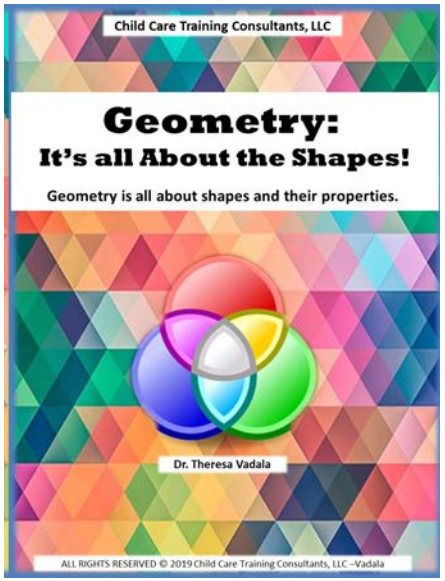
GEOMETRY

It's all About the Shapes!

Dr. Theresa Vadala

Geometry: is all about shapes and their properties.



Geometry: It's All About the Shapes!
by
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Las Vegas, Nevada 89139

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CKA 1: Environment and Curriculum **Title: NV CKA4.1 Geometry: It's all about the Shapes!**	**1 Hour**	**0.1 CEU**

Dr. Theresa Vadala
(Instructor & Curriculum Designer)

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for your CDA Training Needs!

Learning Assessment

Read the material provided, take the 5-10 quiz questions and complete the training evaluation at the end of the course.

Participants must receive 100% on individual courses to obtain a certificate of completion.

Questions?
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Support Services:

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•Child Care Training Consultants LLC., Goal

The goal is to empower educators as they take Child Development Associate (CDA) courses to make a powerful difference in the lives of young children!

Mission Statement

“Child Care Training Consultants, LLC’s is committed to provide research-based professional growth and development training courses primarily focused on the Child Development Associate. The CDA is the nation’s premier credential that is transferable, valid, competency-based and nationally recognized in all 50 states, territories, the District of Columbia, community colleges and the United State Military.

Vision

Child Care Training Consultants, LLC’s vision is to provide the early childhood community with courses based on CDA competency standards to obtain their CDA Credential and assist in reaching their goal as an exceptional early childhood educator to ultimately achieve higher child outcomes.

About the Instructor

Theresa has over 30 years experience in the field of Early Childhood Education. During that time, she served as a Preschool Teacher, Disabilities Coordinator, Program Facilitator, and Director of an Early Childcare Program. She has a Doctoral Degree in Educational Leadership with Specialization in Curriculum and Instructional Design. Theresa is a Professional Growth & Development Trainer and Curriculum Designer and offers web-based courses internationally. She is the Executive Director/Owner of of the training organization Child Care Training Consultants, LLC., (CCTC).

Business Description

Child Care Training Consultants, LLC. (CCTC) is an accredited provider (AP) with the International Association for Continuing Education and Training (IACET) that provides Continuing Education Units (CEU) for adult education nationally. The business is also a recognized training organization with the Council for Professional Recognition, Child Development Associate Council (CDA), National Credentialing Program.

Learning Outcomes

The learning outcomes for participants are to learn STEM-based teaching activities on geometric math concepts such as shapes and space to implement during daily teaching practices.

Geometry: It's All About the Shapes!
Goals and Learning Objectives

Goal/s:

The goal is to teach children geometric shapes and build an awareness of geometric shapes and spatial relations to better prepare them for later success in school and in the workplace.

Objectives:

Learners will be able to…

Part 1: Geometric Shapes: 2D and 3D

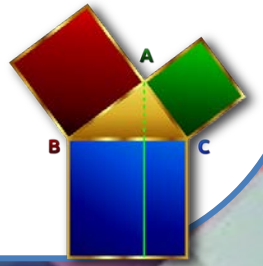
1) Identify geometric shapes (2D & 3D), analyze objects in their environment, and name the basic shape.

Part 2: Geometric Dimensions: Promoting Creative Thinking Skills

2) Engage in activities that promote creative thinking skills and design architecture drawing using *Geometric Dimensions;* Point, Line, Plane and Solid.

Part 3: Child-led Environments: Math in Everyday Play!

3) Engage students in a child-led early learning environment by engaging in the process of architecture innovation through building and construction.



Euclidean Geometry

AGENDA

Part 1: Geometric Shapes: 2D and 3D

1)Identify geometric shapes (2D & 3D), analyze objects in their environment, and name the basic shape.

Part 2: Geometric Dimensions: Promoting Creative Thinking Skills

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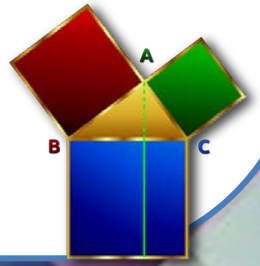


Research: What Children Know and Need to Learn about Shapes and Space

Geometry encompasses two major components. One is reasoning about *shape*. We learn, for example, that triangles must have three straight sides and three angles, but the angles may be narrow or wide, and the triangles may be tall or short, red or blue, or tilted in any number of ways. The second component is thinking about *space*. We learn how objects relate to one another and to us in space: the ball is on top of the sofa, the sofa is under the ball, and we are in front of both.

Although children accurately *perceive* shape and space in their everyday environments, preschool children from about three to five years of age need to learn to *think* about these topics. Our main educational goal should be to promote *understanding* of basic geometry.

Vocabulary Words to use and Glossary

- **Area**- the extent or measurement of a surface or piece of land
- Breath- the distance or measurement from side to side of something; width.
- Free-form- not conforming to a regular or formal structure or shape.
- Geometry- the branch of mathematics concerned with the properties and relations of points, lines, surfaces, solids, and higher dimensional analogs.
- Graphing- plot or trace on a graph.
- **Line**- a straight or curved continuous extent of length without breadth.-
- Linear- able to be represented by a straight line on a graph; involving or exhibiting directly proportional change in two related quantities.; arranged in or extending along a straight or nearly straight line.
- Plane- completely level or flat.; relating to only two-dimensional surfaces or magnitudes.
- **Perimeter-** the continuous line forming the boundary of a closed geometric figure.

