____

2) Label the illustration below:

_____

3) Label the illustration below:

_____

4) Label the illustration below:

_____ _____

5) Label the illustration below:

_____ _____

Multiple Choice: For each item below you see an illustrations and four choices for identifying the correct key vocabulary that matches that definition. Circle the correct answer.

6) Choose the word below that matches the illustration.

a) mirror symmetry

b) line of symmetry

c) point of symmetry

d) symmetry

7) Choose the word below that matches the illustration.

a) mirror symmetry

b) line of symmetry

c) point of symmetry

d) symmetry

8) Choose the word below that matches the illustration.

a) mirror symmetry

b) line of symmetry

c) point of symmetry

d) symmetry

9) Choose the word below that matches the illustration.

a) mirror symmetry

b) line of symmetry

c) point of symmetry

d) symmetry

Fill in the Blank: Complete the following three sentences with the word that fits best. Choose your word from the Word Bank above.

10) A _____ is a set of all the points, lines, or surfaces that satisfies a given requirement.

11) _____ is a transformation in which the distance between any two points of a figure does not change

12) A _____ is the use of identically shaped pieces which do not overlap to cover a plane.

Matching: Match the key vocabulary word on the left with the definition that fits on the right. Place the letter from the definition in front of the matching word.

13) _____ translation

14) _____ angle of rotation

15) _____ center of rotation

16) _____ dilation

17) _____ rotation

a. a stretch or an expansion; a transformation in which a figure grows larger while keeping its shape

b. the point that does not move when the figure is rotated

c. a transformation in which a figure is 201Cpicked up201D and moved to another location, without any change in its size or orientation

d. a transformation in which a plane figure turns around a fixed center point

e. a measure of how far a figure has turned around its center of rotation

18) There can be blank spaces on a tessellation.

a) True

b) False

19) The locus of points that are all the same distance from a given point would be a circle.

a) True

b) False

20) Symmetry is found commonly in nature, in plants, animals, and rock crystals and is very important in Native art forms.

a) True

b) False

Geometry: Unit 12-Transformations

Name: _____
Date: _____

Illustrations: Look at each illustration below and write the write for the illustration on the line provided. You can choose the labels form the words in the Word Bank.

Word Bank		
horizontal	isometry	locus
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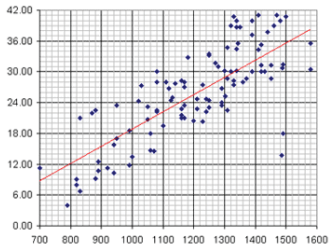

scatter plot_____

2) Label the illustration below:

vertical _____

3) Label the illustration below:

rotation_____

4) Label the illustration below:

reflection _____

5) Label the illustration below:

horizontal _____

Multiple Choice: For each item below you see an illustrations and four choices for identifying the correct key vocabulary that matches that definition. Circle the correct answer.

6) Choose the word below that matches the illustration.

a) mirror symmetry

b) line of symmetry

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9) Choose the word below that matches the illustration.

a) mirror symmetry

b) line of symmetry

c) point of symmetry

d) symmetry

Fill in the Blank: Complete the following three sentences with the word that fits best. Choose your word from the Word Bank above.

10) A **locus** is a set of all the points, lines, or surfaces that satisfies a given requirement.

11) **isometry** is a transformation in which the distance between any two points of a figure does not change

12) A **tessellation** is the use of identically shaped pieces which do not overlap to cover a plane.

Matching: Match the key vocabulary word on the left with the definition that fits on the right. Place the letter from the definition in front of the matching word.

13) **c** translation

14) **e** angle of rotation

15) **b** center of rotation

16) **a** dilation

17) **d** rotation

a. a stretch or an expansion; a transformation in which a figure grows larger while keeping its shape

b. the point that does not move when the figure is rotated

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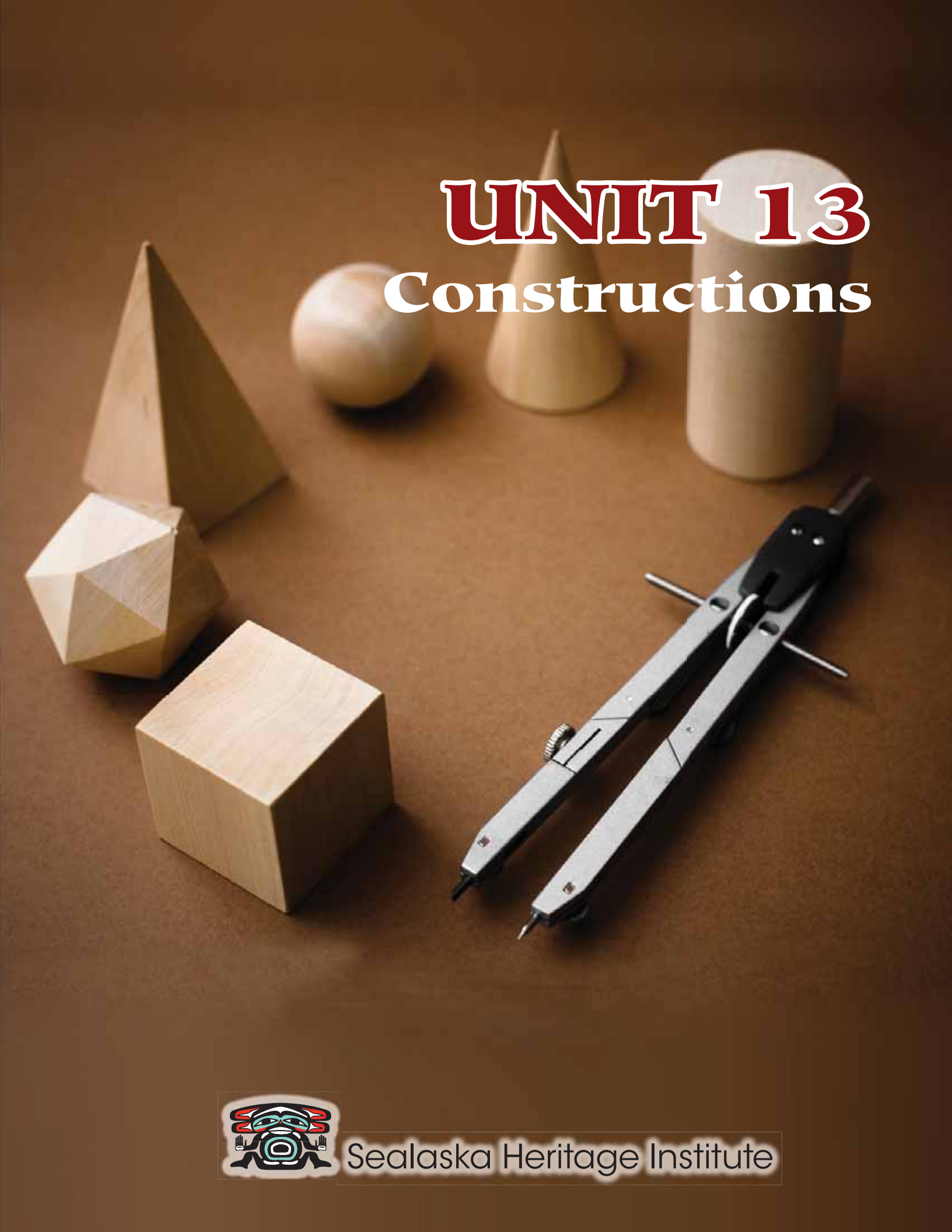
b) False

UNIT 13
Constructions



Sealaska Heritage Institute

Grade Level Expectations for Unit 13

Unit 13—Constructions

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-2 using isometric drawings to create 2-dimensional drawings of 3- dimensional objects (shapes that are composites of rectangular right prisms) (L)

The student demonstrates conceptual understanding of similarity, congruence, symmetry, or transformations of shapes by

[10] G-3 identifying congruent and similar figures using Euclidean geometry (e.g., [constructions L], coordinate geometry) (M5.4.3)

The student demonstrates a conceptual understanding of geometric drawings or constructions by

[9] G-6 drawing, measuring, or constructing geometric models of plane figures (containing parallel and/or perpendicular lines) (L) (M5.4.6)

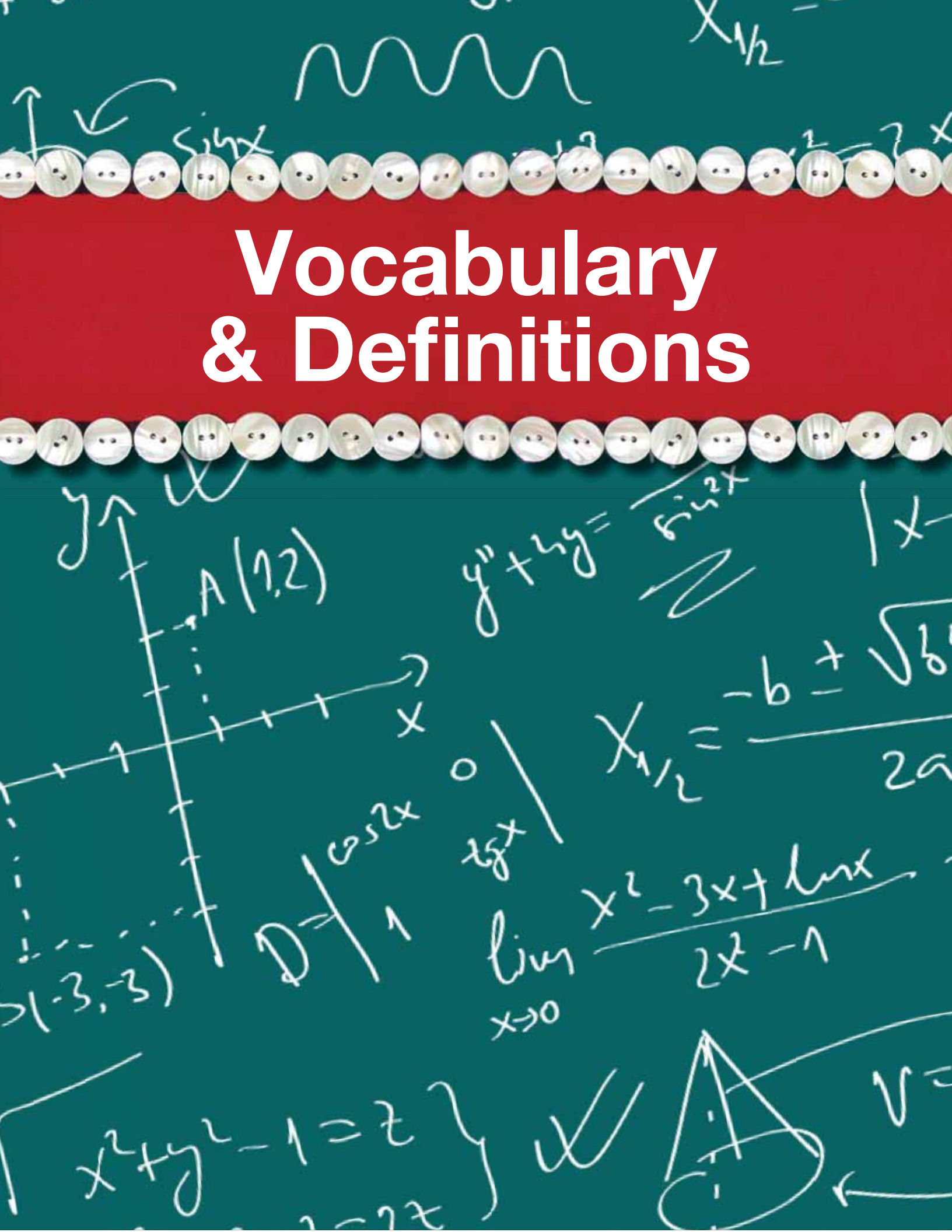
The student demonstrates a conceptual understanding of geometric drawings or constructions by

[10] G-8 drawing, measuring, or constructing geometric models of plane figures (containing parallel and/or perpendicular lines, angles, perpendicular bisectors, congruent angles, regular polygons) (L) (M5.4.6)

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 (M8.4.1, M8.4.2, & M8.4.3)

[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 (M8.4.1, M8.4.2, & M8.4.3)


Vocabulary
& Definitions

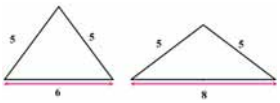
Introduction of Math Vocabulary

Geometric construction

Geometric construction is a precise way of drawing which allows only two tools: a straightedge and a compass. In a way, making a construction is like a game or a challenge. Since the Golden Age of Greece, people have tried to discover what they could or could not construct.

Sketch

A sketch is a drawing that is made by hand or with any tools available. A sketch does not include great detail. If you don't follow the precise rules for constructions, you might be making a sketch.



Compass

We often think of a compass as an instrument that helps us to find our direction. Actually the word compass comes from an old word meaning to go around, to measure, or to divide equally. Since 1387, the word compass has been used in geometry to mean a drawing tool used to draw circles with different radii or to copy distances. A compass has two legs that come together at a movable joint: one leg has a pencil or other marker and the other has a sharp point that is used as a pivot.

