**Lesson Template (Grades 3-5)**

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**Title: Geometric Shapes**

**(I.) Contextual Framework:**

**(A.) Concept:** Geometry Standard

**(B.) Standard:** Use visualization, spatial reasoning, and geometric modeling to solve problems

**(C.) Expectation:** identify and draw a two-dimensional representation of a three-dimensional object;

**(II.) Teaching Framework:**

**(A.) Instructional Translation:** During this lesson, students will draw two-dimensional representations of three-dimensional objects. Upon completing this lesson students will be able to visualize geometric ideas and model various geometric ideas to solve problems.

**(B.) Prior Knowledge:** Prior to this lesson students have been introduced to concepts such as plane and three dimensional shapes. Students have been introduced to concepts such as problem solving strategies such as guess and check, work backwards, making a chart or graph, draw a picture and look for a pattern.

**(C.) Applied Example:** Given the following problem students will be able to find a solution: “Renee was asked to create a hole that cereal boxes can slide through. What should the hole look like?”

**(1.) Teaching Concept:** Students will (1) be able to describe each solid figure and plane shape (2) Identify shapes and their bases as you describe properties of each solid figure (3) match each three dimensional shape with a two-dimensional shape.

**(2.) Skills:** Students will gain experience in visualization and spatial reasoning as they solve real world problems.

**(3.) Essential Vocabulary**:

cube: a solid figure with 6 sides. Each face is a square.

sphere: A solid figure that has the shape of a ball.

rectangular prism: a solid figure that has six sides. Each side is a rectangle.

cylinders: a figure that has a curved surface and two flat circular surfaces like a pop can

cones: a figure that has a curved surface and one flat circular surface

face: If a solid figure has a flat surface we call that flat surface the face

edge: a line segment where two faces of a solid figure meet

solid figure: a figure that has length, width, height and volume

vertex: the point where two edges meet

side: plane figure forming part of the figure

pyramid: a solid figure with a polygon for a base and all of the other faces are triangles with a common vertex.

**(4.) Application:** Students will draw and describe properties of three-dimensional shapes and compare them to two-dimensional shapes in order to solve everyday problems.

 **(III.) Lesson Framework:**

**(A.) Prior Knowledge:** Students will review characteristics of plane shapes andtheir terminology.

**(1.) Teaching Concept 1:**

Teacher prompt: Copy slides #1 and #2 and #3.Put students in groups of two and give each group a set of the slides 1-3. Direct students to cut the cards a part and distribute a card to each child.

Teacher prompt: We are going to play a Geometry Match Up. This game will help you review the some of Geometry terminology

Teacher prompt: To play the game the first person will turn over two cards. If they match, they get to keep them and go again. If the terms do not match, it becomes the other person’s turn. Are there any questions?

Student response: No.

Teacher prompt: We are going to watch the first pair play, then we will all play.

Teacher prompt: Player A, it is your turn. Turn over 2 cards. What did you choose?

Student response: I got vertex and cylinder.

Teacher prompt: Is that a match?

Student response: No.

Teacher prompt: Play B, it is your turn. Turn over 2 cards. What did you get?

Student response: I choose a sphere and a solid figure that has the shape of a ball.

Teacher prompt: Is that a match?

Student response: Yes.

Teacher prompt: Great job, you may go again.

Student response: I got a cube and a side.

Teacher prompt: Sorry, that is not a match. Play A you may go.

Student response: I chose a figure that has a curved surface

 and one flat circular surface and one vertex and I chose a cone.

Teacher prompt: Great job, you may go again. Choose 2 more cards.

Student response: I chose a rectangular prism and a solid figure that has six sides, each side is a rectangle.

Teacher prompt: Is that a match?

Student response: Yes, that is a match.

Teacher prompt: Great job, you can go again.

Student response: I a cylinder and a cube. Your turn, that doesn’t match.

Teacher prompt: Player B, your turn.

Student response: I chose a vertex and the point where two sides meet. That is a match, I get to go again.

Teacher prompt: Great job, you may go again.

Student response: I chose a face and a flat surface on a solid shape

Teacher prompt: Great job, you may go again.

Student response: I chose an edge and a vertex. Your turn.

Teacher prompt: You may choose two cards.