Vocabulary Words to use and Glossary

- **Point**- something having position but not spatial extent, magnitude, dimension, or direction, for example the intersection of two lines.
- **Three dimensional-** Having three dimensions (such as height, width and depth), like any object in the real world.
- **Two dimensional-** Having only two dimensions, such as width and height but no thickness.
- Solid- having three dimensions.
- Value- the numerical amount denoted by an algebraic term; a magnitude, quantity, or number.
- **Vertices-** The common endpoint of two or more rays or line segments. Vertex typically means a corner or a point where lines meet. (vortex)
- Volume- Volume is the measure of the amount of space inside of a solid figure, like a cube, ball, cylinder or pyramid. Its units are always "cubic", that is, the number of little element cubes that fit inside the figure.

Objective 1:

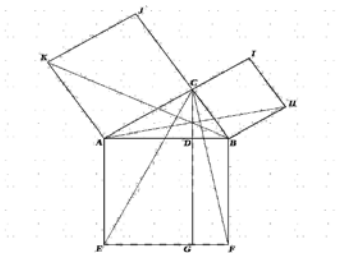
Participants will be able to Identify geometric shapes (2D & 3D)

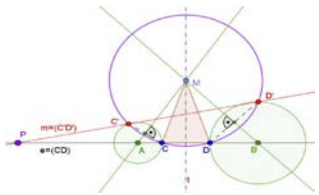
Part 1: Geometric Shapes: 2D and 3D

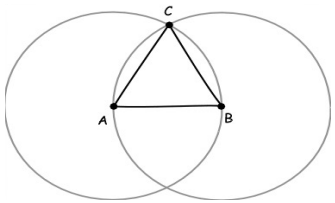
Introduction

The word *Geometry* is derived from the Greek word "Geo" and *Metron* which mean Earth and Measurement; the Earth's Measurement. Geometry is about the characteristics of figures and shapes, and is important in determining *areas, volumes, and lengths.* Euclid is known as the Father of Geometry. He is one of history's greatest mathematicians. Euclidean geometry is a mathematical system attributed to Alexandrian Greek mathematician Euclid, which he described in his textbook on geometry: the Elements. Euclid's method consists in assuming a small set of intuitively appealing axioms and deducing many other propositions (theorems) from these.

Examples of Euclidean Geometry

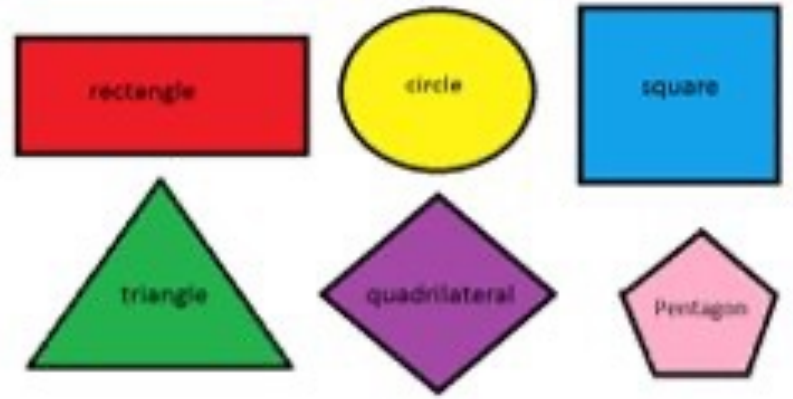






What is a Shape?

In geometry, a shape can be defined as the form of an object or its outline, outer boundary or outer surface. Everything we see in the environment has a shape. We can find different basic shapes such as the two-dimensional square, rectangle, and oval or the three-dimensional rectangular prism, cylinder, and sphere in the objects we see us. These geometric shapes appear in objects we see as credit cards, bills and coins, computer screens, baseballs, houses, and tall buildings, in the world around us.



What is a Shape?

Clearly young children can *see* differences between triangles and rectangles, and between books and balls. They may even know the names *triangle* and *rectangle*. But at the same time, they may not be able to analyze the basis for their discriminations. They may have no knowledge about the properties of triangles and rectangles. They may not understand, for example, that a triangle must have three sides, that it is a closed figure, or that both figures are polygons.

Classification

Young children need to go beyond perceiving sameness and difference. They must learn to classify objects that are *similar* (as opposed to congruent) in key respects. They need to learn that three-sided figures of different sizes are all triangles; that non-congruent but similar four-sided figures with equal length and right angles are all squares; that basketballs and globes are spheres; and that blocks varying in color can be cubes.

Space

Although their everyday spatial ideas are often useful (as in the case of moving around familiar surroundings) and sometimes surprisingly powerful (as in the case of complex symmetries), young children still have a great deal to learn and need adults to help them move forward. Teachers and parents can build upon and extend what young children already know about space. Adults can help young children mathematize their everyday ideas of space. This involves using language and various representations to describe and understand spatial ideas.

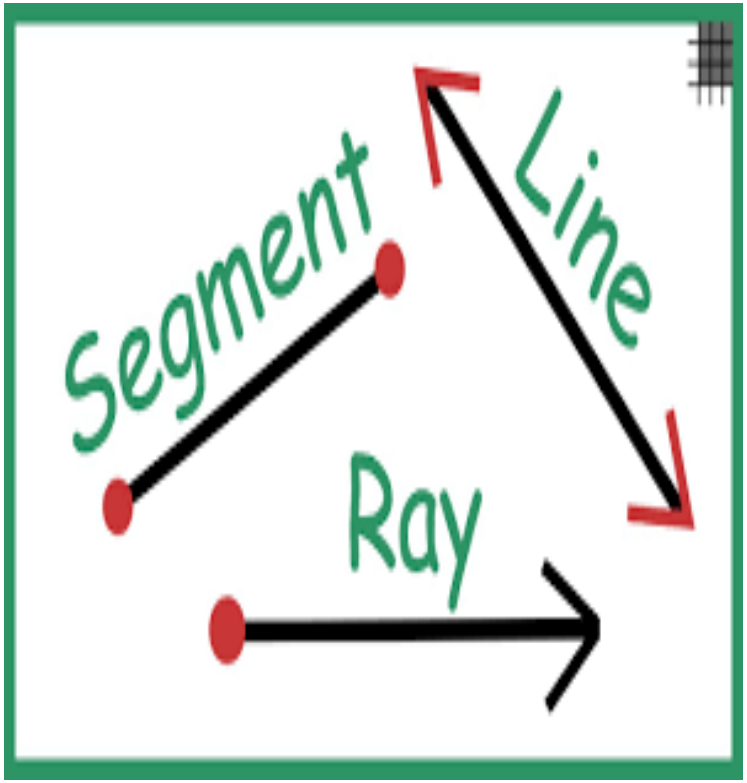
Spatial Ideas and Mathematical Understanding

To understand addition, a child might use ideas of merging two separate groups of objects or jumping to the right on a standard number line. To understand subtraction the child might think of monkeys jumping off a bed. To understand equivalence, the child might imagine balancing objects on a scale. To understand multiplication, the child might refer to areas or arrays of dots. Indeed, spatial metaphors and ideas permeate children's and adults' understanding of number.