Introduction of Math Vocabulary

Straightedge

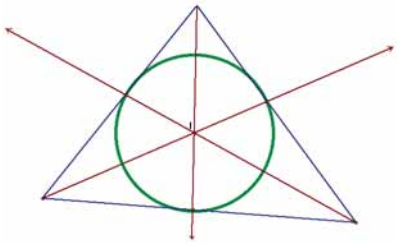
A straightedge is just what it sounds like. It is an unmarked tool used to draw straight lines. A straightedge is one of the two tools that may be used in constructions. A ruler may be used as a straightedge, but the use of the ruler's markings is not allowed. Discuss with students the other tools they might use as straightedges.

Protractor

A protractor is a tool used to measure angles. It usually has an arc that is marked at regular intervals.

Incenter

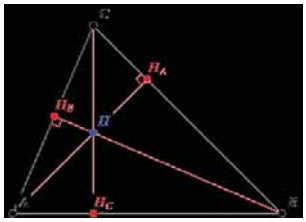
An incenter is the center of a polygon's inscribed circle. The angle bisectors of a triangle meet at the triangle's incenter.



Introduction of Math Vocabulary

Orthocenter

An orthocenter is the point at which the three altitudes of a triangle intersect.

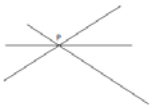


Concurrent lines

Concurrent lines are three or more lines that meet at a single point. This bathroom tile pattern has many sets of concurrent lines.

Point of concurrency

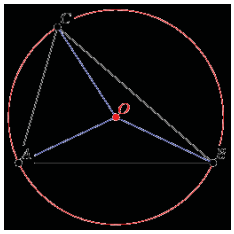
The point of concurrency is the point of intersection for concurrent lines.



Introduction of Math Vocabulary

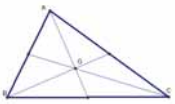
Circumcenter

The circumcenter is the center of a circle that is circumscribed about a plane figure. The perpendicular bisectors of the sides of a triangle meet at the circumcenter.



Centroid

The centroid of a triangle is the point at which its three medians intersect.



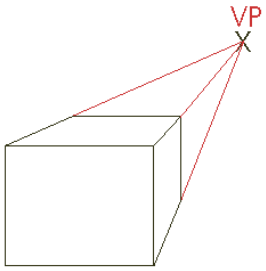
Orthographic view

How would you draw a cube if you were looking at it from the top? An orthographic view of a three-dimensional object is a view that represents the exact shape of an object as it would be seen from one side at a time. For an orthographic view, your line of sight would be perpendicular to the object. From each of its six sides, the orthographic view of a cube looks like a square. An orthographic view looks two-dimensional.

Introduction of Math Vocabulary

Perspective view

When you look at a straight road going off into the distance, the sides of the road appear to converge, or to get closer together. A perspective view shows objects in three dimensions as they are perceived by the eye. On a perspective view of a cube, the sides appear to get closer together as they get farther away from your eye.

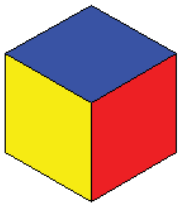


Vanishing point

In a perspective view, the vanishing point is the point at which parallel lines appear to meet in the distance. This picture of a railroad track represents a vanishing point.

Isometric view

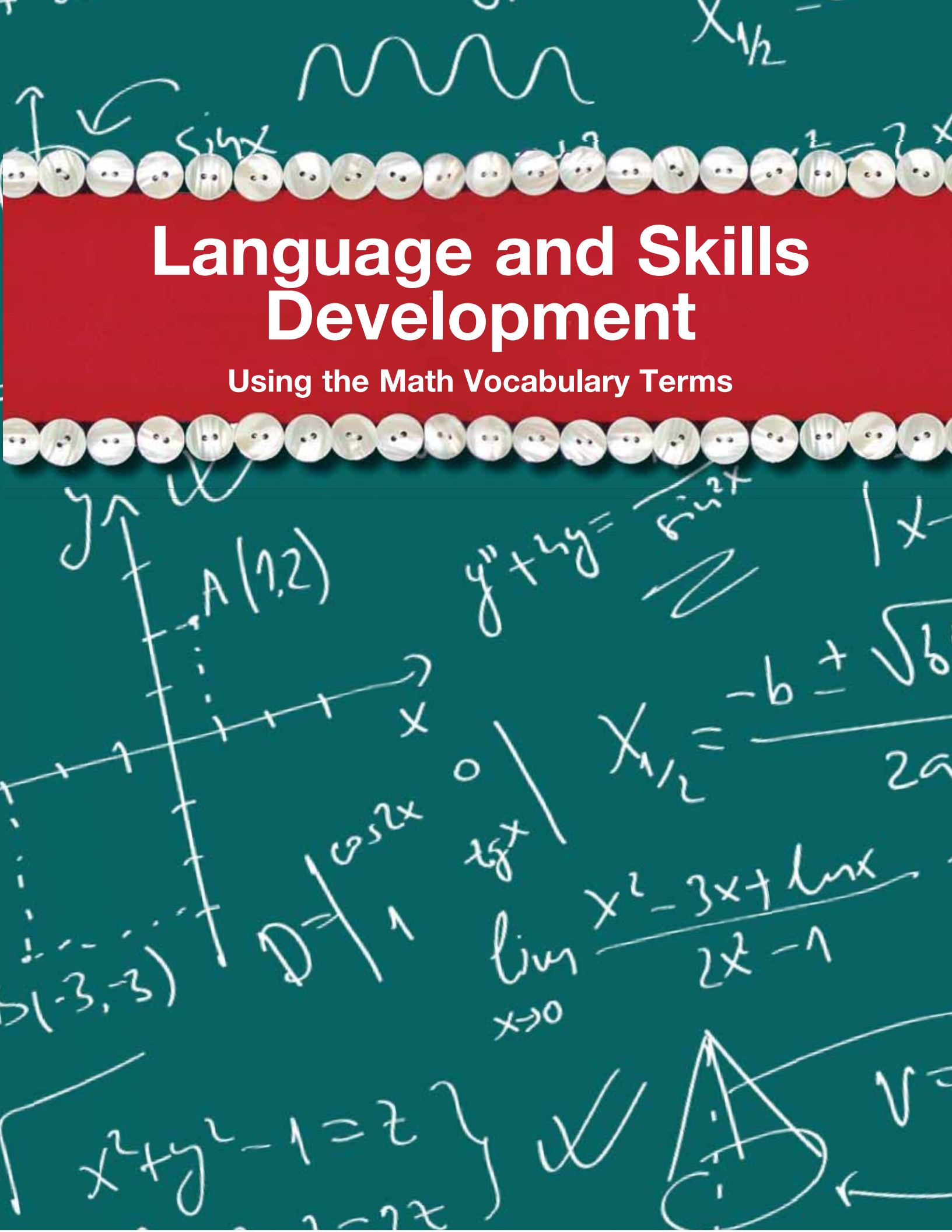
In an isometric view, the height, width, and depth of an object are shown. Unlike in perspective views, in isometric views all the lines on each axis are parallel to each other, and the lines do not converge. Isometric views are sometimes drawn by computer programs or by hand using special isometric dot paper. This image shows an isometric view of a cube.



Introduction of Math Vocabulary

Scale factor

A scale factor is used to show how the sizes of similar plane figures or solids compare. It is the ratio of any two corresponding lengths in two similar geometric figures. A simple example uses two squares: one with a side 3 cm long and one with a side 6 cm long. The scale factor would be 2, since one has a side twice as long as the other one has. One use of scale factors is to make scale models of cars or other objects.



Language and Skills Development

Using the Math Vocabulary Terms

Language & Skills Development

LISTENING

Use the activity pages from the Student Support Materials.

Locomotive

Have the students stand in a straight line in the center of the room. Each student should place his hands on the shoulders of the student in front of him/her. Mount an illustration on each of the four walls in the classroom. Tell the students that when they hear one of the four vocabulary words (for the four illustrations on the walls), they should step in that direction - while still holding onto the shoulders of the players in front of them. Say the four words a number of times; the students should step towards the illustrations as they are named.

SPEAKING

Batch Match

Make a photocopy of each of the vocabulary illustrations. Group the students in a circle. Cut each of the photocopied illustrations in half. Mount an illustration half on each student's back. Do not let the students see which halves you are attaching to their backs. When you say "Go," the students should attempt to match themselves together according to the illustration halves. When the students have done this correctly, have the students in each pair say a sentence about the illustration represented by their halves (a different sentence from each student). Continue until each student has responded with a sentence of his own.

READING

Use the activity pages from the Student Support Materials.

Mixed-up Sentences

Before the activity begins, prepare a number of "mixed-up sentences," relating to the concept being studied and using the sight words. Write the mixed-up sentences on the chalkboard. Call upon individual students to read the sentences, saying the words of the sentences in their correct order. An alternative approach to the one above is to have the mixed-up sentences written on sentence strips. Group the students into two teams. Show the first player in each team one of the mixed-up sentences. The first player to correctly read the sentence with the words in their correct order, wins the round. Repeat until all players have participated. Rather than having the players merely read the mixed-up sentences, you may wish to lay the sentence strips on the floor at the front of the classroom. Place two pairs of scissors beside the sentence strips. When you say "Go," the first player in each team must rush to the scissors, select one of the sentence strips and cut each word out. Then, the player must rearrange the words to create the sentence. Repeat until all players have played. Of course, this activity can also be done as an activity sheet with the students.