Student response: I chose a line segment where two faces of a solid figure meet

 and edge. I get to go again, that is a match.

Teacher prompt: Great job!

Student response: I chose a vertex and a side, your turn.

Teacher prompt: Player A, you may go.

Student response: I chose a line segment where two faces of a solid figure meet and a vertex.

Teacher prompt: Great job, you may go again.

Student response: I chose figure that has length, width, height and volume and a three-dimensional

 Shape.

Teacher prompt: Great job! That is another match, go again.

Student response: I chose side and a cube. That isn’t a match, your turn.

Teacher prompt: Player B, your turn.

Student response: I chose a solid figure with 6 sides with each face is a square and a cube.

Teacher prompt: That is a match, go again.

Student response: I chose a figure that has a curved surface and two flat circular surfaces like a

pop can and a cylinder. That is a match.

Teacher prompt: Great job, go again.

Student response: There are only 2 left so they must match. I chose a side and line segment forming part of the figure.

Teacher prompt: Praise students for great work! Allow each pair of students to play.

 **(2.) Teaching Concept 2: Identifying two dimensional shapes that corresponds with solids**

Teacher prompt: We are going to look at several three- dimensional shapes. I want you to think in your head and visualize these solids looking at them in different positions.

Teacher prompt: What is the first shape? (Slide #4)

Student response: It is a rectangular prism.

Teacher prompt: Great job! Now, think about it if you were looking down from the top of it. What shape would it be?

Student response: It would be a square.

Teacher prompt: Great job. What would you see if you looked at it from the front?

Student response: It would be a rectangle.

Teacher prompt: You are right. It all depends on your point of view. Let’s look at another shape.

Teacher prompt: What is this shape? (Slide #5)

Student response: It is a cube.

Teacher prompt: What would you see if you looking directly down from the top?

Student response: You would see a square.

Teacher prompt: What if you looked at it from the front?

Student response: You would still see a square. No matter what viewpoint you take, it will always be a square.

Teacher prompt: What would you see if you looked across the top of it. Not directly down from the top but at a bit of an angle?

Student response: It would look more like a rhombus.

Teacher prompt: Great job visualizing this. You are all doing a great job!

Teacher prompt: What is this shape? (Slide #6)

Student response: It is a cylinder.

Teacher prompt: What shape would you see if you looked at it from the top?

Student response: It would look like a circle.

Teacher prompt: What would it look like if you looked at it from the front?

Student response: It would look like a rectangle.

Teacher prompt: How do you know it would look like a rectangle?

Student response: I know because I have traced around a pop can before.

Teacher prompt: Let’s see if you are correct. I have several cylindrical items. I want you to each choose one and trace around. What shape do you get when you trace it?

Student response: We all got rectangles.

Teacher prompt: You did a great job investigating that! Can you think of another three- dimensional shape that when you look at it from the top it will appear as a circle?

Student response: If you look at a sphere from any direction it will always look like a circle.

Teacher prompt: Great job, you are right. I have collected many different three-dimensional objects on the front table. I want you to all draw the top view and front views that goes with each three-dimensional object. For example, when you choose the pencil what will be the top view?

Student response: It will be a circle.

Teacher prompt: What will the front view be?

Student response: It will be a rectangle.

Teacher prompt: Great job. I want to see both views for each three-dimensional object. Are there any questions?

Student response: No.

Teacher prompt: Give students ample time to complete this task. Praise students as the work and help students who may be struggling.

**(8.) Application of standard concept(s):** (Connect to age appropriate life experience):

A designer drew up this picture of a patio for your family. You need to create a two dimensional drawing of the major structures to take them to the landscaper on Monday. ( Slide #7)

Teacher prompt: Read the scenario aloud as a group.

Teacher prompt: So, we need to turn this three-dimensional picture into a two-dimensional one. What is one important or major structure that you see?

Student response: The table and chairs.

Teacher prompt: Great. I would agree. They are right in the middle and seem to be important to the setting. What shape would the table be, if you were looking from above?

Student response: It would be a circle.

Teacher Prompt: Excellent, draw that near the middle of your page. What shape would the chairs be from above?

Student response: They would be seen as a square basically.

Teacher prompt: Good job. You are right. From above they would be a square. Draw four squares around the table.

Teacher prompt: What is another important feature of this setting?

Student response: I think the bird bath.