Two-dimensional and Three-dimensional Symmetries

Children create both two-dimensional and three-dimensional symmetries all the time when they play with blocks. Figure 11 shows an example of how a child can explore symmetries using pattern blocks. Notice that in order to make this figure, the child had to manually rotate some of the blocks, such as the red trapezoids, to produce the mirror image. Young children may need to physically manipulate objects to correctly show the reflection. Further, these experiences can help a child later to develop the ability to see how shapes can be mentally turned or flipped without having to construct them.

One-Dimension (1D) Shape Activity



A **line segment** has two endpoints. It contains these endpoints and all the points of the **line** between them.

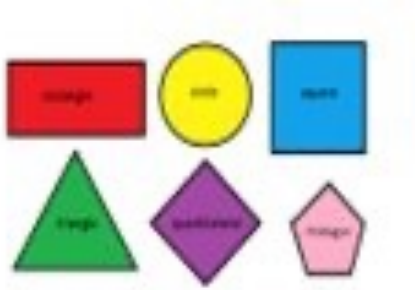
You can measure the length of a **segment**, but not of a **line**.

A **ray** is a part of a **line** that has one endpoint and goes on infinitely in only one direction.

Teach students the meaning of a line, segment, and ray. Use this terminology during daily teaching practices as students draw or use sidewalk chalk outdoors. “Draw a line. Now show me part of the line (segment). A line has no end. A ray is a line going in one direction.”

Draw Geometry Shapes Activity

Directions: Have students draw basic shapes by listening to the name of the shape as you describe how many sides the shape has.



Oval	Heart	Cross	Arrow
Right Triangle	Triangle	Circle	Star
Nonagon	Octagon	Heptagon	Heptagon
Hexagon	Rhombus	Square	Pentagon

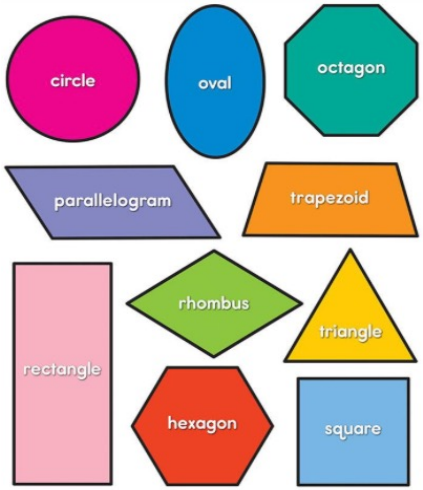
Use more complex shapes as students become more familiar with them.

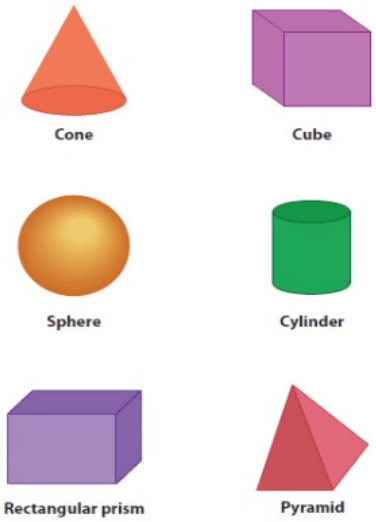
Guess the Shape! Activity

Objectives: Students will be able to guess the 2D or 3D shape by listening when read verbal characteristics of the shape.

Directions: Think about the properties or definition of 3 shapes and write a description for each. For example, a triangle has three sides and and three interior angles. Have class/group/student draw the shape in their journal as you read its properties. This can be done in a group, with a partner or individually. Students are learning spatial relations, classification, perception of sameness and differences, and Geometry basics!

Oval
What shape looks like a squished circle that looks like a balloon. Guess the shape!



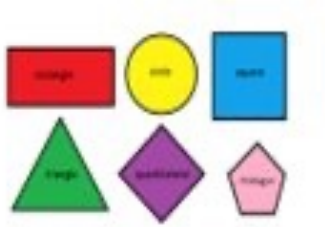


Cone
What shape looks like an ice cream cone? Guess the shape!

Variations:
Gather students in a circle. Hand them rope/yarn and tell them to move around and form a square or other shape without letting go of the yarn.

Two Types of Geometric Shapes

There are two types of shapes:



Geometric

Free-form

Geometric shapes are precise shapes that can be described using mathematical formulas.

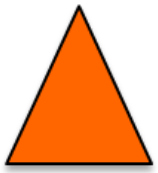
Free-form is a free style drawing.

2D Verbal Identification Activity

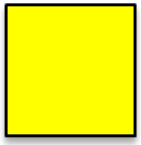
Objective: Students will be able to listen to verbal directions and count the number of vertices and edges of the 2D shape.

Verbal Instructions

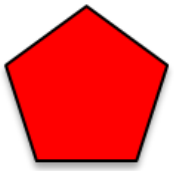
1. Draw a large *2D* shape on a sheet of paper.
2. Draw a *point* on the center of the 2D shape.
3. Draw a point on each *vertex.*
4. Count the number of vertices and edges.
5. Measure the *edge* from one vertex to the next and write measurements in journal



3 vertices
& 5 edges



4 vertices
& 5 edges



5 vertices
& 5 edges

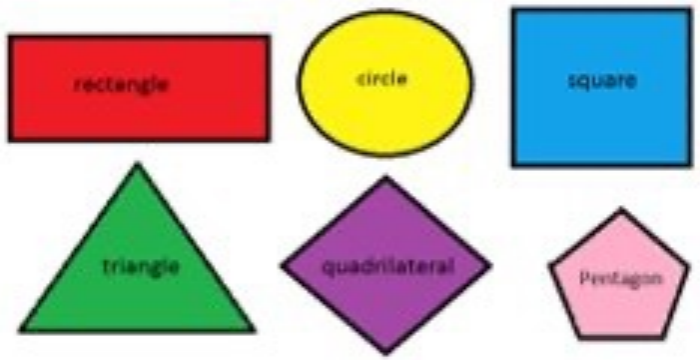
Number of Vertices _____

Number of Edges _____

Name of Shape _____

Two-Dimension (2D) Shapes

- A shape or a figure that has a length and a width **(Breadth)** is a 2D shape.
- The sides are made of straight or curved lines.
- They can have any number of sides.