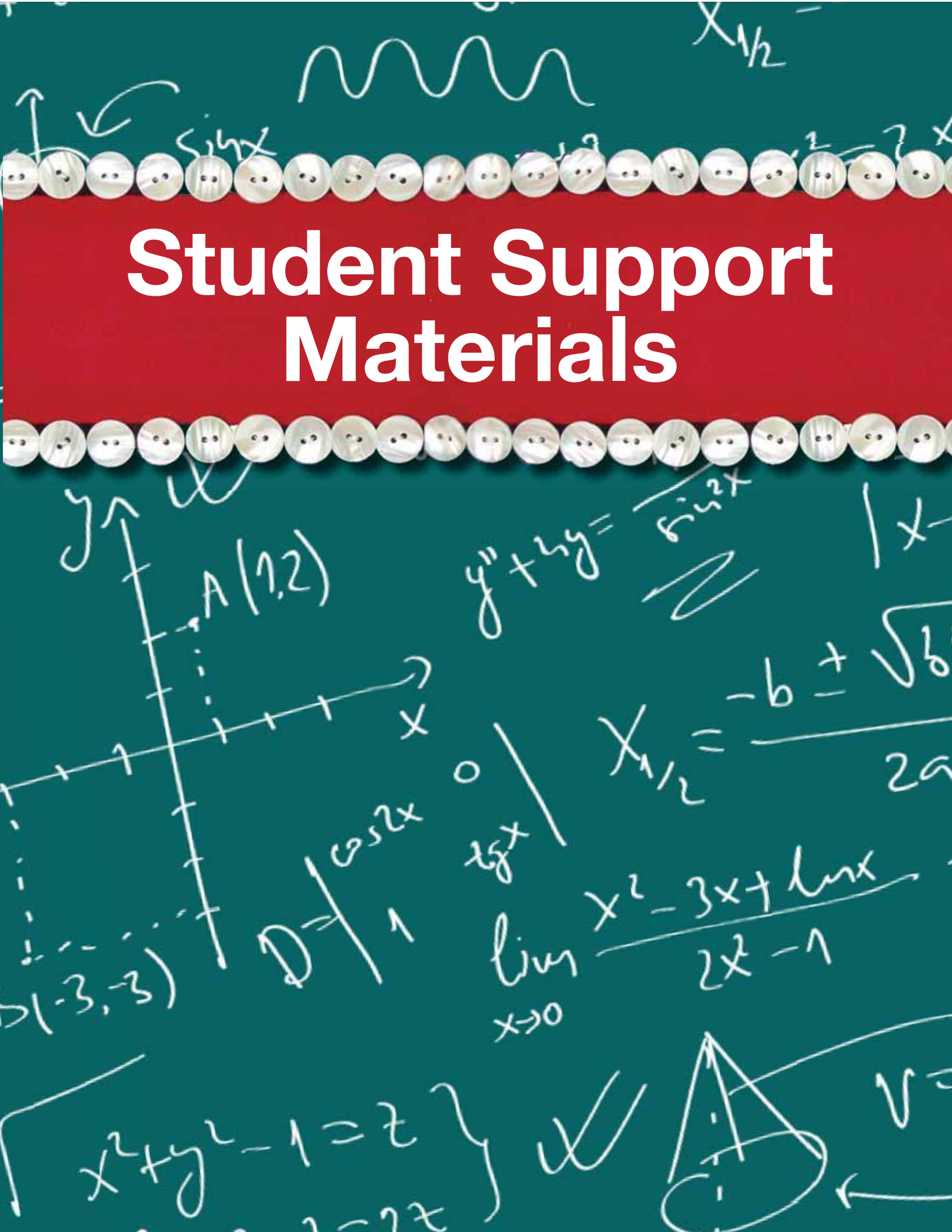
WRITING

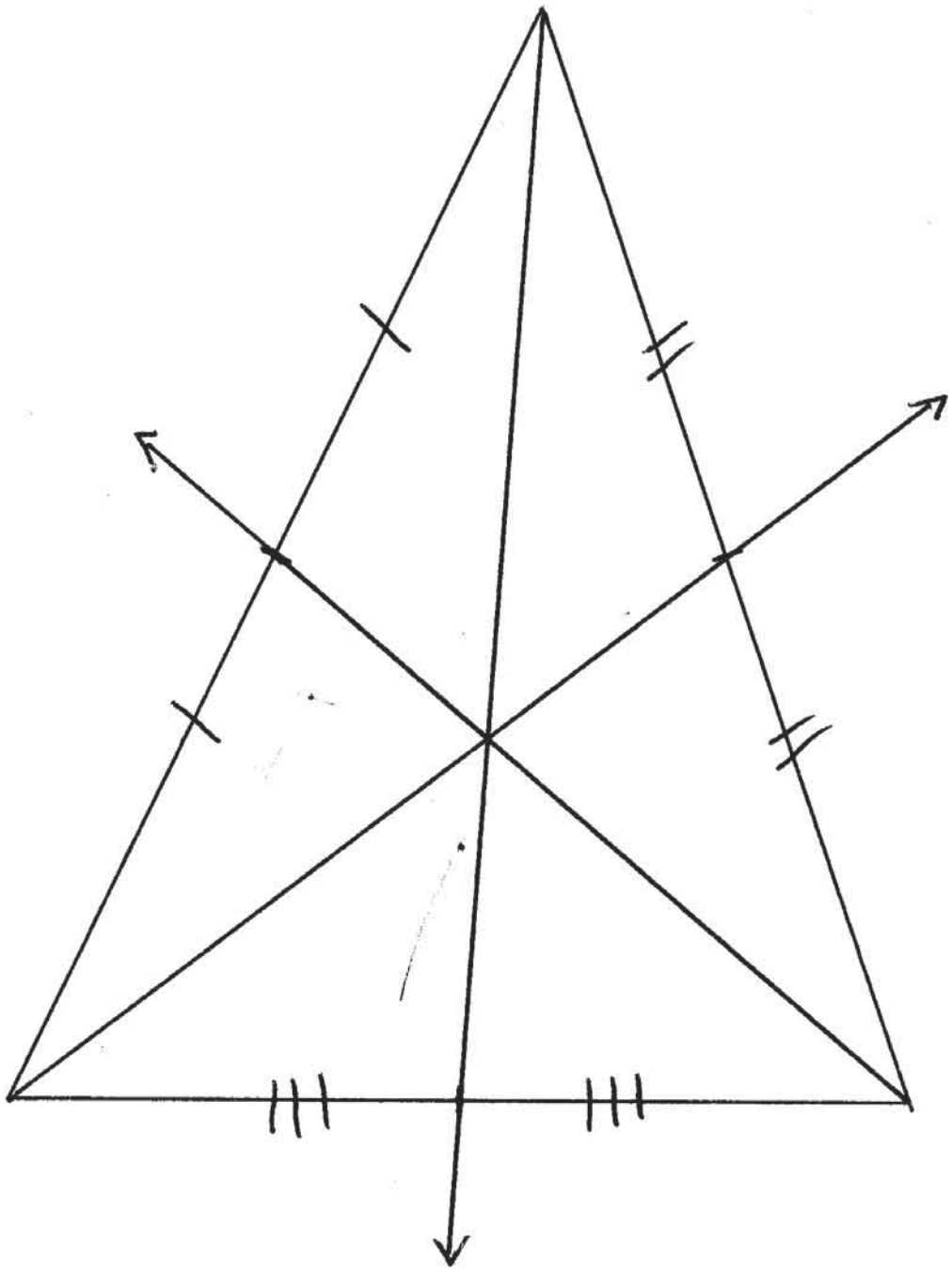
Use the activity pages from the Student Support Materials.

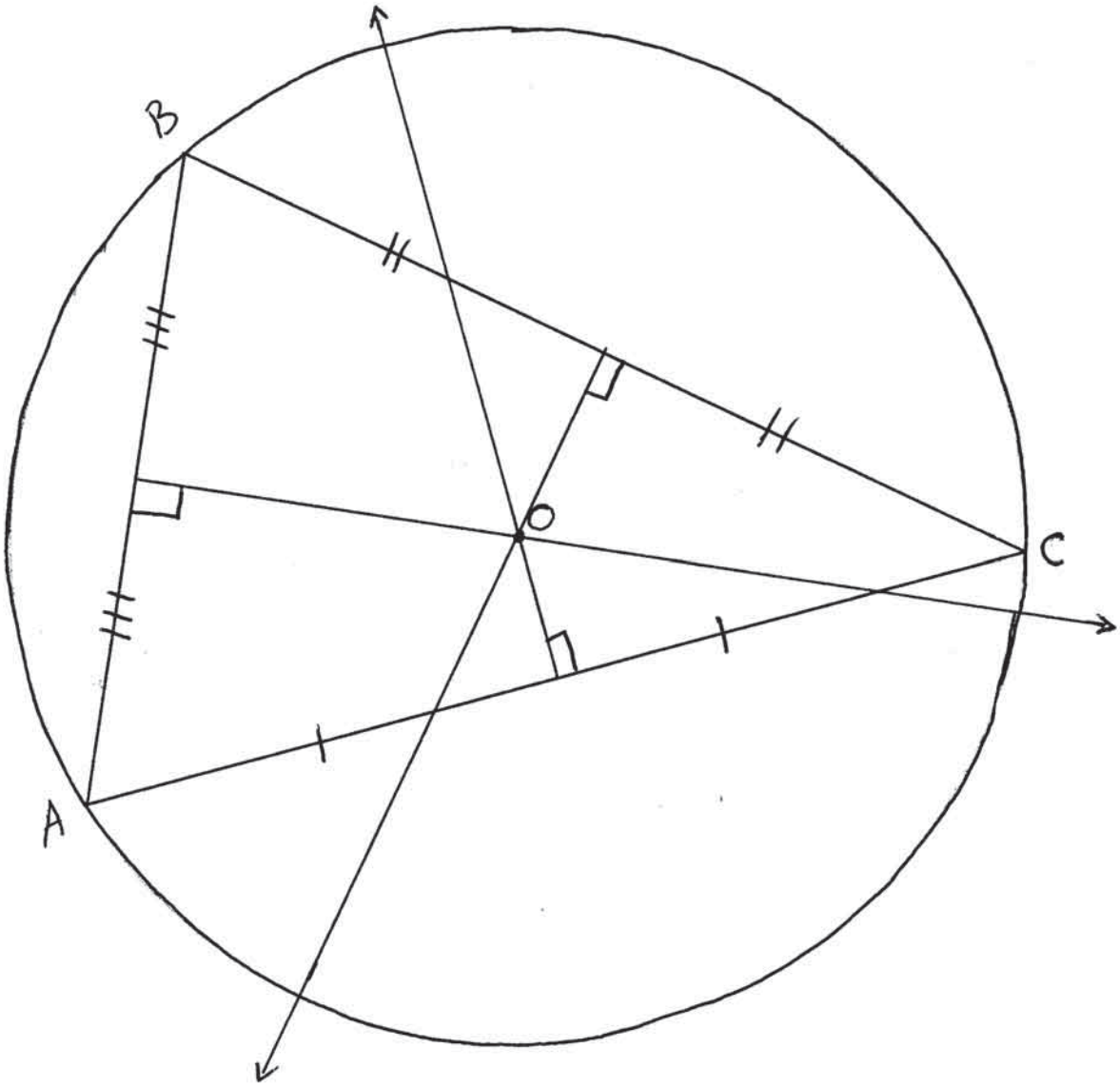
Sentence Completion

Write a number of sentence halves on individual sentence strips. These should include both the beginning and ending halves of sentences. Mount the sentence halves on the chalkboard and number each one. Provide the students with writing paper and pencils/pens. Each student should then complete ONE of the sentence halves in his/her own words, writing his/her part of the sentence on the sheet of paper. When the students have completed their sentence halves, have a student read ONLY the sentence half he/she wrote. The other students must then attempt to identify the "other half" of the sentence on the chalkboard (by its number). Repeat until all of the students have shared their sentence halves in this way.

