



artsNOW

Integrated learning solutions

**STRINGING IT TOGETHER:
EXPLORING ANGLES THROUGH ABSTRACT SCULPTURE**
Grade Band: 9-12
Content Focus: Visual Arts & Algebra/Geometry



LEARNING DESCRIPTION

In this engaging one-day lesson, students integrate mathematics and visual art by creating abstract string sculptures that demonstrate angles of elevation and depression. Using yarn or string, students design sculptures throughout the classroom (or outdoors), anchoring string to surfaces to form right triangles of varying sizes. Students then identify where the angles of elevation and depression appear in their sculpture, measure side lengths, and use trigonometric ratios and inverse trigonometric functions to find the angle measurements. Through the process, they learn what abstract art is and how it can express ideas using shapes, space, and movement.

LEARNING TARGETS

Essential Questions	"I Can" Statements
How can we use abstract art and trigonometry to understand angles of elevation and depression in real spaces?	<p>I can create an abstract sculpture that includes right triangles and angles of elevation and depression.</p> <p>I can measure and solve for angles using trigonometric ratios and inverse trig functions.</p> <p>I can explain how my sculpture is an example of abstract art.</p>

GEORGIA STANDARDS

Curriculum Standards	Arts Standards
<p>Geometry: G.GSR.6.3 Use trigonometric ratios and the Pythagorean Theorem to solve for sides and angles of right triangles in applied problems.</p>	<p>VAHSSC.CR.1.a Generate sculptural ideas through the sequential process of ideation, innovation, development, and actualization.</p> <p>VAHSSC.CR.1.b Investigate choice of themes, materials, and methods as they relate to personal, contemporary, and traditional sculptural artists/works.</p>

SOUTH CAROLINA STANDARDS

Curriculum Standards	Arts Standards
<p>Geometry with Statistics: GS.MGSR.6. Discover and apply relationships in similar right triangles.</p> <p>Algebra 2 with Probability: A2P.MGSR.1. Explore and analyze sine and cosine functions using the unit circle, right triangle definitions, and models of periodic phenomena.</p>	<p>Anchor Standard 1: I can use the elements and principles of art to create artwork.</p> <p>Anchor Standard 2: I can use different materials, techniques, and processes to make art.</p> <p>Anchor Standard 7: I can relate visual arts ideas to other arts disciplines, content areas, and careers.</p>

KEY VOCABULARY

Content Vocabulary	Arts Vocabulary
<ul style="list-style-type: none"> • <u>Angle of Elevation</u> — The angle between the horizontal and a line of sight looking upward • <u>Angle of Depression</u> — The angle between the horizontal and a line of sight looking downward • <u>Right Triangle</u> — A triangle with one 90° angle • <u>Inverse Trigonometry</u> — Using \sin^{-1}, \cos^{-1}, or \tan^{-1} to find an angle when sides are known 	<ul style="list-style-type: none"> • <u>Line</u> — A continuous mark made on some surface by a moving point. It may be two dimensional, like a pencil mark on a paper or it may be three dimensional (wire) or implied (the edge of a shape or form) often it is an outline, contour or silhouette. • <u>Shape</u> — A flat, enclosed line that is always two-dimensional and can be either geometric or organic • <u>Space</u> — The distance or area between, around, above or within things. Positive space refers to the subject or areas of interest in an artwork, while negative space is the area around the subject of

	<p>an artwork. It can be a description for both two and three-dimensional portrayals.</p> <ul style="list-style-type: none"> ● <u>Sculpture</u> — A three-dimensional work of art that can be made from a variety of materials, such as wood, clay, metal, or stone ● <u>Abstract Art</u> — Art that does not attempt to represent external reality directly, but uses shapes, colors, forms, and textures to achieve its effect ● <u>Installation Art</u> — Art created to transform the perception of a space, often immersive and site-specific
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MATERIALS

<ul style="list-style-type: none"> ● Colored yarn or string (several colors) ● Yardsticks or measuring tapes ● Tape, push pins, or clips to secure string ● Paper and pencils for calculations ● Optional: printed examples of abstract art and sculptures (or pictures/examples to project) ● Optional: reference sheet ● String Sculpture Measurement and Calculation Worksheet
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INSTRUCTIONAL DESIGN

<p>Opening/Activating Strategy</p>
<ul style="list-style-type: none"> ● Introduce the essential question and explain the day’s objectives. ● Show students examples of abstract art (printed or projected) and discuss: <ul style="list-style-type: none"> ○ What do you notice? ○ How does it use space, shape, and line? ○ How could we create our own abstract art installations by making angles of elevation and depression using string? ● Optional: Offer students the reference sheet. ● Review trigonometric ratios and how to find angles of elevation and depression.
<p>Work Session</p>
<ul style="list-style-type: none"> ● Explain to students that they will be working in small groups to create abstract string sculpture in the classroom or an outdoor space. ● Students are encouraged to use multiple surfaces and create several visible right triangles. <ul style="list-style-type: none"> ○ <i>Be sure that students understand they can use any of the space in the classroom from floor to ceiling (or other parameters set by the teacher).</i> ● Once sculptures are completed, groups will identify angles of elevation and depression within their sculpture. ● Using yardsticks, they will measure the side lengths of their triangles and record their data.

- Students will then calculate the angle measurements using inverse trigonometric functions and record their findings on their worksheet. Students will use [String Sculpture Measurement and Calculation Worksheet](#).
- As the teacher circulates, they can support students by prompting:
 - Where is your angle of elevation? Where is your angle of depression?
 - How can you use different levels (high, middle, low) to make your sculpture more interesting?
 - How does your sculpture transform the space around you?

Closing/Reflection

- Groups will briefly present their sculptures to the class, pointing out their angles and how they calculated them.
- Reflect as a class:
 - How did creating the sculpture help you understand and demonstrate your understanding of elevation and depression?
 - How did it feel to use art to express a math concept?
- Students will write an artist's statement to explain the meaning behind their sculpture, its angles, and how they calculated them. They should connect how their sculpture represents abstract art and geometric principles.

ASSESSMENTS

Formative

- Observations of student discussions and work during sculpture creation and calculations.

Summative

- Completed sculpture, measurements, and angle calculations.
- Artist's statement

DIFFERENTIATION

Acceleration: Students create more complex sculptures with multiple triangles and calculate additional unknowns.

Remediation: Teacher supports groups by helping identify right triangles and provides sample calculations.

ADDITIONAL RESOURCES

- [Calder](#)
- [Hepworth](#)
- [Mondrian](#)
- [Kandinsky](#)

**This integrated lesson provides differentiated ideas and activities for educators that are aligned to a sampling of standards. Standards referenced at the time of publishing may differ based on each state's adoption of new standards.*

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