Teacher prompt: What two-dimensional shape would the birdbath be represented by?

Student response: It would be seen as two circles. The top one would be a little smaller than the bigger on. So, looking from above, the bigger circle would be around the littler circle.

Teacher prompt: Great job! Go ahead and draw that about where it would go with respect to the table and chairs. What is another important feature?

Student response: The shrubs going in a semi circle around the patio area.

Teacher prompt: How many shrubs are there?

Student response: There are 8 little light green shrubs and two bigger darker green shrubs.

Teacher prompt: In real life these would be more like spheres. What shape would they be from above?

Student response: They would be circles. The bigger green ones look like they would be more of an oval though.

Teacher prompt: I agree, go ahead and draw 8 smaller circles in an arc approximately where they would go around the table. Then, you can draw the two oval shrubs on the left side.

Teacher prompt: What other structures do you think are essential?

Student response: I think the grill is very important!

Teacher prompt: That is excellent. I agree. What two-dimensional shape would the grill be from above?

Student response: It would be a rectangle.

Teacher prompt: Great job! You may draw in the grill. Is there anything else we left out?

Student response: The shed.

Teacher prompt: Yes, the shed. The top of the shed is actually a pyramid. However, what shape would it look like from above?

Student response: It would like a rectangle if you were directly over it.

Teacher prompt: Great job, go ahead and draw in the shed. Now, you are ready to send your plans to the landscape designer

Teacher prompt: Praise students for their efforts.

**(B.) Modeling New Concept (standard):** During this stage of the lesson, students will be provided with real-life examples of the new concept and step by step demonstrations of how to create use two and three-dimensional shapes to solve real-world problems.

**(1) Concrete Example: Nets**

Teacher prompt: A local box company needs to choose a pattern to use to make their boxes from.

Teacher prompt: Look at slide #8. You need to visualize each of these different two-dimensional shapes folded up into three-dimensional shapes. I want to know which ones will create a box?

Teacher prompt: These are 4 of the designs the company is looking is at. We need to decide which of these nets will form a cube.

Teacher prompt: Let’s look at the first design. How many faces does a cube need? ( Slide #9)

Student response: A cube needs six faces.

Teacher prompt: You are right! Does this design have 6 faces?

Student response: Yes

Teacher prompt: Will this design be able to be folded to form a cube then?

Student response: No, it will not fold into a cube because there is not a top or bottom. All the faces are in a straight line. None of them will form a base.

Teacher prompt: You have a great point.

Teacher prompt: Pass out a copy of slide # 9 to each child. Direct students to cut out the design and fold it on the lines.

Teacher prompt: I have given each of you a copy of this design. Test the design. Our prediction is that it will not form a cube. Test it.

Teacher prompt: Give students ample time to complete this task.

Teacher prompt: Did anyone’s design form a cube?

Student response: No.

Teacher prompt: You were right then. To form a cube, you need two bases.

Teacher prompt: Let’s look design number 2. ( Slide #10)

Teacher prompt: A cube needs six faces right?

Student prompt: Right, and this one has 6.

Teacher prompt: Will this design be able to be folded to form a cube then?

Student response: Yes, because there are 4 faces in a line and those can be used to form the side faces. Then, there are two more faces. The one on the bottom can be folded to make the bottom base and the one on the top can be folded to make the top base.

Teacher prompt: Great job.

Teacher prompt: Pass out a copy of slide #10 to each child. Direct students to cut out the design and fold it on the lines.

Teacher prompt: I have given each of you a copy of this design. Test the design. Our prediction is that it will form a cube. Test it.

Teacher prompt: Give students ample time to complete this task.

Teacher prompt: Did anyone’s design form a cube?

Student response: Yes!

Teacher prompt: Show me your cube. You were right then. Great job!

Teacher prompt: Let’s look at the third design. (Slide #11)

Teacher prompt: Will this design be able to be folded to form a cube then?

Student response: No, it will not fold into a cube because there is too many faces coming off of the the line. If you fold this, it will make you have 3 bases and you won’t have 4 side faces.

Teacher prompt: You have a great point.

Teacher prompt: Pass out a copy of slide # 11 to each child. Direct students to cut out the design and fold it on the lines.