Student Support Materials

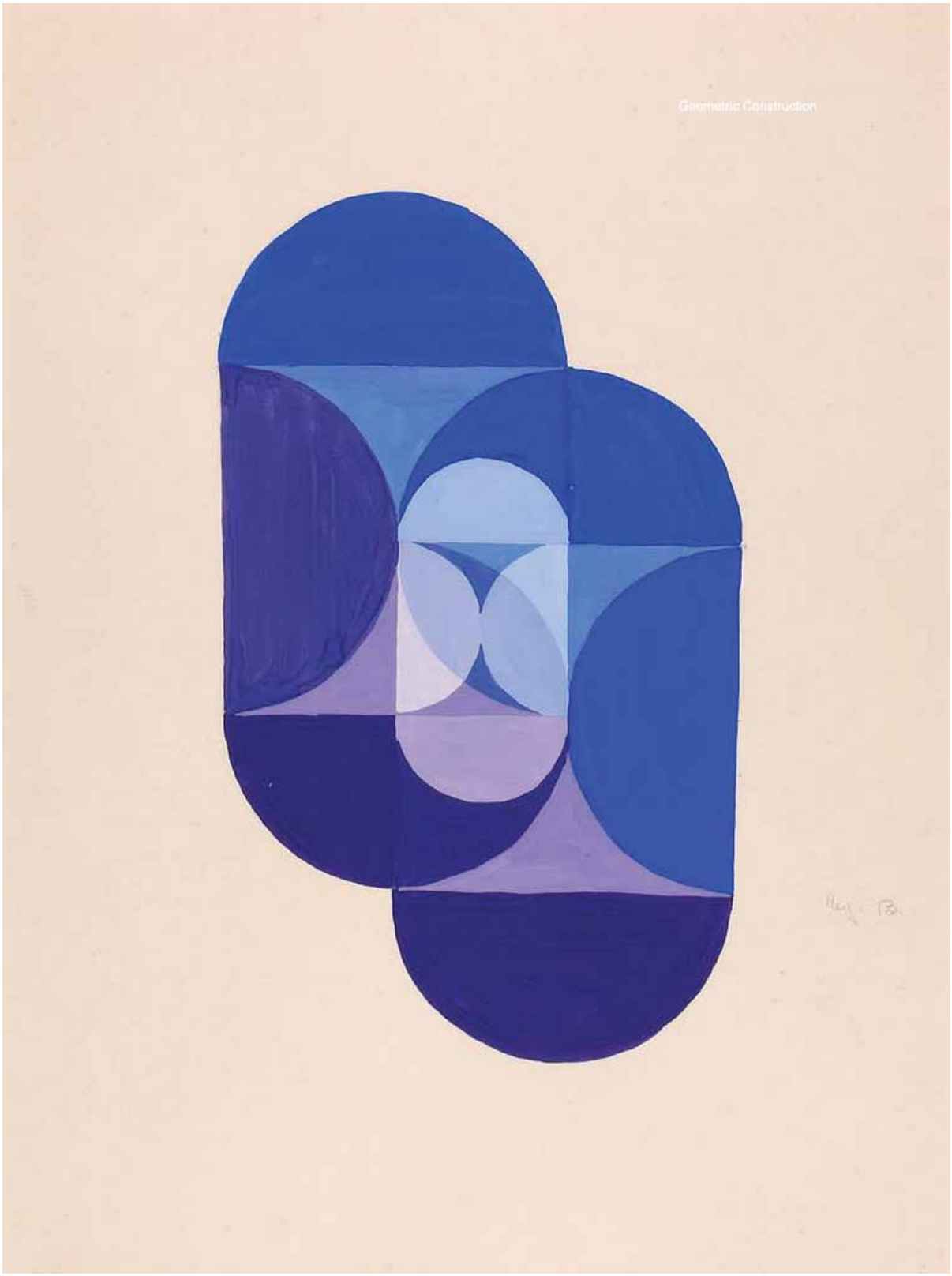




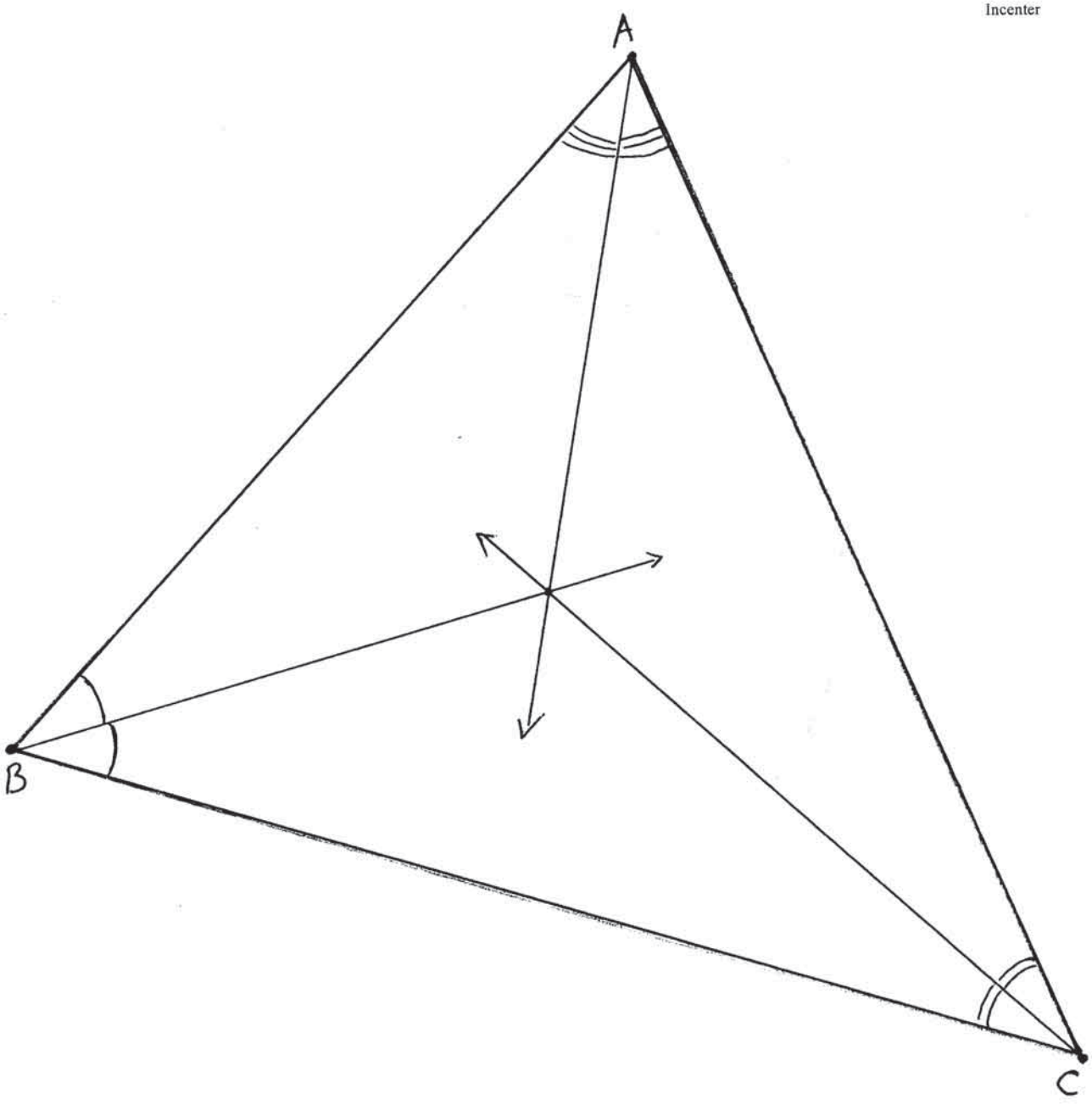

B
O
C
A


Compass

Concurrent Lines

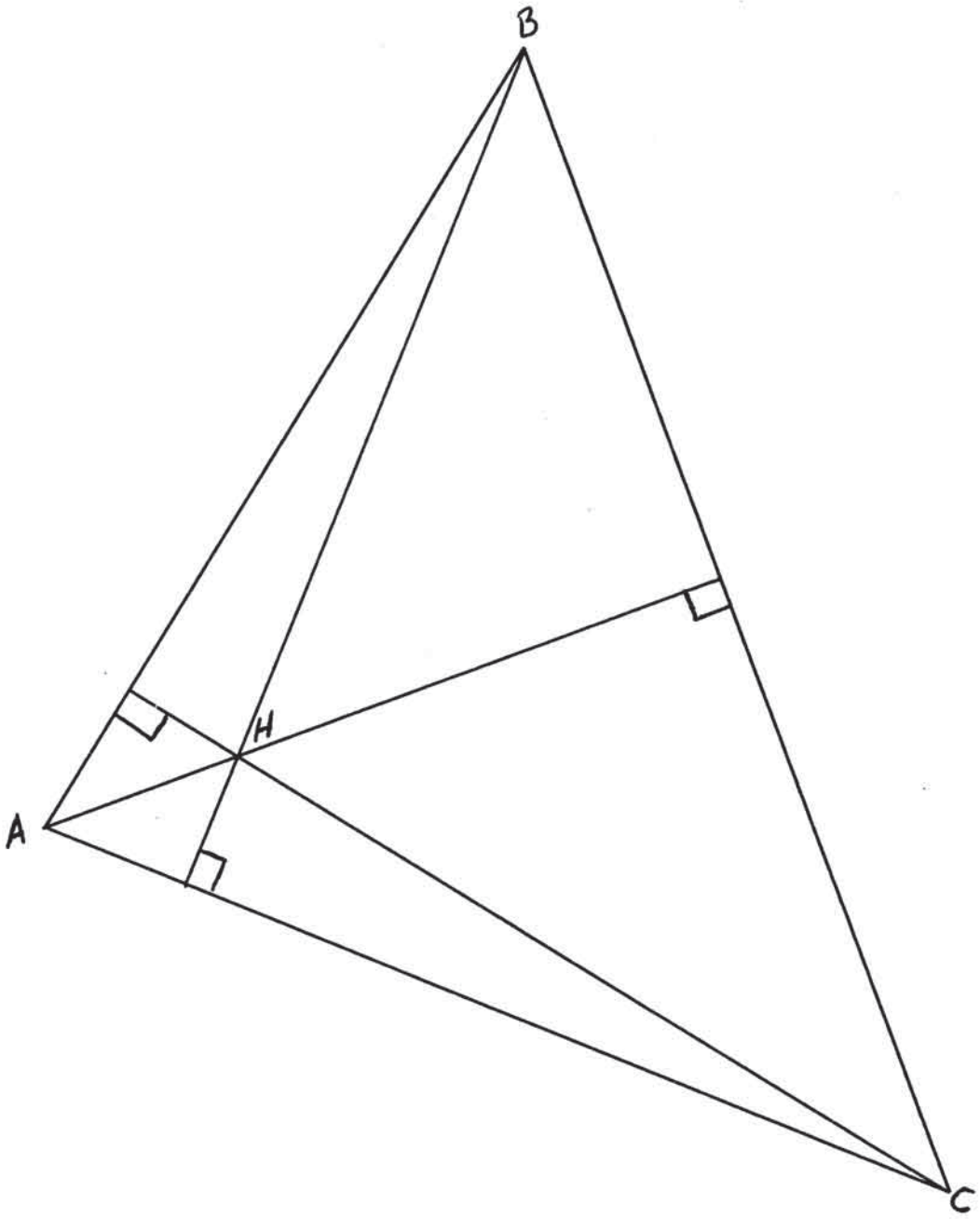

Geometric Construction

Incenter



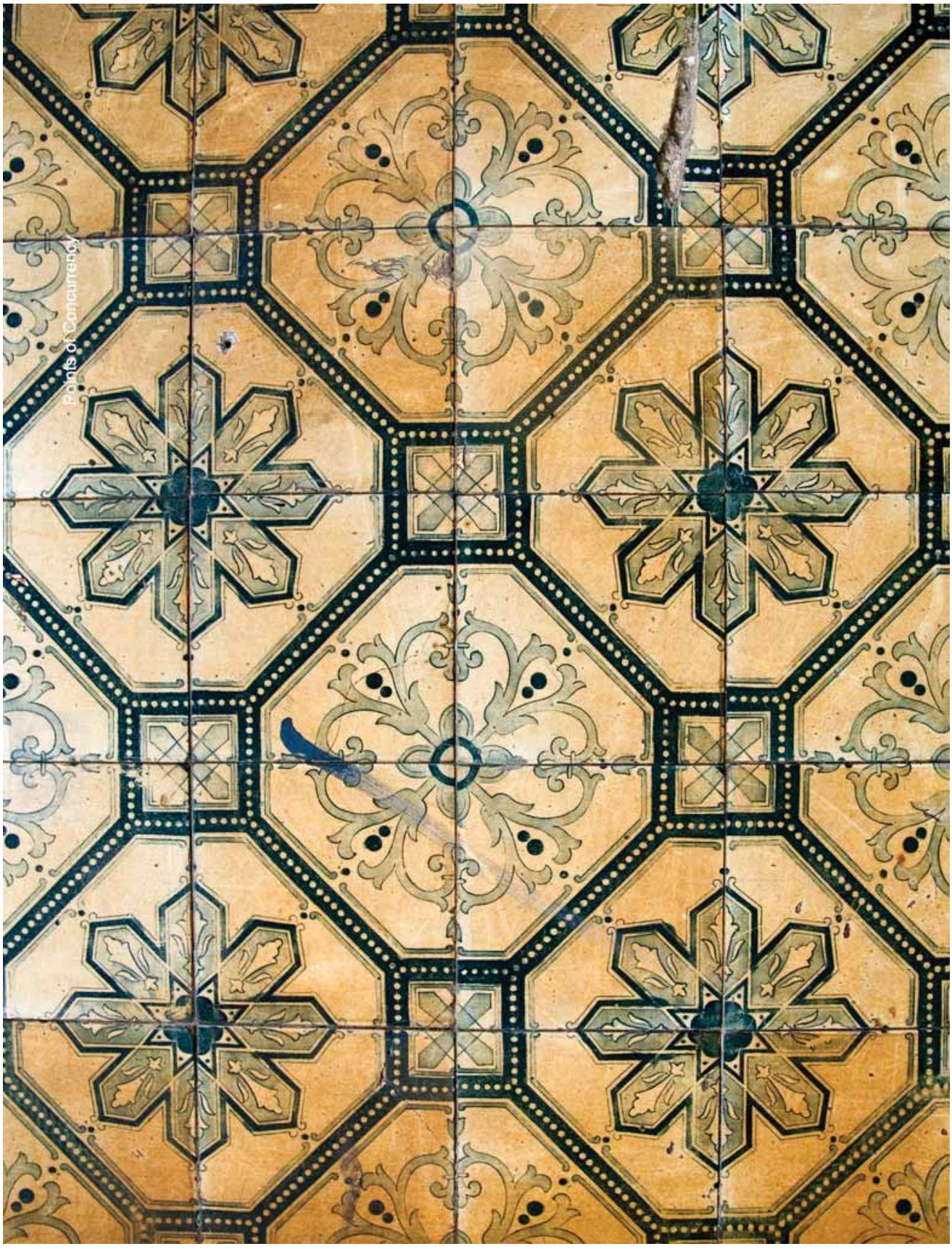

Isometric View

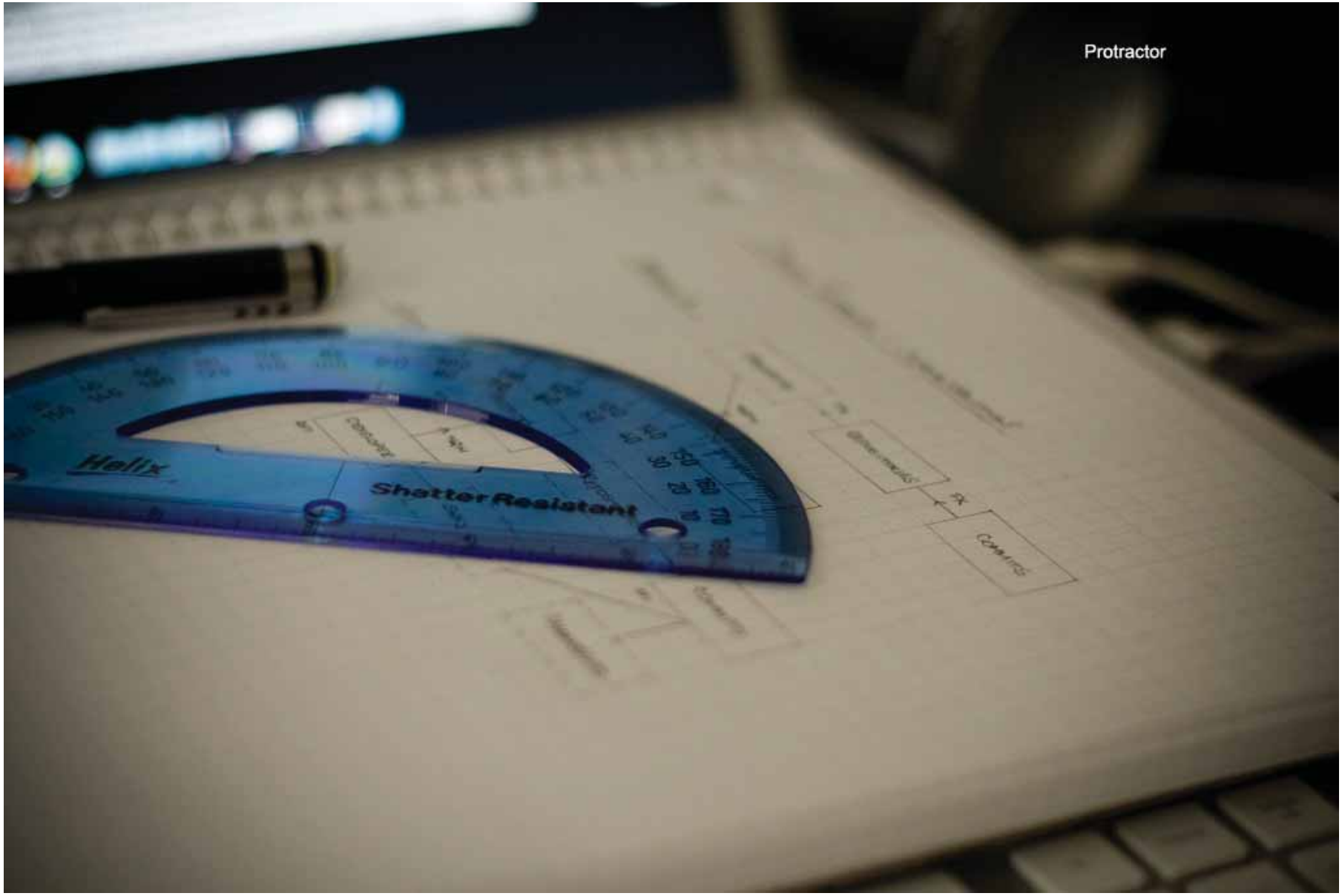
Orthocenter



Orthographic View

Perspective View

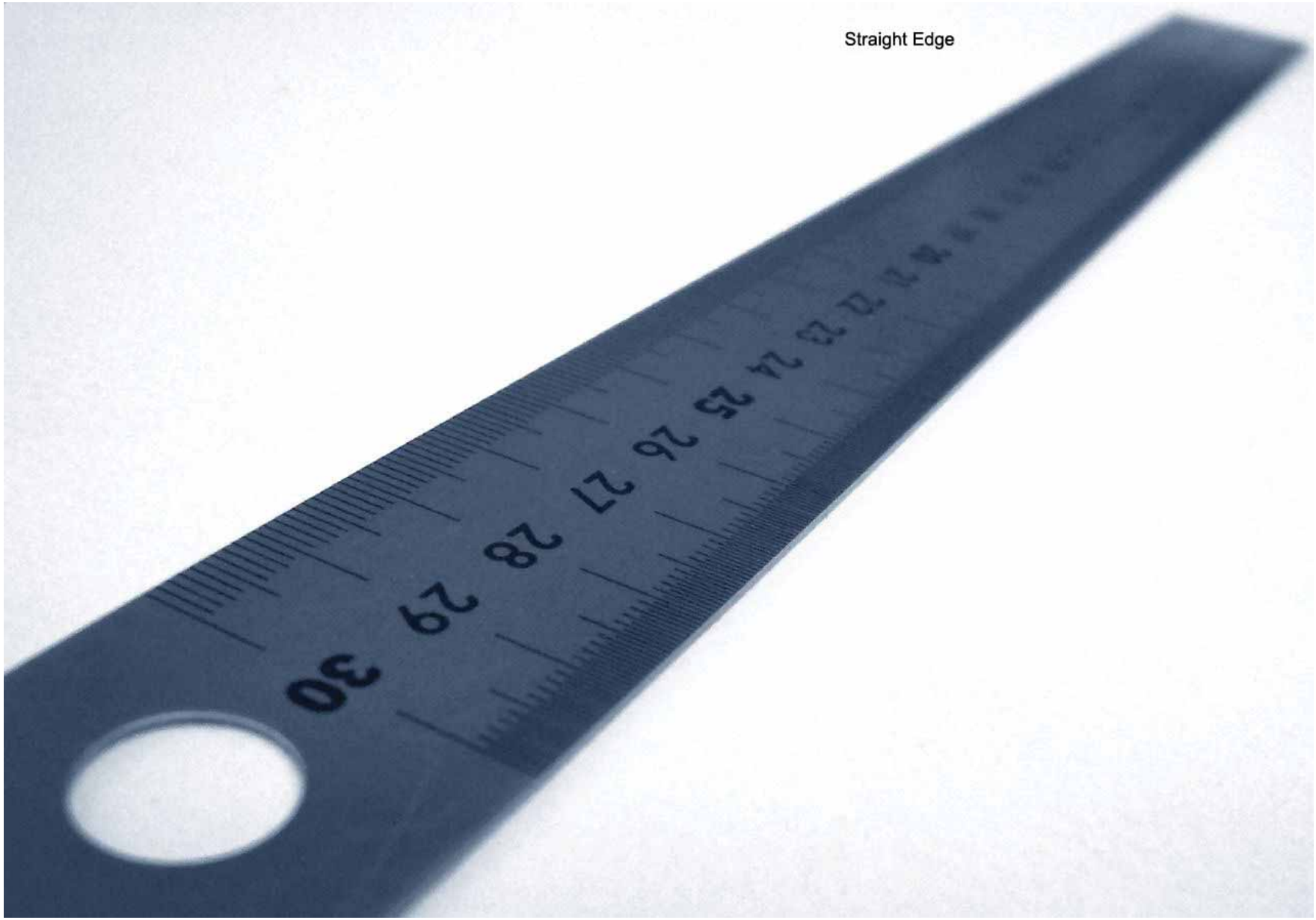

Points of Concurrency



Protractor


Scale Factor


16.01.06
KING COBRA


Straight Edge
30
29
28
27
26
25
24


Vanishing Point

True-False Sentences

(Listening and/or Reading Comprehension)

1. In geometric construction, figures are drawn using a compass and a straightedge.
2. A sketch might be drawn by a computer program.
3. In constructions, a compass is used to make straight lines.
4. A ruler may be used as a straightedge, but the markings on it may not be used for constructions.
5. Most protractors can only measure angles up to 90 degrees.
6. The point of a compass is always placed on an incenter.
7. Three altitudes of a triangle intersect at an orthocenter.
8. The three hands of a clock might represent concurrent lines.
9. Some concurrent lines have no point of concurrency.
10. A circle that is circumscribed around a triangle has a circumcenter.
11. A centroid is a point where any three lines meet.
12. An orthographic view does not show depth.
13. A perspective view is the same as a “bird’s-eye” view.
14. A drawing with a vanishing point is invisible.
15. In an isometric view, all of the lines on the x-axis are parallel.
16. The mass of a solid object is indicated by its scale factor.

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

1. It is permissible to use a protractor to draw angles in geometric constructions.
2. Normally, great detail is shown in a sketch.
3. A compass can be used to make a circle with a radius equal to a given segment.
4. Only specially-purchased tools may be used as straightedges.
5. A protractor might be used to measure angles of slope for a science project.
6. The center of a circle that is inscribed in a pentagon would be an incenter.
7. An orthocenter is the center of a circle inscribed in an orthogon.
8. Concurrent lines might have more than one point in common.
9. A point of concurrency is an intersection of three or more lines.
10. A circumcenter is the center of any circle.
11. Three medians of a triangle intersect at its centroid.
12. A three dimensional object has only one orthographic view.
13. A perspective view represents the way that an object is viewed by the eye.
14. In a perspective view, lines appear to come together at a vanishing point.
15. An isometric view does not show the depth of an object.
16. A scale factor gives the relationship between two corresponding lengths on similar figures.

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

Match the Halves

1. The edge of a protractor	A. a triangle's medians.
2. An incenter is the center of	B. a perspective view.
3. The intersection of three or more lines	C. of similar figures.
4. A centroid is the intersection of	D. an inscribed circle.
5. An arc with graduated markings	E. a triangle's altitudes.
6. An aerial photograph shows	F. intersect at one point.
7. A vanishing point is associated with	G. an orthographic view.
8. Geometric construction	H. circumscribed circle.
9. An orthocenter is the intersection of	I. an isometric view.
10. A scale factor shows the size relationship	J. might be used as a straightedge.
11. A protractor	K. lines appear to converge.
12. A 3-D view in which the lines don't come together is	L. includes a pencil or other marker.
13. Concurrent lines	M. is the point of concurrency.
14. In a perspective view	N. has precise rules.
15. A circumcenter is the center of a	O. might be used to make a sketch.
16. A compass used in constructions	P. is found on a protractor.

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

Definitions

Geometric construction - a precise way of drawing which allows only two tools: the straightedge and the compass

Sketch - a drawing that is made by hand or with any tools, and that does not include great detail.

Compass - a hinged drawing tool used to draw circles.

Straightedge - an unmarked tool used to draw straight lines.

Protractor - a tool used to measure angles.

Incenter - the center of a polygon's inscribed circle.

Orthocenter - the point at which three altitudes of a triangle intersect.

Concurrent lines - three or more lines that intersect in a single point.

Point of concurrency - the point of intersection for concurrent lines

Circumcenter - the center of a circle that is circumscribed about a plane figure.

Centroid - the point at which three medians of a triangle intersect.

Orthographic view - a view that represents the exact shape of an object seen from one side at a time as you are looking straight at it.

Perspective view - the view that shows a three-dimensional image as it is perceived by the eye.

Vanishing point - the point at which parallel lines appear to meet in the distance.