Definition

What is *Breadth* in Math?

In mathematics a breadth is used to describe the distance from the right side to the left side of a shape.

The blue rectangle has a breadth of 20 inches.

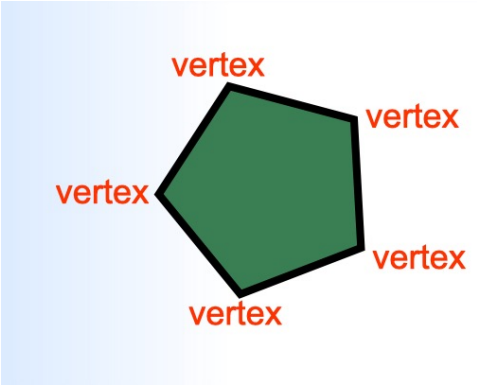
What is a Vertex?

A vertex is a point where two or more line segments meet. A corner.

Examples:

- any corner of a pentagon (a plane shape)
- any corner of a tetrahedron (a solid)

(The plural of vertex is "vertices".)

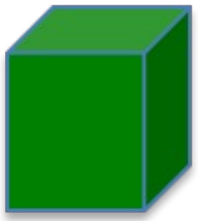


Vertices, Edges, Faces and Base

Vocabulary

Vertex, Edges, Faces, Base

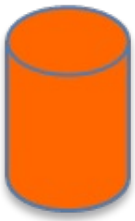
Every 3D-dimensional shape has three measurements. These are height, width, and length.



12 edges

8 vertices

6 faces



2 edges

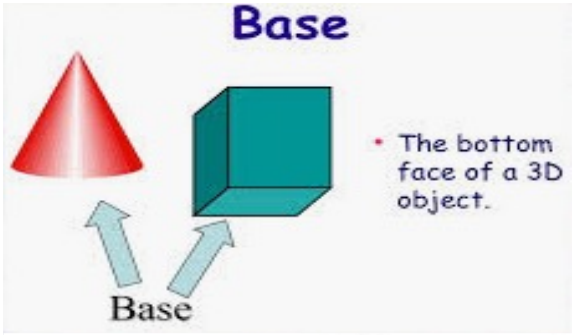
0 vertices

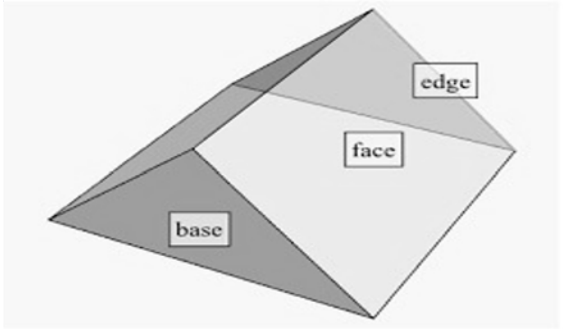
3 faces

1 edge

1 vertex

2 faces

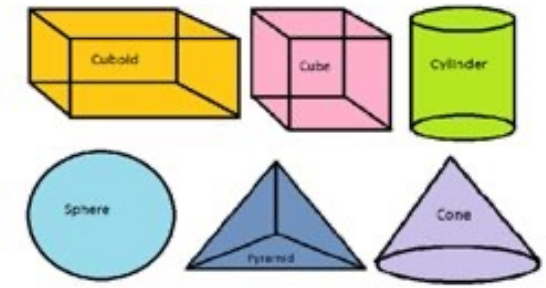




Three-Dimension (3D) Shapes

Three-dimension shapes all have some length, width and height or depth. Therefore, they all occupy space and have three dimensions. Figures that are drawn on paper and have length, width and height are called 3-D figures. A 3D shape has three dimensions. Three dimensional entities, can travel forward, backward, right, left, and even up and down.

The area of the green rectangle is 24. To find the **area** of a rectangle, multiply its height by its width. For a square you only need to find the length of one of the sides (as each side is the same length) and then multiply this by itself to find the **area**.



Definition

What is *Area* in Math?

The area of a space tells us how much space is inside of it.

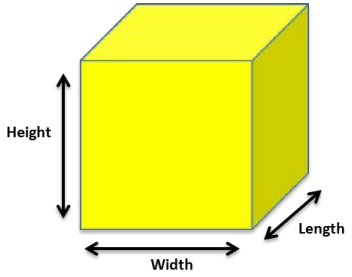
2in.

12 in.

The rectangle has a breadth of 12 inches.

3D Shape Measurement Activity

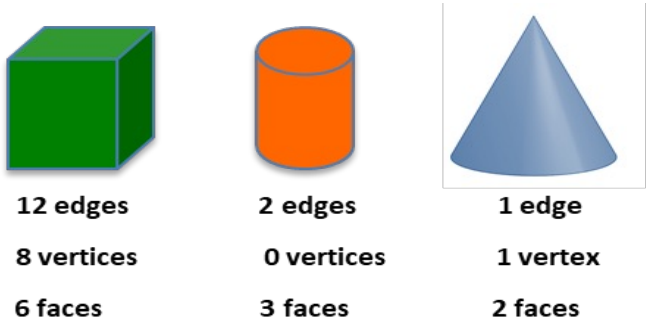
Objective: Students will be able to count the number of vertices, edges, and faces of a 3D shape and measure the height, width, and length using a variety of different size boxes.



Instructions

Before you begin, build on prior knowledge and introduce new vocabulary words.

1. Count the number of vertices, edges, and faces of the 3D object/box.
2. Measure the height of the 3D object/box and write the measurements in the journal.