Teacher prompt: I have given each of you a copy of this design. Test the design. Our prediction is that it will not form a cube. Test it.

Teacher prompt: Give students ample time to complete this task.

Teacher prompt: Did anyone’s design form a cube?

Student response: No.

Teacher prompt: You were right. Great job!

Teacher prompt: Let’s look at the last design #12. How many faces does a cube need?

Student response: A cube needs six faces.

Teacher prompt: You are right! Does this design have 6 faces?

Student response: Yes

Teacher prompt: Will this design be able to be folded to form a cube then?

Student response: Yes because there are 4 faces in a row and then there are two extra pieces on the sides that can be folded to make the top and the bottom.

Teacher prompt: Great idea!

Teacher prompt: Pass out a copy of slide #12 to each child. Direct students to cut out the design and fold it on the lines.

Teacher prompt: I have given each of you a copy of this design. Test the design. Our prediction is that it will form a cube. Test it.

Teacher prompt: Give students ample time to complete this task.

Teacher prompt: Did anyone’s design form a cube?

Student response: Yes!

Teacher prompt: Show me your cubes.

Teacher prompt: So, which of these designs will should we tell the company forms a cube?

Student response: Design #2 and #4 will form a cube.

Teacher prompt: Great job! Praise students for their effort and work.

**(2) Step-by-Step Demonstration: Building shapes**

Teacher prompt: We are going to build some three-dimensional structures from two dimensional plans

Teacher prompt: Direct students to slide #13. This is our plan. We need to create a three-dimensional structure using these plans. The number in each square tells you how many cubes high it should be.

Teacher prompt: Pass out cubes to each child.

Teacher prompt: Looking at this plan, what is the back row of this plan going to look like?

Student response: It is going to look like stair steps.

Teacher prompt: What makes you think that?

Student response: I think it looks like stairs because the first one has three cubes then the next one will have 2 cubes then the last one will have three cubes.

Teacher prompt: You are right! Great thinking! Go ahead and build that with your cubes.

Teacher prompt: What is the second row going to look like?

Student response: It is going to look like small stairs. The first one will be 2 cubes tall, then the next one will be just one cube tall.

Teacher prompt: Great job! Build the second row with your blocks.

Teacher prompt: Monitor students as they build the second row, correct students ‘ errors and praise proper skills.

Teacher prompt: Now for the last row, how many will be in it?

Student response: There will be just one.

Teacher prompt: Great job! Go ahead and build the last row.

Teacher prompt: If you were flying above this structure what would it look like?

Student response: It would look kind of like a triangle.

Teacher prompt: You are right! Why would it be important to be able to see a flat, two-dimensional figure and be able to predict what kind of structure it is?

Student response: If you were in the Air Force and flying over buildings you would want to know what the buildings and structures were.

Teacher prompt: Great job! You are right! If you were flying over this structure, where would you be for it to look like the plan we started with?

Student response: We would need to be right over top of it.

Teacher prompt: Great job. Let’s try another.

Teacher prompt: Direct students to slide #14..

Teacher prompt: If we build a three-dimensional structure of this plan what is it going to look like?

Student response: It would look like a rectangular.

Teacher prompt: If each cube is an inch tall and an inch wide, how tall would the structure be?

Student response: It would be 3 inches tall.

Teacher prompt: Excellent job! How wide would it be?

Student response: It would be 4 inches wide because it is 4 cubes wide.

Teacher prompt: Great job! How deep would it be?

Student response: It would be 2 inches deep.

Teacher prompt: Great job! You may go ahead and build this structure. Make sure you follow the plan. Measure the dimensions and see if our calculations were correct.

Teacher prompt: Monitor students as the build their structures. Praise correct building and help correct students who are struggling!

**(IV.) Application Framework:**

**(A.) Practice:**

(1.) Guided Practice:

Teacher prompt: Direct students to question #1

Teacher prompt: Ask students to read the problem.

Student response: Name two three dimensional shapes that when viewed from above would be a square.

Teacher prompt: If we want to find something that looks like a square from above, what shape would its bases be?

Student response: It would have a square base.

Teacher prompt: That is great. What can you think of that has a square base?

Student response: A barn.

Teacher prompt: Great, what else?

Student response: A house or a shed.

Teacher prompt: Excellent, what else can you think of?

Student response: A trash can.

