Big Blue Blocks and Grade 6 Mathematics

Common Core State Standards – Mathematics Grade 6

Unit Standards

CCSS.6.G Solve real-world and mathematical problems involving area, surface area, and volume.

6.G.1 Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

CCSS6.RP Understand ratio concepts and use ratio reasoning to solve problems.

6.RP.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."*

6.RP. 2 Understand the concept of a unit rate *a/b* associated with a ratio *abs* with *b* =/ 0 and use rate language in the context of a ratio relationship. *For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."*

6.RP.3.c Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.

CCSS 6.NS Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

6.NS.1 Interpret and compute quotients of fractions and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/by.) How much chocolate will each person get if 3 people share 1/2 lb. of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?*

Title	Standard(s)	Lesson Description
Day 1: Bringing Plans to Life	6.G.1 Materials: Big Blue Blocks Set Rulers or measuring tapes Paper and Pencils	Summary: Working in groups, students will plan an architectural structure, drawing their plan and sketching what the structure will look like. Students then build the structure, taking measurements as necessary so that when their construction is finished, they can compute its full volume.
Day 2: What's Up with This Relationships?	6.RP.1 Materials: Paper and Pencils Big Blue Blocks Set Handouts describing real-world examples of proportional relationships	Summary: Introduce the concepts of ratio and proportion using the Big Blue Blocks to illustrate. An example such as a recipe works well, but it should be a real-world example that students recognize and are familiar with. Explain, for example, that a recipe requires 1 spoonful of butter and 2 eggs for every 3 cups of flour. Illustrate the relationship directly with the blocks, using a different block or blocks to represent each part of the recipe. Then ask students to apply the ratio. For example, if there are six cups of flour, how many spoons full of butter and how many eggs? Break students into small groups and give each a handout describing real-world examples of proportional relationships. Students will determine the ration, making their calculations on paper. Students will then show the ratio using Big Blue Blocks.

Day 3 Party Planning	6.RP.2 Materials: Paper and Pencils Big Blue Blocks Set 1 of each shape of the Big Blue Blocks, labeled as different party "ingredients" Whiteboard	Summary: Students will work in groups to plan a party and make a budget. The goal is to plan a party with the lowest cost per guest. Show students their "menu" of party options and prices. One type of block could be venue rental, others could be labeled and priced for food, drinks, entertainment, or games, and so forth. Provide multiple options, but limit students to fewer options, so that they must weigh their choices. Students will gather the shapes to correspond to the party options that they want. Once students pick their party "ingredients," they decide how many people should come to the party. They then calculate the price per guest by determining the unit rate. Demonstrate on your whiteboard or other device how to calculate the unit rate (in this case the price per guest) using a hypothetical party. Students' groups make their own calculations and reveal their prices. Lead a discussion about how the price per guest changes depending on party options and how many guests are invited. Next, give students the opportunity to plan a party, and use Big Blue Blocks to represent their "ingredients," without restrictions on their choices. Then discuss the difference caused in the ratio relationship.
Day 4: Build It Up and Break It Down	6.G.1 Materials: Big Blue Blocks Set Pencils Rulers or tape measures Timer Handout with multiple geometric shapes, including	Summary: This lesson gives students a chance to really engage with the Big Blue Blocks. Start the activity by allowing students to have free play with the Big Blue Blocks. Ask students to build their own structures as they like. When they have completed their structures, distribute the handout. Tell students now that they have built their structures, it is time to break them down by shape. They must find as many of the shapes as possible and calculate the area of the shape, showing their work on their handout. Encourage them to get creative