Isometric view - a three-dimensional view that shows the height, width, and depth of an object, with all the lines on each axis parallel to each other.

Scale factor - the ratio of the lengths of any two corresponding parts in two similar geometric figures.

Which Belongs

1. Altitudes of a triangle are (concurrent, orthocenter, vertical) line segments.
2. The (circumcenter, centroid, incenter) is part of an inscribed circle.
3. A(n) (orthographic, perspective, isometric) view has lines that appear to converge at a point in the distance.
4. The altitude of a triangle passes through the triangle's (centroid, incenter, orthocenter).
5. A (geometric construction, diagram, sketch) is made by following precise rules.
6. In making a construction, a (protractor, compass, straightedge) is used for making circles and arcs, and for copying segments.
7. A three- dimensional view of a house shows its length, width, and height, and is made up of parallel lines. It is a(n) (perspective, isometric, orthographic) view.
8. A (vanishing point, orthocenter, centroid) is <u>not</u> associated with a triangle.
9. One type of tool used in constructions is a (straightedge, protractor, computer program).
10. A (circumcenter, vanishing point, point of concurrency) is the intersection of three or more lines.
11. The center of a circle circumscribed about a triangle is the (incenter, centroid, circumcenter).
12. A (circumcenter, centroid, orthocenter) is the point of concurrency for medians.
13. Angles might be measured using a (protractor, compass, straightedge).
14. A(n) (perspective, orthographic, isometric) view of a three-dimensional object might look two-dimensional.
15. A (perspective view, geometric construction, scale factor) is used to show how the sizes of similar figures compare.
16. When Jim used his protractor to draw an angle, he was making a (construction, sketch, vanishing point).

1. Concurrent
2. Incenter
3. Perspective view
4. Orthocenter
5. Geometric construction
6. Compass
7. Isometric view
8. Vanishing point
9. Straightedge
10. Point of concurrency
11. Circumcenter
12. Centroid
13. Protractor
14. Orthographic view
15. Scale factor
16. Sketch

Multiple Choice

1. A sketch might be a
    a) freehand drawing
    b) drawing made using the markings on a ruler
    c) either of the above
    d) neither or the above

2. On which view of a cabin would you see only one side of the cabin?
    a) a perspective view
    b) an isometric view
    c) a photographic view
    d) an orthographic view

3. Which of the following is true about a vanishing point?
    a) it is the same as a vertex
    b) it is the point at which lines appear to converge in the distance
    c) it is the point at which something is so far away that you can no longer see it
    d) it can be found on an orthographic view.

4. Which of the following is <u>not</u> part of a compass?
    a) a sharp point
    b) equally-spaced markings
    c) a moving joint
    d) a pencil or marking device

5. The point of concurrency for altitudes of a triangle is called the
    a) orthocenter
    b) circumcenter
    c) incenter
    d) centroid

6. Which of the following is true of concurrent lines?
    a) they intersect
    b) they have a point of concurrency
    c) they are noncollinear
    d) all of the above

7. Which of the following is permissible in geometric constructions?
    a) the use of measuring tools such as rulers
    b) the use of a computer program
    c) the use of a compass and a straightedge
    d) the use of a compass, a straightedge, and a protractor

8. Which of the following describes the use of a protractor?
    a) it is used to measure angles
    b) it is used to draw circles
    c) neither of the above
    d) both of the above

9. If the scale factor for two squares is three, then
    a) the squares are concurrent
    b) three sides of each square are congruent
    c) the squares intersect at three points
    d) the side of one square is three times as long as the side of the other

10. Centroids, circumcenters, incenters, and orthocenters are all types of
    a) triangles
    b) altitudes
    c) points of concurrency
    d) vertices

11. A circumcenter is the center of
    a) an inscribed circle
    b) a circumscribed circle
    c) a circumscribed triangle
    d) a sphere

12. The point of concurrency for three medians of a triangle is a(n)
    a) centroid
    b) orthocenter
    c) media center
    d) circumcenter

13. Which of the following is true about a straightedge?
    a) it is used to draw straight lines
    b) it can be used in constructions
    c) it does not need to have markings
    d) all of the above

14. On which three-dimensional view of a road would the sides of the road appear to get closer together in the distance?
    a) perspective
    b) orthographic
    c) converging
    d) isometric

15. An incenter is the center of a(n)
    a) circumscribed triangle
    b) inscribed triangle
    b) circumscribed circle
    c) inscribed circle

16. On which three-dimensional view of a box are the top and bottom of the box drawn parallel to each other.?
    a) a perspective view
    b) a photographic view
    c) an isometric view
    d) an orthographic view