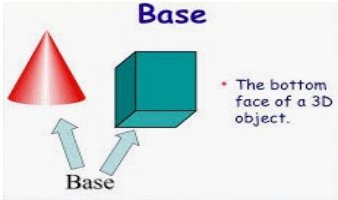


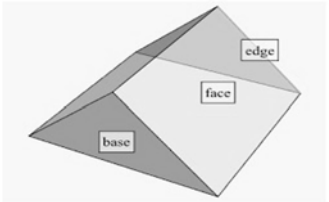
Number of Edges _____

Number of Vertices _____

Number of Faces _____

Name of Shape _____



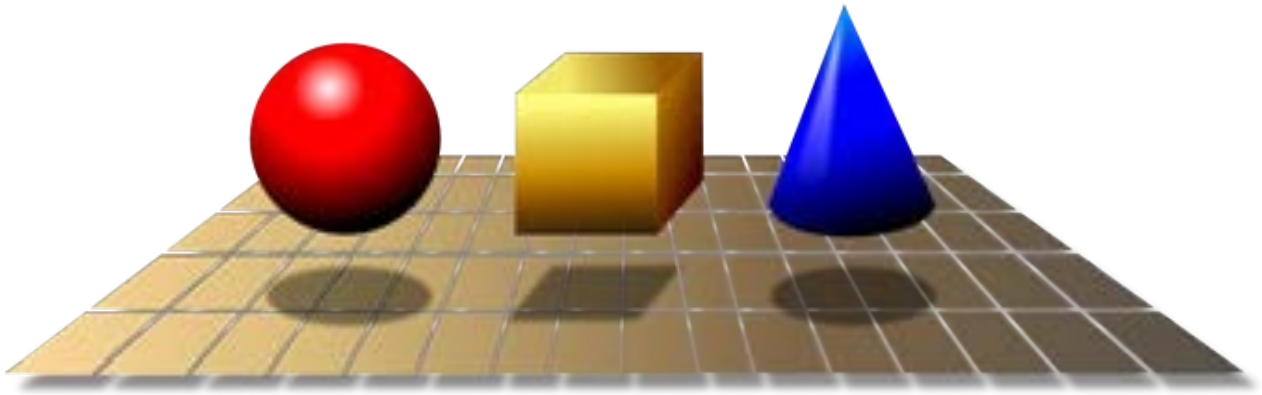


Part 1: Geometric Shapes: 2D and 3D Review

1. In geometry, a shape can be defined as the form of an object or its outline, outer boundary or outer surface.
2. Students are learning spatial relations, classification, perception of sameness and differences, and Geometry basics!
3. There are two types of shapes; Geometric and free form.
4. A line segment has two endpoints. It contains these endpoints and all the points of the line between them.
5. You can measure the length of a segment, but not of a line.
6. A ray is a part of a line that has one endpoint and goes on infinitely in only one direction.

Part 2: Geometric Dimensions:
Promoting Creative Thinking Skills

- Geometric Dimensions
- Geometric Dimensions 2
- Build a Cube Activity
- Draw a City with Geometric Shapes Activity
- Shape Web Activity
- Measuring Properties of a Circle
- Area and Perimeter
- Shape Robot Activity
- Review



Geometric Dimensions

Geometry is about shapes and their properties

Plane Geometry	Solid Geometry
can be drawn on a piece of paper line, circle, or triangles	refers to three dimensional objects cubes, prisms, spheres, and cylinders

Plane

A plane is two dimensions (2D), and two values. The point moves in a different direction. circles, squares, triangles, etc.

Solid

A solid is three dimension (3D). The point moves in another completely different direction. spheres, cylinders, cubes, etc.

Geometric Dimensions 2

Point

A point has no dimensions, only positions. It's just a point.

Line

A line is two-dimensional (2D), and one dimensional. A line has one value. The point moves from one direction to another.