	right triangles and other triangles, polygons and special shapes, and circles, along with the formula for area.	and explain that they can take apart their structures and use their blocks to build some of the shapes they need to find. Pass among the students and offer help. Give students 20 minutes to find their shapes. If a student could not find one or more of the shapes, ask other students to show how they were able to find the shapes. NOTE: Students will find that they must construct many of the triangles. You can tell them to build the triangles or look closely at the rectangles and see that the rectangle could be viewed as two triangles and can be measure as such.
Day 5: How to Get Your Fair Share	6.NS.1 Materials: Big Blue Blocks Paper and pencils Handout with three scenarios Whiteboard	Summary: Students will use the Big Blue Blocks to represent division using fractions. Distribute the handout. The scenarios are: There is ¾ of a birthday cake on the table. You and four friends each want a piece. What fraction of the cake does each person get? Your parents give you and your two siblings 2 ½ (5/2) hours of television time each day. You don't agree on what to watch, so the three of you agree to divide the time equally among you. How many hours of television time, represented as a fraction, do you get? You and three friends pooled your money to buy a hoverboard. You decide to rent the hoverboard out, and the investment you and your friends made paid off. You have $350 (3 ½ hundreds) in profit. How much money do each of you get if you split the profit equally?

		Then demonstrate, using the Big Blue Blocks, how to represent a fraction. For example, to represent ¾, use four of the same block, and explain "out of these four, we only get three." Then, move those three blocks slightly away from the fourth. Next, explain that these blocks need to be divided between two of the students, meaning each takes half of the ¾. Ask students to visually determine how many blocks each one gets. Then demonstrate the mathematical equation for determining the fair share. After your demonstration, have students use the Big Blue Blocks to represent each scenario. Ask them to visually judge the "fair share," then show and solve the appropriate division by fraction. Explain that their solution must be in the form of a fraction.
Day 6: How Big Are We Talking Here?	6.RP.3.c Materials: Big Blue Blocks Paper and pencils	Summary: Students will visualize percentages and work to determine the "whole" based on a given percentage and part. Begin by setting up 10 of the same Big Blue Blocks. Explain that each block represents the number 10, and all the blocks together make 100. Explain that having all the blocks means that you have 100% of the blocks. Explain that per-cent means "part of 100." The most you can have is 100%. Now ask students how many blocks they should take if you gave them 30%. Thirty out of 100. Students should select three blocks of tens. Form small student groups and ask them to recreate the scenario, but then give them a few percentages to represent. Ask: "Show me 40%

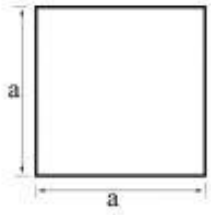
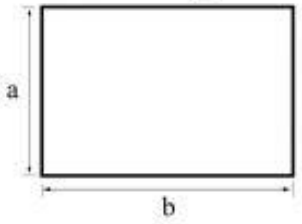
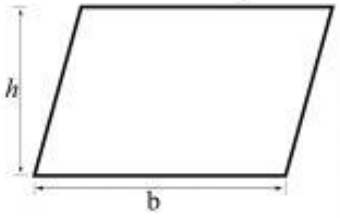
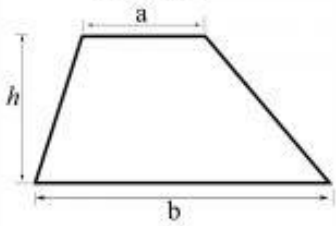
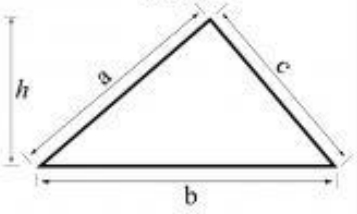
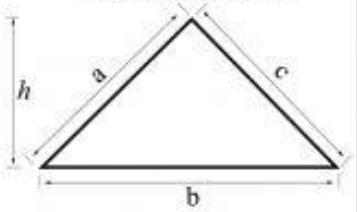
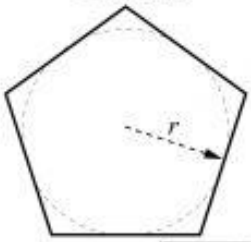
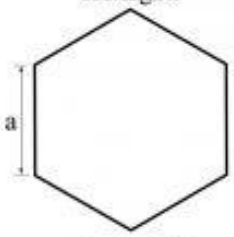
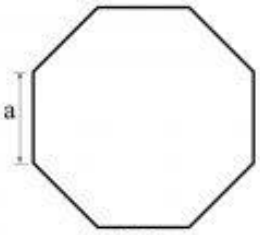
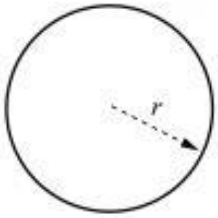
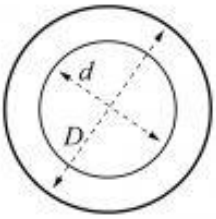
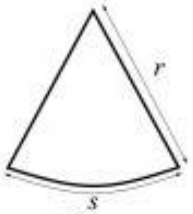
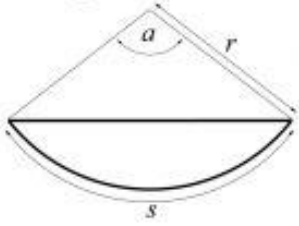
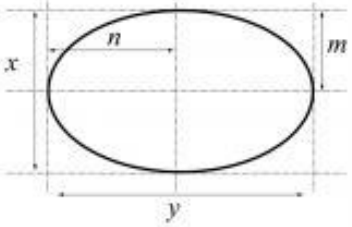
		of the blocks." Have the groups hold up the right number of blocks. You might challenge them as ask "Show me 65% of the blocks." Next, challenge students with this scenario: If you know you have 25% of all the available Halloween candy and you got 15 pieces, how many pieces of Halloween candy are there in total? Guide students on how to represent this scenario with blocks. Tell them they can use smaller block to represent the 5 in 25%. They know what 25% looks like. They should have two blocks with one smaller block. Now explain that instead of looking at the three blocks as "25," they should see the whole set as the number 15. That's the number of pieces of candy. See if they can determine that there are sixty pieces of Halloween candy in total. If they can see that 25 times 4 is 100, they can also see that their 15 pieces of candy must be counted four times. Demonstrate how to find a whole given a part and percentage. Ask students to represent their scenario in the form of an equation on their papers, and then solve it.