Answers: 1C, 2D, 3B, 4B, 5A, 6D, 7C, 8A, 9D, 10C, 11B, 12A, 13D, 14A, 15D, 16C

Complete the Sentence

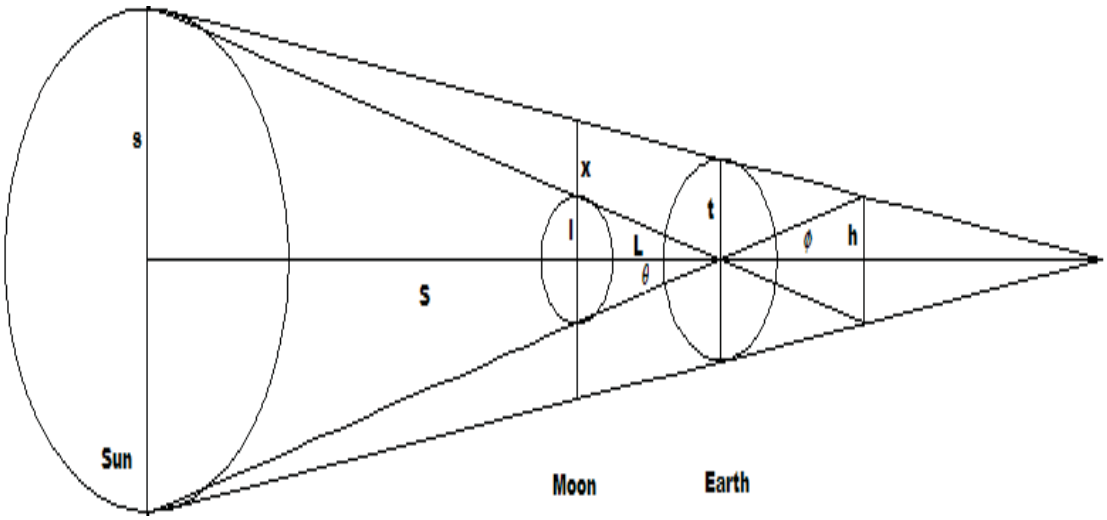
1. A _____compares the lengths of corresponding sides of similar figures.
2. In a geometric construction, you may use a straightedge and a _____.
3. An unmarked _____ may be used to draw a line.
4. To make a _____ you may use a protractor or a ruler.
5. A(n) _____view shows height, width, and depth but does not represent the way that an object would be perceived by the eye.
6. A point of concurrency for medians is a(n) _____.
7. A point of concurrency for altitudes is a(n) _____.
8. To find out if an angle is right or acute, a _____might be used.
9. A(n) _____ view has a vanishing point.
10. Three or more lines that intersect at a single point are _____.
11. Centroids and incenters are examples of _____.
12. A(n) _____is part of a circumscribed circle.
13. In a(n) _____view, only one side of a three-dimensional object may be represented.
14. Lines appear to converge in the distance at a_____.
15. _____ is a type of drawing with very specific rules.
16. A circle can be inscribed in a triangle using its _____.

Answers:

1. Scale factor
2. Compass
3. Straightedge
4. Sketch
5. Isometric view
6. Centroid
7. Orthocenter
8. Protractor
9. Perspective view
10. Concurrent lines
11. Points of concurrency
12. Circumcenter
13. Orthographic view
14. Vanishing point
15. Geometric construction
16. Incenter

Creative Writing

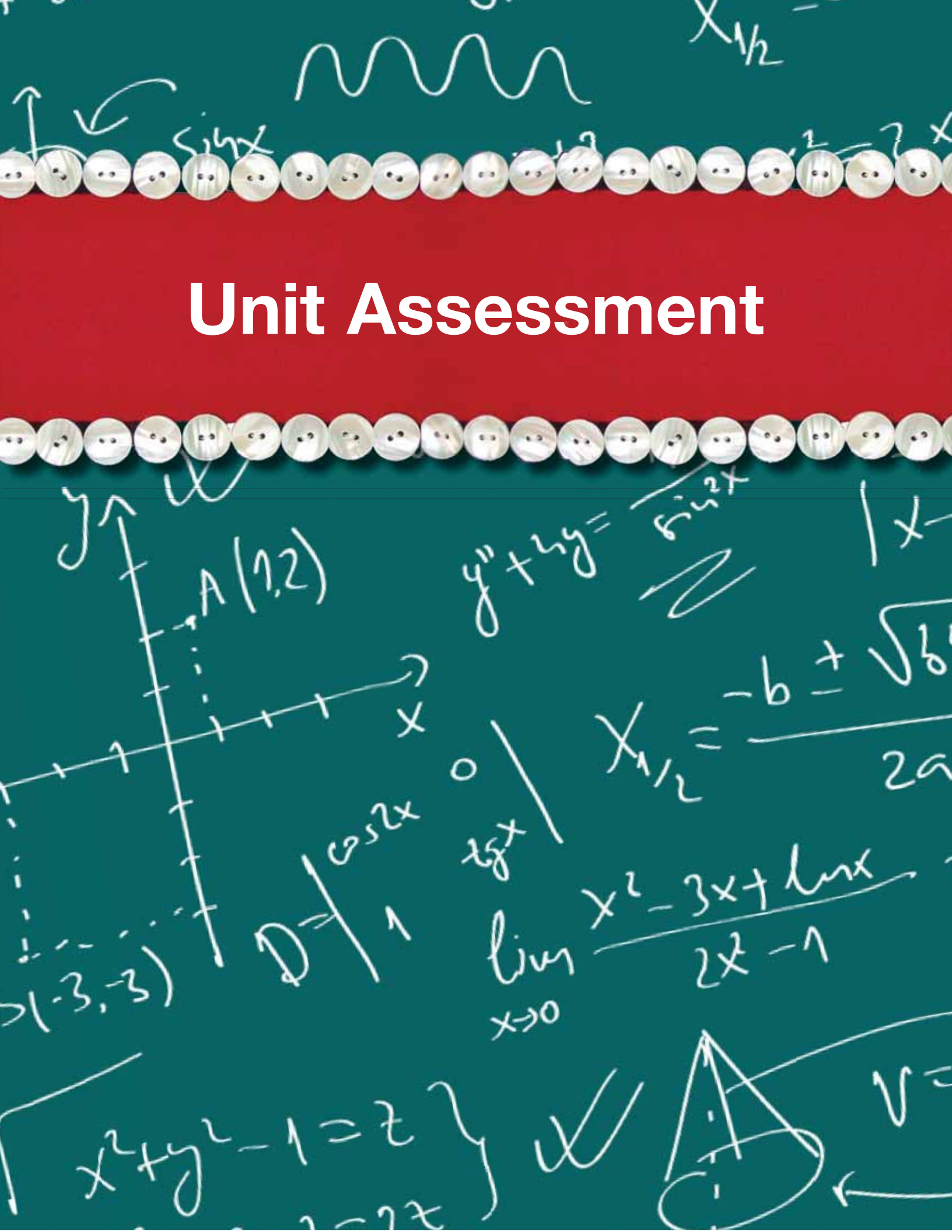
Use the words from the unit to write about the following diagram. You may add things to the diagram if you wish.



Place-Based Practice Activity

1. Look at orthographic view and perspective views of your school, street, and town using Google Earth.

2. Investigate traditional drawing tools and methods used for various purposes by indigenous people in your area.


Unit Assessment

Geometry: Unit 13-Constructions and Drawing

Name: _____
Date: _____

Matching: Match the key vocabulary words on the left with the correct definition on the right. Place the letter of the definition in front of the word it matches.

1) _____ incenter
2) _____ orthocenter
3) _____ circumcenter
4) _____ centroid

a. the point at which the three altitudes of a triangle intersect
b. the center of a polygon's inscribed circle
c. the point at which its three medians intersect in a triangle
d. the center of a circle that is circumscribed about a plane figure

Fill in the Blank: Read each statement carefully and select the word that best fits. Choose the words from the Word Bank.

Word Bank		
circumcenter	isometric	orthographic
perspective	scale factor	vanishing point

5) A _____ is used to show how the sizes of similar plane figures or solids compare. It is the ratio of any two corresponding lengths in two similar geometric figures.

6) In a/an _____ view the height, width, and depth of an object are shown and all the lines on each axis are parallel to each other, and the lines do not converge.

7) A/An _____ view of a three-dimensional object is a view that represents the exact shape of an object as it would be seen from one side at a time.

8) In a perspective view, the _____ is the point at which parallel lines appear to meet in the distance.

9) When you look at a straight road going off into the distance, the sides of the road appear to converge, or to get closer together it is _____.

Matching: Match the key vocabulary words on the left with the correct definition on the right. Place the letter of the definition in front of the word it matches.

10) _____ compass

11) _____ straightedge

12) _____ protractor

13) _____ geometric construction

a. a tool used to measure angles. It usually has an arc that is marked at regular intervals.

b. an unmarked tool used to draw straight lines

c. a precise way of drawing which allows only two tools: a straightedge and a compass

d. a drawing tool used to draw circles with different radii or to copy distances

Word completion: Complete each of the word or words in the following statement.

14) An o_____ _____ is two numbers written in the form (x, y) to represent the position of a point on a coordinate plane.

15) G_____ _____ is a precise way of drawing which allows only two tools: a straightedge and a compass.

16) A s_____ is a drawing that is made by hand or with any tools available, and does not include great detail. If you don2019t follow the precise rules for constructions, you might be making a s_____.

17) C_____ are numbers that give the location of a point. Latitude and longitude are c_____ and used in geography and in navigation to pinpoint locations and in mathematics, a point may be located on a plane with an x-axis and a y-axis, and have its location given by an ordered pair of c_____ (x, y)..

Geometry: Unit 13-Constructions and Drawing

Name: _____
Date: _____

Matching: Match the key vocabulary words on the left with the correct definition on the right. Place the letter of the definition in front of the word it matches.

1) **b** incenter
2) **a** orthocenter
3) **d** circumcenter
4) **c** centroid

a. the point at which the three altitudes of a triangle intersect
b. the center of a polygon's inscribed circle
c. the point at which its three medians intersect in a triangle
d. the center of a circle that is circumscribed about a plane figure

Fill in the Blank: Read each statement carefully and select the word that best fits. Choose the words from the Word Bank.

Word Bank		
circumcenter	isometric	orthographic
perspective	scale factor	vanishing point

5) A **scale factor** is used to show how the sizes of similar plane figures or solids compare. It is the ratio of any two corresponding lengths in two similar geometric figures.

6) In a/an **isometric** view the height, width, and depth of an object are shown and all the lines on each axis are parallel to each other, and the lines do not converge.

7) A/An **orthographic** view of a three-dimensional object is a view that represents the exact shape of an object as it would be seen from one side at a time.

8) In a perspective view, the **vanishing point** is the point at which parallel lines appear to meet in the distance.

9) When you look at a straight road going off into the distance, the sides of the road appear to converge, or to get closer together it is **perspective**.

Matching: Match the key vocabulary words on the left with the correct definition on the right. Place the letter of the definition in front of the word it matches.

10) _d_ compass

11) _b_ straightedge

12) _a_ protractor

13) _c_ geometric construction

a. a tool used to measure angles. It usually has an arc that is marked at regular intervals.

b. an unmarked tool used to draw straight lines

c. a precise way of drawing which allows only two tools: a straightedge and a compass

d. a drawing tool used to draw circles with different radii or to copy distances

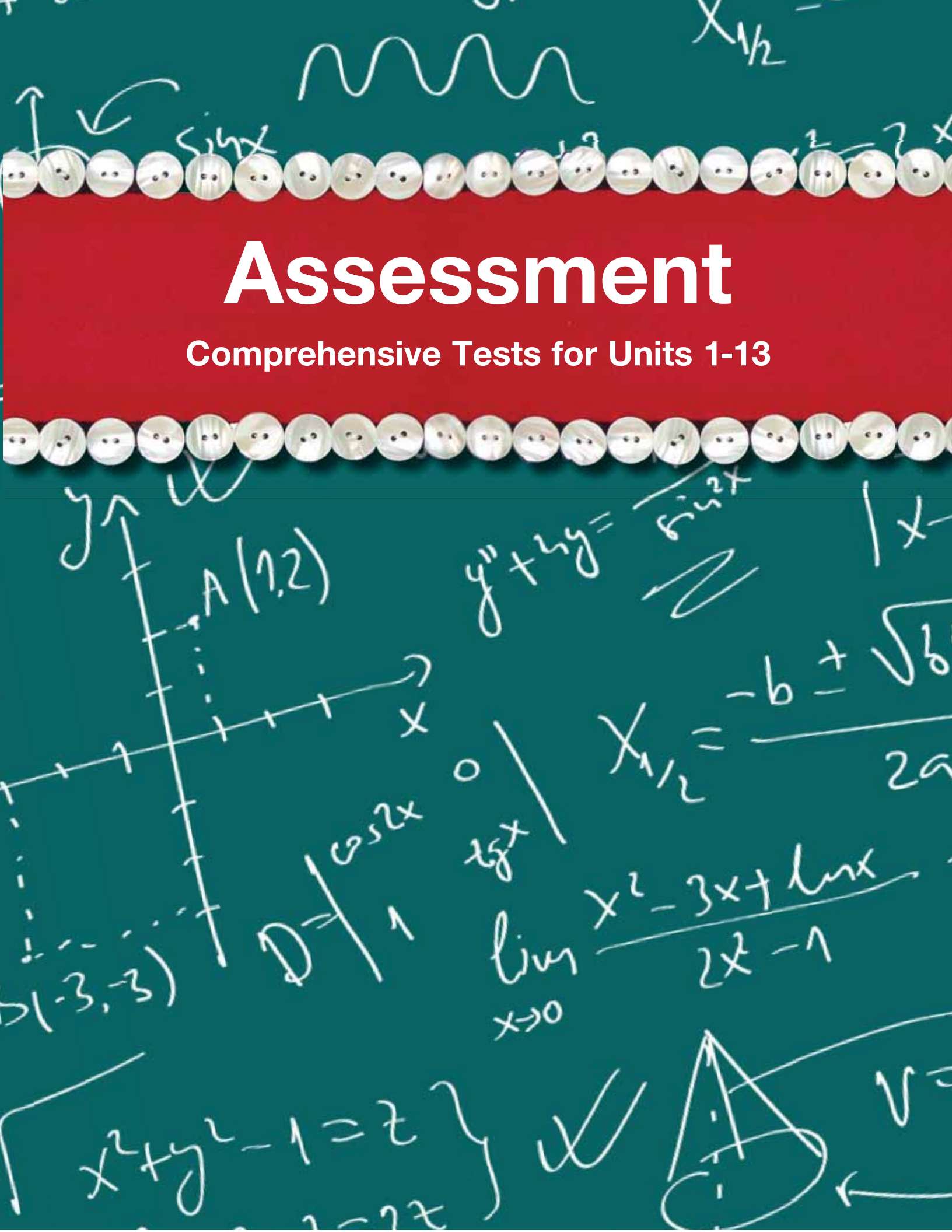
Word completion: Complete each of the word or words in the following statement.