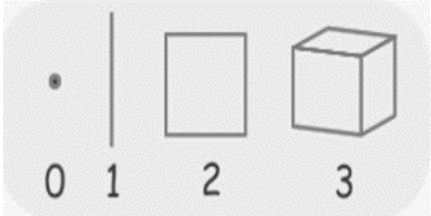
Geometry Dimensions

0 - Point

1 - Line

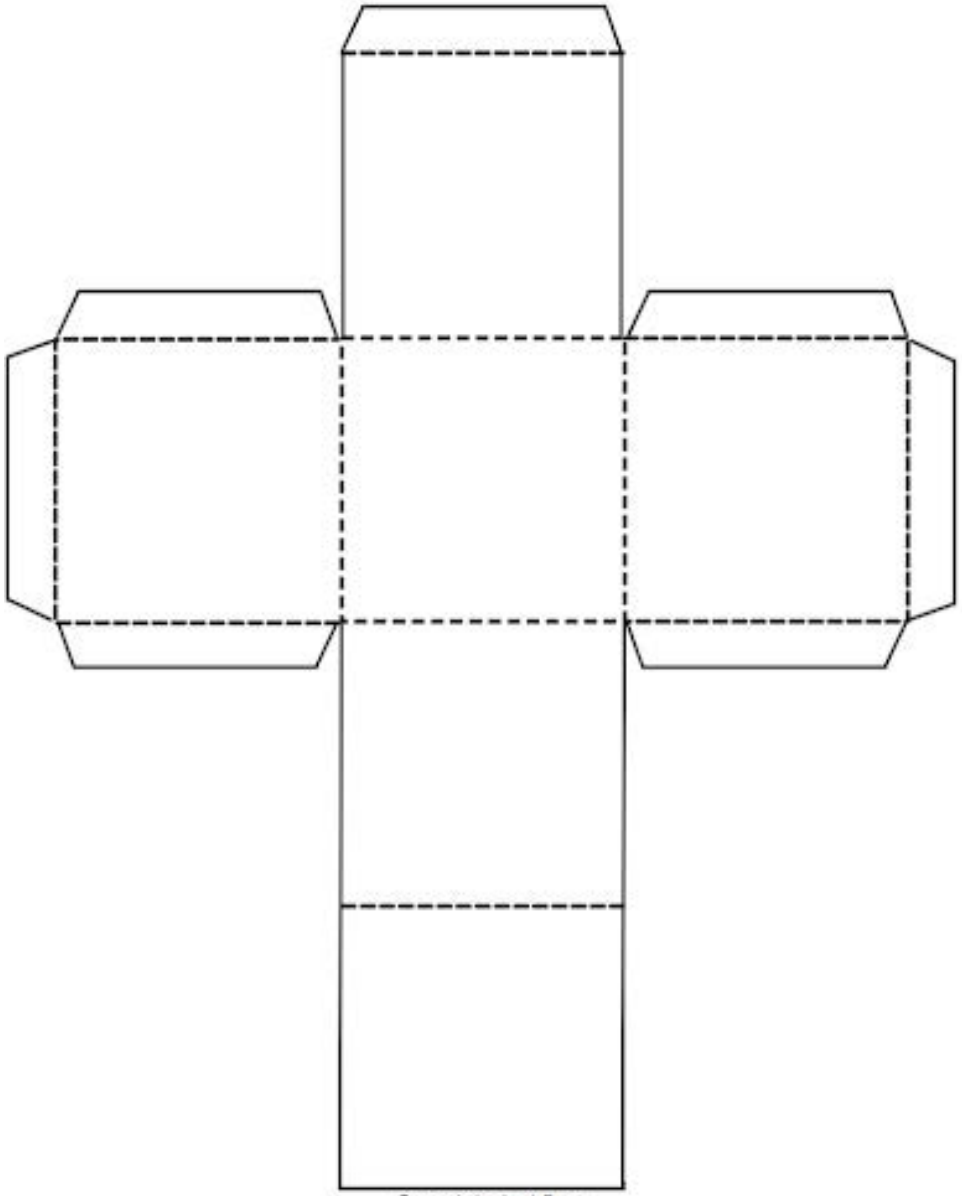
2 - Plane

3 - Solid



Build-a-Cube Activity

This is a simple yet powerful shift in building number sense! Using math tools and manipulatives allows **students** to engage with math facts and presents a strong visual for our learners. Have students write numbers or shapes on the cube.



Draw a City with Shapes Activity

Objectives: Students will be able to draw a city on chart paper or butcher paper and identify the 2D & 3D shapes by drawing a square, rectangle, circle, or triangle around the object formation.

Draw a City: Shape Identification Activity

Objectives: Students will be able to draw a city on chart paper or butcher paper and identify the 2D & 3D shapes by drawing a square, rectangle, circle, or triangle around the object formation.

Materials:

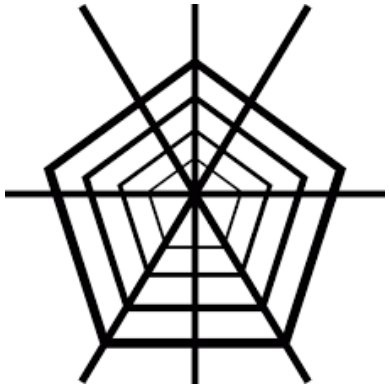
- Chart paper/butcher paper
- Drawing Utensils

Variations:

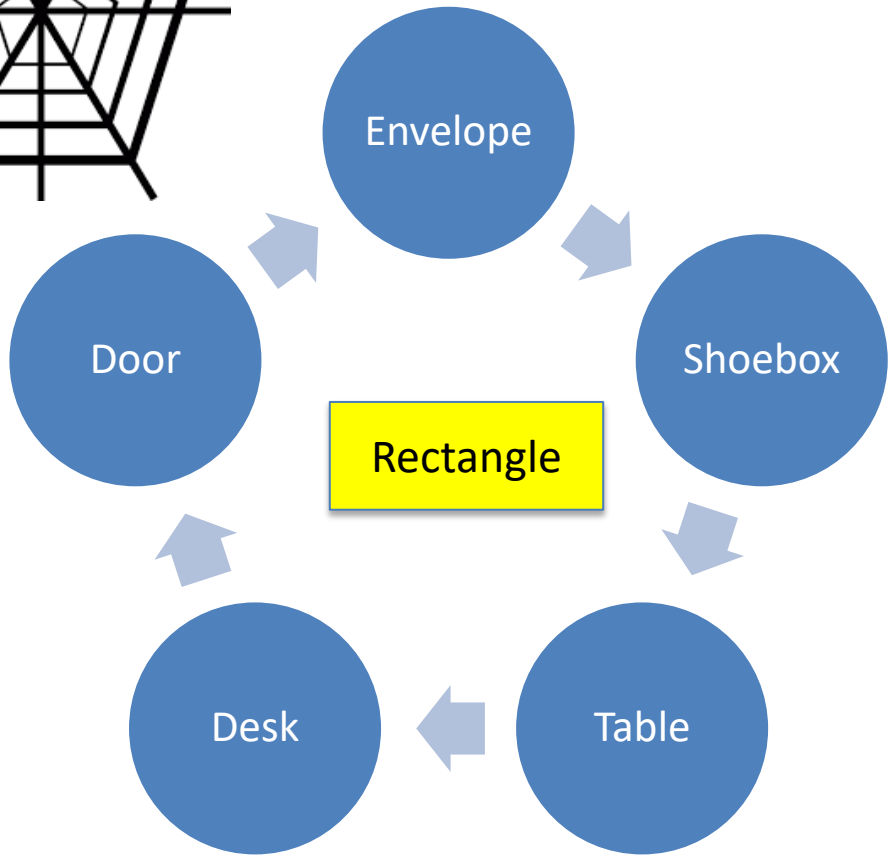
Provide students with specific shapes to use to build their city. Use more complex shapes to identify object formation.

Shape Web Activity

Directions: Have students walk around the room and list all the items that are in the shape of a rectangle, square, circle, etc.



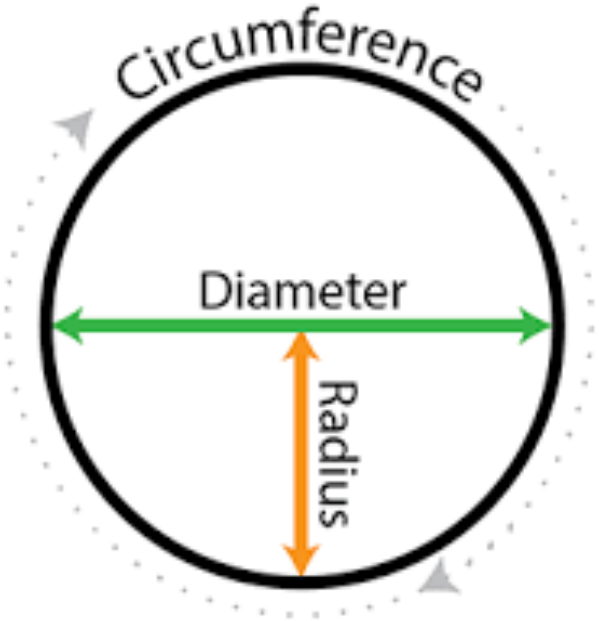
Shape Web Activity



Measuring Properties of a Circle

To measure the properties of a circle, start be measuring the circumference, the out of the circle. Next measure across the circle, the diameter of the circle. **Radius** definition, a straight line extending from the center of a circle or sphere to the circumference or surface: The **radius** of a circle is half the diameter.

Measuring Properties of a Circle



Students can start by measuring the circumference of each circle with a piece of yarn or string. The students should record their measurements in a journal. Next, encourage your students to draw a line across the center of the circle to mark the diameter. The students can use the ruler to measure the diameter and radius of each circle.