Student response: An electric box.

Student response: A table.

Teacher prompt: Those are all excellent ideas. Write down at least two in the work space.

Teacher prompt: Direct students to question #2

Teacher prompt: Ask students to read the problem.

Student response: Draw a plan that when viewed from above would appear as a square.

Teacher prompt: We need to think back to the activity we did with the cubes and the plans. There can be many different solutions to this problem. How will we know if one is correct or not?

Student response: After we have built the structure, we can trace around it to see if it is a square or not.

Teacher prompt: That is great. What will it look like if it a square?

Student response: All of the sides will have the same length.

Teacher prompt: Good job. Go ahead and start creating your plan. Make sure you write in the squares the number of cubes tall it is that way I know what the structure you built looks like.

Teacher prompt: Monitor kids’ work and praise drawings. Help struggling students.

Teacher prompt: Direct students to question #3

Teacher prompt: Ask students to read the problem.

Student response: A landscaper is going to plant 3 evergreen trees around the school and install one bench near the building. Draw a two dimensional plan of this.

Teacher prompt: What shape should we use to represent the school?

Student response: A rectangle.

Teacher prompt: Great job. Draw a rectangle in the space to the right. What shape would the trees appear as?

Student response: They would be circles because they are like a cone. They have round bases but come together at the top.

Teacher prompt: Excellent. On the right side, draw three circles to show where these trees will go.

Teacher prompt: What would the bench look like from above?

Student response: It would look like a rectangle.

Teacher prompt: Great job. Draw that on your plan. It needs to be near the building.

Teacher prompt: Monitor students as the work praising students and helping those in need.

(2.) Independent Practice: Direct students to complete the independent practice on the handout

**(B.)Validation:**

(1.) Reflection: Students demonstrate their understanding of the indicator and what they have learned by creating and describing three-dimensional structures from two-dimensional plans..

If they struggle (Re-teaching):

Prompts/Questions:

Teacher prompt: What three-dimensional shape would match a cube?

Teacher prompt: What is the difference between two and three-dimensional shapes?

Teacher prompt: Why is it important to be able to transform a mat plan into a three-dimensional structure?

Teacher prompt: What occupational would use these skills?

(2.) Concrete Example:

Examples: NASA has been looking at some satellite images and have discovered some dark square shapes resting at the bottom of the ocean floor. Make a list to submit to NASA to explain what these spots might be.

Teacher prompt: What is the problem we are asked to solve?

Student response: We need to figure out what the objects could be at the bottom of the ocean that have a square shape.

Teacher prompt: Great, are some possibilities?

Student response: Maybe it is a treasure trunk.

 Student response: Maybe it is a table that got tossed overboard.

Student response: It could be some windows.

Teacher prompt: Great job, work with a partner to generate as many ideas as you can.

Teacher prompt: Monitor groups as they work. Praise efforts and redirect those who are coming up with inaccurate responses.

If they are successful:

Reinforce:

(3.) Constructive Response Item/Open-Ended Question: Draw a picture of our school as if you were looking at it from a plane. Only draw objects that are polygons. Label each structure. Explain how a map like this might be helpful and who would use it.

Criteria for grading:

1. The student drew at least 5 structures. The two-dimensional drawing matches the real three-dimensional objects (10 pts).
2. Each object is labeled. (5 pts)
3. The student gave a reasonable explanation. (10 pts) Example: A landscape designer might use a map like this as a plan to show where bushes and gardens are going to be placed near buildings and other structures.

**(V.) Extensions Framework:**

(A.) Activities for Children in Need of Enrichment:

* Invite students to interview a pilot. Have students ask the pilot to bring in aerial photos to look and evaluate the two-dimensional objects. See if the students can figure out what the real shape of the buildings are.
* Have students look at their school or neighborhood on Google Earth. Look at the area in two dimension and three-dimension views to compare and contrast the views.
* Have students use Google Sketch up to design the classroom using three-dimensional and two dimensional representations.

(B.) Activities for Children with Special Learning Needs:

* Have students look at their school or neighborhood on Google Earth. Look at the area in two dimension and three-dimension views to compare and contrast the views.
* Have students review the shapes and their characteristics.
* Have students stamp the bases of three-dimensional shapes on paper to form two-dimensional shapes.

**Attributions (References):**