14) An o**rdered** **pair** is two numbers written in the form (x, y) to represent the position of a point on a coordinate plane.

15) G**eometric** **construction** is a precise way of drawing which allows only two tools: a straightedge and a compass.

16) A s**ketch** is a drawing that is made by hand or with any tools available, and does not include great detail. If you don2019t follow the precise rules for constructions, you might be making a s**ketch**.

17) C**oordinates** are numbers that give the location of a point. Latitude and longitude are c**oordinates** and used in geography and in navigation to pinpoint locations and in mathematics, a point may be located on a plane with an x-axis and a y-axis, and have its location given by an ordered pair of c**oordinates** (x, y)..



Assessment

Comprehensive Tests for Units 1-13

Geometry Unit Test: 1, 2, 3

Geometry, Angles, Proofs

Math Vocabulary

Name: _____

Date: _____

Matching: Match the key vocabulary words on the left with the definitions on the right. Place the letter of the definition in front of the word it matches.

1) _____ conditional statement

2) _____ hypothesis

3) _____ dimension

4) _____ angle

5) _____ point

6) _____ line

7) _____ ray

8) _____ acute angle

a. An angle that has a measure less than 90o

b. directions of extension- length, width, and height

c. the first part, or the IF part, of an IF-THEN statement

d. half a line, or part of a line that has a starting point and extends infinitely in one direction

e. made up of two rays with a common starting point

f. the combination of two statements in an IF-THEN structure

g. an infinitely small position in space with no size or dimension

h. the straight path that connects two points and goes on forever in both directions

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

Word Bank		
angle	conjecture	contrapositive
corollary	counterexample	degree
indirect	midpoint	parallel lines
perpendicular lines	postulate	segment
summary	theorem	verify

9) When someone gives a/an _____ of something it is a concise, comprehensive statement or an abridged explanation.

10) To _____ something means to test and confirm its truth.

11) In a statement where two parts of the "If then" part of the sentence are switched and are BOTH negative, the statement is _____ . For Example: *If the field is not wet, then it is not raining.*

12) A/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.

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

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

15) A /An _____ is one that proves a statement to be false. For instance, the statement about a yard in Southeast Alaska- *There is a cedar tree in my yard* proves that the following statement cannot be true-----*All trees in Southeast Alaska are hemlocks*.

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

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

18) 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 are calculating an _____ measure.

19) A /An _____ is a statement accepted as true without proof.

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

21) A /An _____ is a statement or opinion that is not based on evidence. It is an educated guess, like in the statement-----*Halibut taste better than salmon to most people.*

Multiple Choice: Read each statement and choose the best word to complete the sentence. Circle the letter in front of the correct word.

22) Either of the two rays that make up an angle is the _____ of an angle.

a) vertex

b) degree

c) side

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

a) segment

b) infinite

c) a ray

24) _____ angles are pair of angles that are opposite each other and formed by two lines that intersect.

a) vertical

b) complementary

c) supplementary

25) Two angles whose measures add up to 180o are called _____.

a) obtuse angles

b) complementary angles

c) adjacent angles

Illustrations: Look at each illustration below and choose the label that matches it. Circle the letter in front of the correct key word.

26) Identify the illustration below by marking the key vocabulary that matches it.

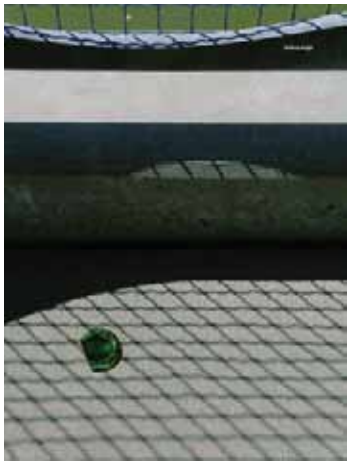
a) acute angle

b) obtuse angle

c) vertical angle

d) adjacent angle

27) Identify the illustration below by marking the key vocabulary that matches it.



a) acute

b) obtuse

c) vertical

d) adjacent

28) Identify the illustration below by marking the key vocabulary that matches it.

a) acute angle

b) obtuse angle

c) vertical angle

d) adjacent angle

Labeling: look at the illustrations below and write the correct label for each illustration.

29) Label the following illustration.

_____

30) Label the following illustration.

_____

Geometry Unit Test: 1, 2, 3
Geometry, Angles, Proofs
Math Vocabulary

Name: _____
Date: _____

Matching: Match the key vocabulary words on the left with the definitions on the right. Place the letter of the definition in front of the word it matches.

1) **f** conditional statement
2) **c** hypothesis
3) **b** dimension
4) **e** angle
5) **g** point
6) **h** line
7) **d** ray
8) **a** acute angle

a. An angle that has a measure less than 90o
b. directions of extension- length, width, and height
c. the first part, or the IF part, of an IF-THEN statement
d. half a line, or part of a line that has a starting point and extends infinitely in one direction
e. made up of two rays with a common starting point
f. the combination of two statements in an IF-THEN structure
g. an infinitely small position in space with no size or dimension
h. the straight path that connects two points and goes on forever in both directions

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

Word Bank		
angle	conjecture	contrapositive
corollary	counterexample	degree
indirect	midpoint	parallel lines
perpendicular lines	postulate	segment
summary	theorem	verify

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

10) To **verify** something means to test and confirm its truth.

11) In a statement where two parts of the "If then" part of the sentence are switched and are BOTH negative, the statement is **contrapositive** . For Example: *If the field is not wet, then it is not raining.*

12) A/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.

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

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

15) A /An **counterexample** is one that proves a statement to be false. For instance, the statement about a yard in Southeast Alaska- *There is a cedar tree in my yard* proves that the following statement cannot be true-----*All trees in Southeast Alaska are hemlocks*.

16) The point in the middle of a line segment that divides a line segment in half is known as the **midpoint** .

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

18) 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 are calculating an **angle** measure.

19) A /An **postulate** is a statement accepted as true without proof.

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

21) A /An **conjecture** is a statement or opinion that is not based on evidence. It is an educated guess, like in the statement-----*Halibut taste better than salmon to most people.*

Multiple Choice: Read each statement and choose the best word to complete the sentence. Circle the letter in front of the correct word.

22) Either of the two rays that make up an angle is the _____ of an angle.

a) vertex

b) degree

c) side

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

a) segment

b) infinite

c) a ray

24) _____ angles are pair of angles that are opposite each other and formed by two lines that intersect.

a) vertical

b) complementary

c) supplementary

25) Two angles whose measures add up to 180o are called _____.

a) obtuse angles

b) complementary angles

c) adjacent angles

Illustrations: Look at each illustration below and choose the label that matches it. Circle the letter in front of the correct key word.

26) Identify the illustration below by marking the key vocabulary that matches it.

(matt...insert an acute angle.)

a) acute angle

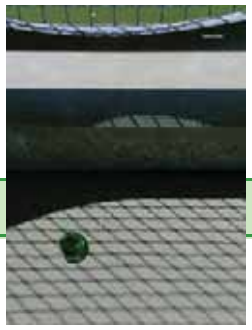
b) obtuse angle

c) vertical angle

d) adjacent angle

27) Identify the illustration below by marking the key vocabulary that matches it.

(matt...insert a vertical angle.)



a) acute

b) obtuse

c) vertical

d) adjacent

28) Identify the illustration below by marking the key vocabulary that matches it.

(matt...insert an obtuse angle.)

a) acute angle

b) obtuse angle

c) vertical angle

d) adjacent angle

Labeling: look at the illustrations below and write the correct label for each illustration.

29) Label the following illustration.

Matt insert perpendicular lines

perpendicular lines

30) Label the following illustration.

Matt insert parallel lines.

parallel lines

bev williams 11.9999

Geometry Test: Units 4, 5, 6, 7

Lines and Transversals
Triangles
Quadrilaterals
Circles

Name: _____
Date: _____

Label the following geometric figures. Choose the label from words provided in the Word Bank.

Word Bank		
acute triangle	arc	isosceles triangle
parallel lines	perpendicular lines	polygon
right triangle	semicircle	

1) Label the illustration below.

_____

2) Label the illustration below.

_____

3) Label the illustration below.

_____

4) Label the illustration below.

_____

5) Label the illustration below.

_____

6) Label the illustration below.

_____

7) Label the illustration below.

_____

8) Label the illustration below.

_____

Matching: Match the geometric term on the left with the definition on the right. Place the letter from the definition in front of the word it matches.

9) _____ equidistant

10) _____ transversal

11) _____ interior angle

12) _____ right triangle

13) _____ triangle

14) _____ median of a triangle

15) _____ vertex angle

16) _____ rectangle

a. a four-sided polygon with four right angles

b. any polygon with three sides

c. an angle in the interior (inside) of a geometric figure

d. the angle opposite the base

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

f. equally distant, or at the same distance

g. a line segment drawn from one vertex to the midpoint of the opposite side

h. a line that cuts across another set of lines

17) Illustrate OR define **square.** Illustrate in the space provided OR write your definition on the lines provided below.

_____

_____

_____

18) Illustrate OR define **rhombus.** Illustrate in the space provided OR write your definition on the lines provided below.

_____

_____

_____

19) Illustrate OR define **trapezoid.** Illustrate in the space provided OR write your definition on the lines provided below.

20) Illustrate OR define **parallelogram.** Illustrate in the space provided OR write your definition on the lines provided below.

Multiple Choice: Read each statement below and choose the word that fits best. Circle the letter in front of the correct answer.

21) A _____is a closed curve whose points are all on the same plane and at the same distance from a fixed point

a) circumference

b) circle

c) radius

d) diameter

22) The _____ is the perimeter or outer boundary of a circle and also the distance around the outside of a circle.

a) circumference

b) circle

c) radius

d) diameter

23) A _____ is a line segment that connects the center of a circle with a point on its circumference, or is the length of that line segment.

a) circumference

b) circle

c) radius

d) diameter

24) A _____ is a line segment between two points on a circle which passes through the center.

a) circumference

b) circle

c) radius

d) diameter

Word Unscramble: In the next four test items, unscramble the word and write it in the blank space at the end of the definition.

25) **naloitporpro:** means that the ratio is the same. _____

26) **dauqrltaeral:** any four-sided polygon. _____

27) **atlitdeu:** The distance between a vertex of a triangle and the opposite side. _____

28) **citrnecnoc:** means having a common center. _____

Word Completion: In the next two test items, complete the spelling of the word. Use the definition to help with the correct answer.

29) **__A__E:** the part of a triangle where the side of the triangle is perpendicular to the altitude. _____

30) **P__L__G__N:** a plane shape with three or more straight sides. _____

Geometry Test: Units 4, 5, 6, 7
Lines and Transversals
Triangles
Quadrilaterals
Circles

Name: _____
Date: _____

Label the following geometric figures. Choose the label from words provided in the Word Bank.

Word Bank		
acute triangle	arc	isosceles triangle
parallel lines	perpendicular lines	polygon
right triangle	semicircle	

1) Label the illustration below.

Matt..insert perpendicular lines

perpendicular lines

2) Label the illustration below.

Matt..insert a polygon

polygon

3) Label the illustration below.

Matt..insert an acute triangle

acute triangle

4) Label the illustration below.

right triangle

5) Label the illustration below.

isosceles triangle

6) Label the illustration below.

arc

7) Label the illustration below.

semicircle

8) Label the illustration below.

parallel lines

Matching: Match the geometric term on the left with the definition on the right. Place the letter from the definition in front of the word it matches.

9) f equidistant

10) h transversal

11) c interior angles

12) e right triangle

13) b triangle

14) g median of a triangle

15) d vertex angle

16) a rectangle

a. a four-sided polygon with four right angles

b. any polygon with three sides

c. an angle in the interior (inside) of a geometric figure

d. the angle opposite the base

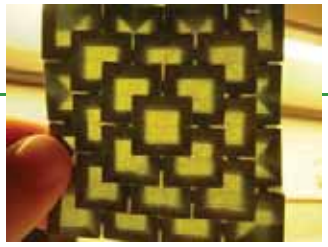
e. a triangle which has a right (90Â°) interior angle

f. equally distant, or at the same distance

g. a line segment drawn from one vertex to the midpoint of the opposite side

h. a line that cuts across another set of lines

17) Illustrate OR define **square.** Illustrate in the space provided OR write your definition on the lines provided below.



Definition: A square is a four-sided polygon with four right angles and all four sides congruent

18) Illustrate OR define **rhombus.** Illustrate in the space provided OR write your definition on the lines provided below.