Area and Perimeter

The area of the green rectangle is 24.
To find the **area** of a rectangle, multiply its height by its width. For a square you only need to find the length of one of the sides (as each side is the same length) and then multiply this by itself to find the **area**.

Definition

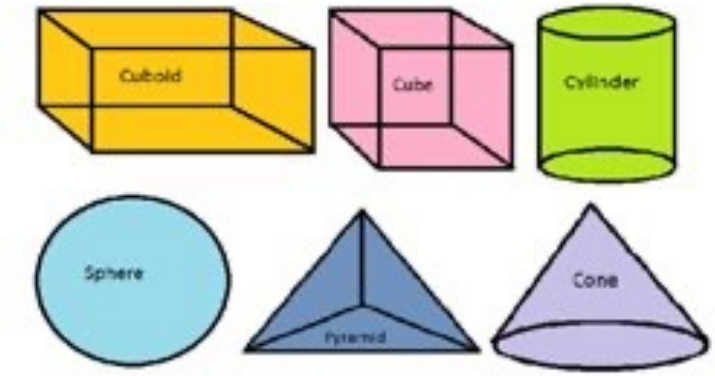
What is *Area* in Math?

The area of a space tells us how much space is inside of it.

2in.

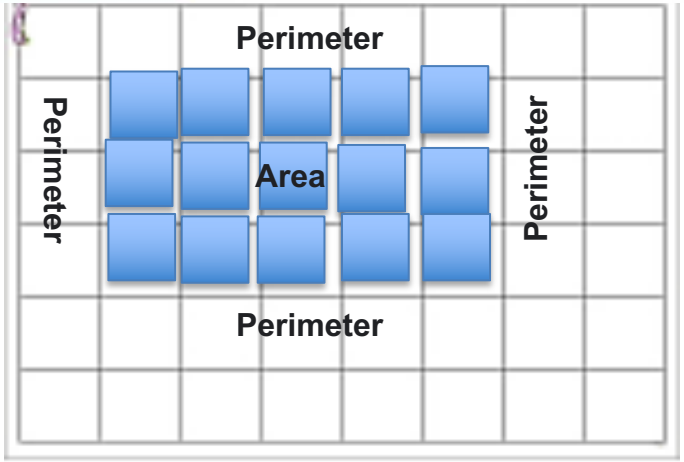
12 in.

12 x2 = 24

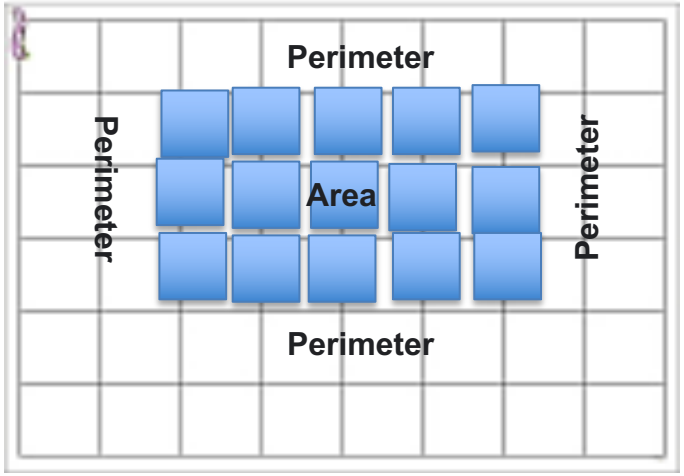


Area and Perimeter

NOTE: We found that the 6 by 3 **rectangle** works, because 6+3+6+3=18 and 6x3=18, so this has **equal area** and **perimeter**. ... But if both the length and the width are odd, then the **area** will be odd, meaning that it is impossible for the **perimeter** to be the **same** as the **area**.



Teach children to measure the perimeter of shapes. As you measure discuss the height and length. Write the numbers down on a paper. Use objects/blocks to count and add the numbers together. Students will be learning the concept of a perimeter and adding numbers of height and length. Squares and rectangles are great shapes to use to start teaching the basics of area and perimeter.



AREA AND PERIMETER ACTIVITY

PERIMETER IS THE DISTANCE AROUND THE OUTSIDE OF A SHAPE.

Directions: Provide students with Grid paper and ask them to color in the shape of a rectangle in a size of their choice.

AREA MEASURES THE SPACE INSIDE A SHAPE. THE AREA IS MEASUREMENT OF THE SURFACE OF A SHAPE. TO FIND THE AREA OF A RECTANGLE OR A SQUARE YOU NEED TO MULTIPLY THE LENGTH AND THE WIDTH OF A RECTANGLE OR A SQUARE. USE A RULER FOR MEASURING IN INCHES.

PERIMETER

Measure all sides of the triangle and add.

For example:

3 inches (Height)
5 inches (Width)
3 inches (Height)
\+ 5 inches (Width)

The perimeter of the rectangle is 12.

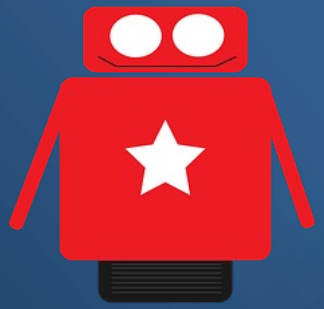
AREA

Measure the height and width of the Triangle and multiply

For example:

3 inches (Height)
X 5 inches (Width)

The area of the rectangle is 15.

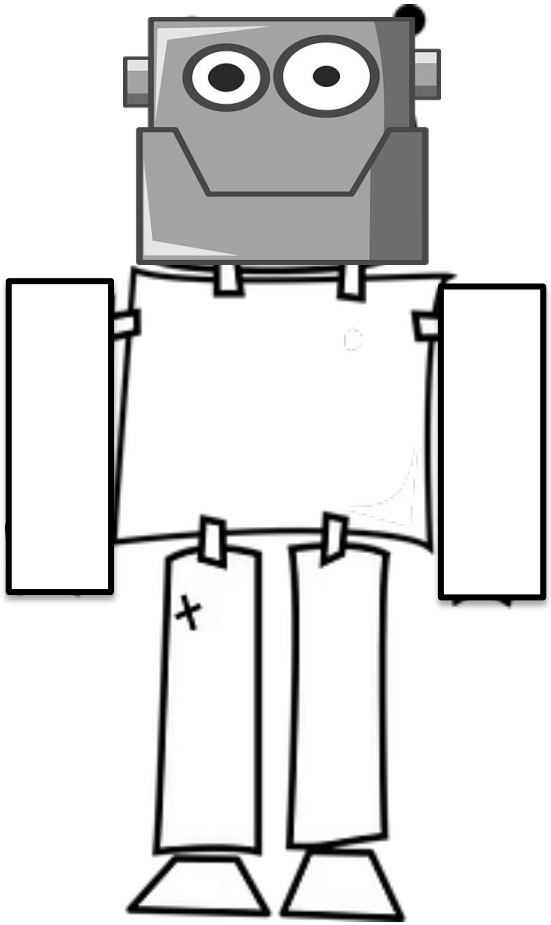


Shape Robot Activity

Shape Robot Activity

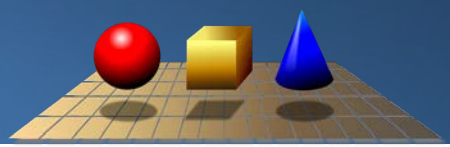
Objective: Students will be able to draw geometric shapes and measure the perimeter of the robot.

Directions: Have students draw a robot using shapes. Identify shapes. Measure the perimeter of the robot.



Part 2: Geometric Dimensions Review

Promoting Creative Thinking Skills



1. A plane is two dimensions (2D), and two values. The point moves in a different direction. circles, squares, triangles, etc.

2. A solid is three dimension (3D). The point moves in another completely different direction. spheres, cylinders, cubes, etc.

3. The radius of a circle is a straight line extending from the center of a circle or sphere to the circumference or surface: The radius of a circle is half the diameter.

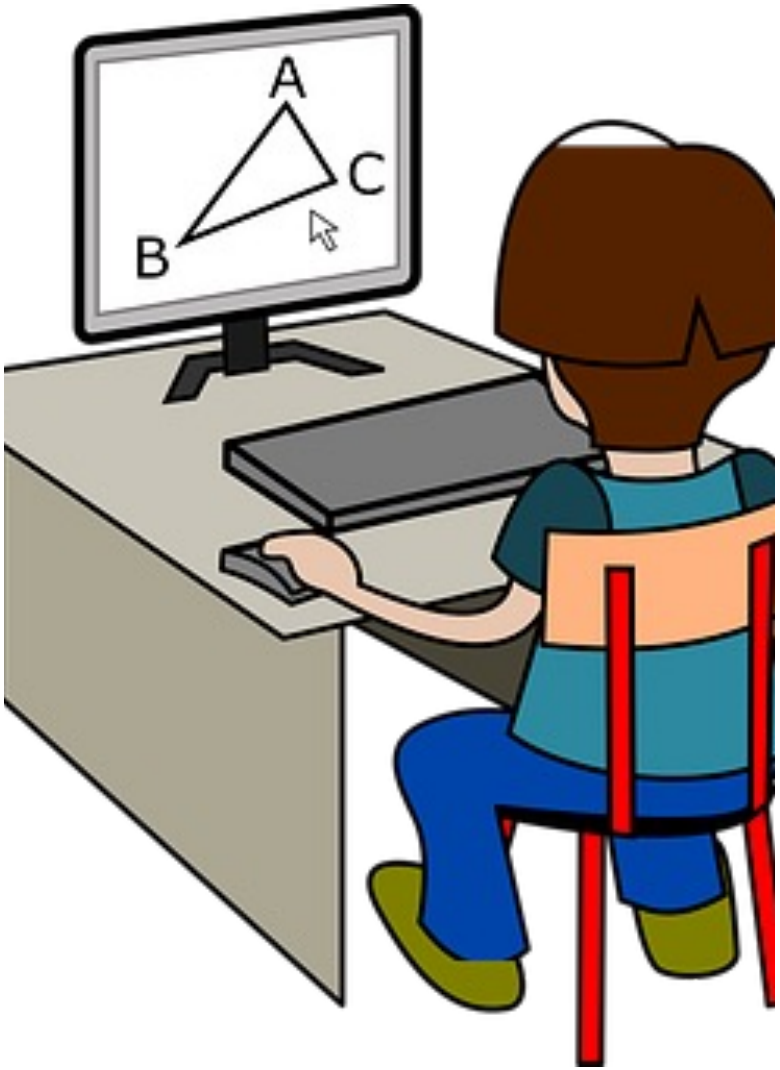
4. The area of a space tells us how much space is inside of it.

5. If both the length and the width of the perimeter are odd, then the area will be odd, meaning that it is impossible for the perimeter to be the same as the area.

6. Perimeter is the distance around the outside of a shape.

Part 3: Child-led Environments: Math in Everyday Play!

- Child Led Environments
- Engage students in a child-led early learning environment by engaging in the process of architecture innovation through building and construction.



Part 3: Child-led Environments: Math in Everyday Play!

Toddler and Preschool age children are in constant, active states of making sense of the world around them, formulating ideas about the way that different pieces of their world fit together based on their experiences. They are also very sensory oriented, and the majority of their "sense making" takes place through exposure to sensory input, where each of their senses is engaged in one way or another, giving them unique perspective and personal understanding of their environment.

Part 3: Child-led Environments: Math in Everyday Play!

Understanding the importance of architecture for young children is paramount for teachers and parents, as building and construction projects give children much tactile sensory input and allow for limitless “sense making” opportunities. The true process of architecture- original innovation through building and construction, is an important feature of any child-led early learning environment, as it fosters many areas of development for the child and nurtures connectivity and investment to the child’s larger community.

Part 3: Child-led Environments:

Math in Everyday Play!

Begin by helping children build a basic knowledge of shapes. Point out all the circles around you, such as plates or the tops of cans. Naming the shapes children see in their environment is important.

Extend these experiences by running your finger around the objects while you say "circle," and talk about how it keeps curving. Ask children to do the same. When you are talking about triangles, talk about the straight sides and the sharp corner.

Overview

1. Geometry encompasses two major components. One is reasoning about *shape and the other is space*.

2. In geometry, a shape can be defined as the form of an object or its outline, outer boundary or outer surface.

3. Young children need to go beyond perceiving sameness and difference. They must learn to classify objects that are *similar* (as opposed to congruent) in key respects.

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Transfer of Learning

How will you transfer learning into your work environment?

Think about strategies or activities that you found of interests.

- How will you use them in the classroom?
- How will you differentiate activities to meet students' needs?
- If you were observed in the classroom, would your supervisor see the connection between the training content and your interactions with students?

Appendix
Geometric Shapes