Definition: A rhombus is a parallelogram with four congruent sides

23) A _____ is a line segment that connects the center of a circle with a point on its circumference, or is the length of that line segment.

a) circumference

b) circle

c) radius

d) diameter

24) A _____ is a line segment between two points on a circle which passes through the center.

a) circumference

b) circle

c) radius

d) diameter

Word Unscramble: In the next four test items, unscramble the word and write it on the blank space at the end of the definition.

25) **naloitporpro:** means that the ratio is the same. **proportional**

26) **dauqrltaeral:** any four-sided polygon. **quadrilateral**

27) **atlitdeu:** The distance between a vertex of a triangle and the opposite side **altitude**

28) **citrnecnoc:** means having a common center. **concentric**

Word Completion: In the next two test items, complete the spelling of the word. Use the definition to help with the correct answer.

29) **__A__E:** the part of a triangle where the side of the triangle is perpendicular to the altitude. **BASE**

30) **P__L__G__N:** a plane shape with three or more straight sides. **POLYGON**

Geometry 8, 9, 10
Polygons and Area
Three Dimensional Figures
Surface Area and Volume

Name: _____
Date: _____

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

1) _____ cone
2) _____ sphere
3) _____ hemisphere
4) _____ base
5) _____ altitude
6) _____ area
7) _____ pyramid
8) _____ cube

a. half of a sphere
b. a polyhedron with a single base that is a polygon, tapering to a vertex
c. the extent of a two-dimensional surface or region within given boundaries
d. the bottom side of a figure, or the side to which an altitude is drawn
e. a three-dimensional solid consisting of all points equidistant from a given point
f. the shortest distance between the base of a geometric figure and its top; height
g. the common name for a regular hexahedron
h. a solid with a single base that is a circle, tapering to a vertex

Multiple choice: For the next 8 items, match the key vocabulary geometric term with the illustration or shape it matches. Circle the letter that corresponds with the correct answer.

9) **Tangent**

a) 

b) 

c) 

d) 

e) 

f) 

g) 

h) 

10) **Axis**

a) i 

b) i 

c) i 

d) i 

e) 

f) i 

g) 

h) 

11) **Parallelepiped**

a) 

b) 

c) 

d) 

e) 

f) 

g) 

h) 

12) **Volume**

a) 

b) 

c) 

d) 

e) 

f) i 

g) 

h) 

13) **Radius**

a) 

b) 

c) 

d) 

e) 

f) il 

g) 

h) 

14) **Surface Area**

a) 

b) 

c) 

d) 

e) 

f) i 

g) 

h) 

15) **Edge**

a) 

b) 

c) 

d) 

e) 

f) 

g) 

h) 

16) **Pyramid**

a) 

b) 

c) 

d) 

e) 

f) 

g) 

h) 

Word Bank		
cylinder	edge	lateral area
oblique solids	platonic solid	polyhedron
right solids	solid	tetrahedron

17) A _____ is a solid that has two congruent circles in parallel planes as its bases.

18) A geometric _____ is a three-dimensional closed figure that has a boundary.

19) A _____ is a regular polyhedron. Its surfaces are congruent regular polygons, and all of its angles are congruent

20) _____ are *straight up and down* and have bases aligned directly one above the other so that the sides are perpendicular to the bases.

21) _____ are *slanted;* the bases are not aligned directly one above the other, or, the apex is not directly above the center of the base.

22) A _____ is a solid with no curved surfaces or edges. Examples are wall tents, paper stars, and cereal boxes.

23) A _____ is a pyramid with a triangular base and four triangular surfaces. Its shape is seen in nature in the structure of a very common molecule, methane (CH4). The four hydrogen atoms lie in each corner of it with the carbon atom in the center.

24) _____ is a word used to describe a border or a line where a surface terminates.

25) The _____ of a geometric solid is the combined area of all of the faces except the base(s). On a can of salmon it would be the area that is covered by the label.

Matching: Match the key vocabulary word son the left with the illustration on the right. Place the letter from the illustration in front of the words it matches on the right.

26) _____ regular polygon

27) _____ concave polygon

28) _____ convex polygon

29) _____ hexagon

30) _____ pentagon

31) _____ octagon

32) _____ nanogon

a. 

b. 

c. 

d. 

e. 

f. 

g. 

Geometry 8, 9, 10
Polygons and Area
Three Dimensional Figures
Surface Area and Volume

Name: _____
Date: _____

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

1) **h** cone
2) **e** sphere
3) **a** hemisphere
4) **d** base
5) **f** altitude
6) **c** area
7) **b** pyramid
8) **g** cube

a. half of a sphere
b. a polyhedron with a single base that is a polygon, tapering to a vertex
c. the extent of a two-dimensional surface or region within given boundaries
d. the bottom side of a figure, or the side to which an altitude is drawn
e. a three-dimensional solid consisting of all points equidistant from a given point
f. the shortest distance between the base of a geometric figure and its top; height
g. the common name for a regular hexahedron
h. a solid with a single base that is a circle, tapering to a vertex

Multiple choice: For the next 8 items, match the key vocabulary geometric term with the illustration or shape it matches. Circle the letter that corresponds with the correct answer.

9) **Tangent**

a) 

b) 

c) 

d) 

e) 

f) 

g) 

h) 

10) **Axis**

a) 

b) 

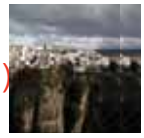
c) 

d) 

e) 

f) 

g) 

h) 

11) **Parallelepiped**

a) 

b) 

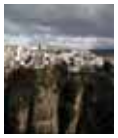
c) 

d) 

e) 

f) i 

g) 

h) 

12) **Volume**

a) 

b) 

c) 

d) 

e) 

f) 

g) 

h) 

13) **Radius**

a) 

b) 

c) 

d) 

e) 

f) i 

g) 

h) 

14) Surface Area

a) 

b) 

c) 

d) 

e) 

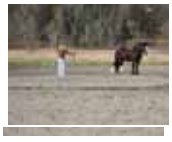
f) i 

g) 

h) 

15) Edge

a) 

b) 

c) 

d) 

e) 

f) 

g) 

h) 

16) Pyramid

a) 

b) 

c) 

d) 

e) 

f) i 

g) 

h) 

Word Bank		
cylinder	edge	lateral area
oblique solids	platonic solid	polyhedron
right solids	solid	tetrahedron

17) A **cylinder** is a solid that has two congruent circles in parallel planes as its bases.

18) A geometric **solid** is a three-dimensional closed figure that has a boundary.

19) A **platonic solid** is a regular polyhedron. Its surfaces are congruent regular polygons, and all of its angles are congruent

20) **Right solids** are *straight up and down* and have bases aligned directly one above the other so that the sides are perpendicular to the bases.

21) **Oblique solids** are *slanted;* the bases are not aligned directly one above the other, or, the apex is not directly above the center of the base.

22) A **polyhedron** is a solid with no curved surfaces or edges. Examples are wall tents, paper stars, and cereal boxes.

23) A **tetrahedron** is a pyramid with a triangular base and four triangular surfaces. Its shape is seen in nature in the structure of a very common molecule, methane (CH4). The four hydrogen atoms lie in each corner of it with the carbon atom in the center.

24) **Edge** is a word used to describe a border or a line where a surface terminates.

25) The **lateral area** of a geometric solid is the combined area of all of the faces except the base(s). On a can of salmon it would be the area that is covered by the label.

Matching: Match the key vocabulary word son the left with the illustration on the right. Place the letter from the illustration in front of the words it matches on the right.

26) e regular polygon

27) f concave polygon

28) c convex polygon

29) g hexagon

30) b pentagon

31) a octagon

32) d nanogon

a. 

b. 

c. 

d. 

e. 

f. 

g. 

Geometry: Test 11, 12, 13
Coordinate Geometry
Transformations
Construction and Drawings

Name: _____
Date: _____

Fill in the Blank: Complete each statement below with the word that fits. Choose the word from the Word Bank.

Word Bank		
centroid	circumcenter	linear equation
ordered pair	ordered triple	slope

1) A/An _____ is three numbers written in the form (x, y, z) to represent the position of a point in space.

2) Road engineers, roof designers, and avalanche forecasters all need to calculate _____, because it is a number that indicates the steepness of a line and tells which way the line is tilted.

3) A /An _____ has two variables and each variable has a power of one. Its graph is a straight line.

4) The _____ is the center of a circle that is circumscribed about a plane figure; it is where the perpendicular bisectors of the sides of a triangle meet.

5) The _____ of a triangle is the point at which its three medians intersect.

6) A/An _____ is two numbers written in the form (x, y) to represent the position of a point on a coordinate plane.

Labeling: Label the following illustrations. Write the key vocabulary word for each illustration in the blank provided.

7) Identify the following illustrations. Write the label in the space provided.

_____

8) Identify the following illustrations. Write the label in the space provided.

_____

9) Identify the following illustrations. Write the label in the space provided.

_____

10) Identify the following illustrations. Write the label in the space provided.

_____

11) Identify the following illustrations. Write the label in the space provided.

_____

12) Identify the following illustrations. Write the label in the space provided.

_____

13) Label each of the following illustrations of geometry tools/instruments.

_____

_____

_____

Matching: Match the key vocabulary word on the left with its definition on the write. Place the letter of the definition in front of the word it matches.

14) _____ incenter

15) _____ orthocenter

16) _____ reflection

17) _____ line of symmetry

18) _____ point of symmetry

19) _____ mirror symmetry

20) _____ symmetry

a. The replacement of a point on each side of a line or plane with a symmetric point on the other side of the line or plane

b. a center point for some kinds of symmetry.

c. the point at which the three altitudes of a triangle intersect

d. the center of a polygon's inscribed circle where the angle bisectors of a triangle meet

e. the line about which a figure is reflected

f. the correspondence in size, form, and arrangement on opposite sides of a plane, a line, or a point

g. symmetry that involves a reflection of a mirror image

Word Completion: Complete the spelling of each word in the following 5 items. Use the definition to help with the answer.

21) **V__C__ __R:** a quantity that has both a magnitude and a direction, such as displacement, velocity, acceleration, or force _____

22) **S C__L__ __:** a quantity that has only magnitude, and does not depend on direction, such as time, length, temperature, density, and mass _____

23) **R__T A__ I O__:** a transformation in which a plane figure turns around a fixed center point

24) **S__ __P E:** a number that indicates the steepness of a line, and also tells which way the line is tilted _____

25) **T__A N__F__R__A T__ __N S:** operations that alter the form or position of a figure without substantially changing it _____

Geometry: Test 11, 12, 13
Coordinate Geometry
Transformations
Construction and Drawings

Name: _____
Date: _____

Fill in the Blank: Complete each statement below with the word that fits. Choose the word from the Word Bank.

Word Bank		
centroid	circumcenter	linear equation
ordered pair	ordered triple	slope

1) A/An **ordered triple** is three numbers written in the form (x, y, z) to represent the position of a point in space.

2) Road engineers, roof designers, and avalanche forecasters all need to calculate **slope**, because it is a number that indicates the steepness of a line and also tells which way the line is tilted.

3) A /An **linear equation** has two variables and each variable has a power of one. Its graph is a straight line.

4) The **circumcenter** is the center of a circle that is circumscribed about a plane figure; it is where the perpendicular bisectors of the sides of a triangle meet.

5) The **centroid** of a triangle is the point at which its three medians intersect.

6) A/An **ordered pair** is two numbers written in the form (x, y) to represent the position of a point on a coordinate plane.

Labeling: Label the following illustrations. Write the key vocabulary word for each label in the blank provided.

7) Identify the following illustrations. Write the label in the space provided.

tessellation

8) Identify the following illustrations. Write the label in the space provided.

horizontal

9) Identify the following illustrations. Write the label in the space provided.

vertical

10) Identify the following illustrations. Write the label in the space provided.

scatter plot

11) Identify the following illustrations. Write the label in the space provided.

distance

12) Identify the following illustrations. Write the label in the space provided.

magnitude

13) Label each of the following illustrations of geometry tools/instruments.

straightedge

compass

protractor

Matching: Match the key vocabulary word on the left with its definition on the write. Place the letter of the definition in front of the word it matches.

14) **d** incenter

15) **c** orthocenter

16) **a** reflection

17) **e** line of symmetry

18) **b** point of symmetry

19) **g** mirror symmetry

20) **f** symmetry

a. The replacement of a point on each side of a line or plane with a symmetric point on the other side of the line or plane

b. a center point for some kinds of symmetry.

c. the point at which the three altitudes of a triangle intersect

d. the center of a polygon's inscribed circle where the angle bisectors of a triangle meet

e. the line about which a figure is reflected

f. the correspondence in size, form, and arrangement on opposite sides of a plane, a line, or a point

g. symmetry that involves a reflection of a mirror image

Word Completion: Complete the spelling of each word in the following 5 items. Use the definition to help with the answer.

21) **V__C__ __R:** a quantity that has both a magnitude and a direction, such as displacement, velocity, acceleration, or force **vector**

22) **S C__L__ __:** a quantity that has only magnitude, and does not depend on direction, such as time, length, temperature, density, and mass **scalar**

23) **R__T A__ I O__:** a transformation in which a plane figure turns around a fixed center point **rotation**

24) **S__ __P E:** a number that indicates the steepness of a line, and also tells which way the line is tilted **slope**

25) **T__A N__F__R__A T__ __N S:** operations that alter the form or position of a figure without substantially changing it **transformations**