Day 1
Build It Up and Break It Down

Standards	CCSS.6.G Solve real-world and mathematical problems involving area, surface area, and volume. 6.G.1 Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.
Materials	• Big Blue Blocks • Pencils • Rulers or tape measures • Whiteboard or other demonstration device • Handout with multiple geometric shapes, including right triangles, polygons, circles, and special shapes, along with the formula for their area. (provided)
Learning Objectives	Students will be able to: • Recognize a variety of geometric shapes • Calculate area of geometric shapes • Recognize geometric shapes in everyday life • Understand how to apply their knowledge to common scenarios
Teaching & Modeling	**Individual work:** Tell students they get to both build and destroy today. Ask students to use the Big Blue Blocks to build a construction of their choosing. Encourage them to get creative. Allow 20 minutes for free play and construction. Pass through the class to offer assistance and encourage creativity.

	Next, distribute the handout. Explain that the handout is like a scavenger hunt, and they must look closely at their structures to find as many two-dimensional shapes as they can and calculate the area of each shape. The students will have to break down their constructions and create new ones to build as many of the shapes as they can. Instruct them to then take measurements of their shapes and calculate the area using the provided formulas. They should show their work on the back of their handouts, showing a drawing of the shape they found, its measurements, and their calculation. Pass among students to offer assistance and guidance, and to confirm that they are selecting the correct shapes. Allow 20 minutes for this portion of the lesson. NOTE: Students will find that they must construct triangles. You can tell them to build the triangles or look closely at the rectangles and see that the rectangle could be viewed as two triangles and can be measured as such. **Model calculating area:** Before students start looking for their shapes, use the whiteboard to model how to calculate the area of each shape using the mathematical formulas. **Whole group:** Ask students to volunteer to show the shapes that they built or found (or call on students to do so). Ask students to think of settings or places in their own lives where they recognize geometrical shapes. As students give examples (a kitchen cabinet door, triangular tiles in their bathroom, square tiles on the floor of the classroom, etc.) write them on the whiteboard.
Evidence of Learning	• Students recognize geometric shapes in many contexts • Students accurately calculate area on their handouts

Areas of 2D shapes

Square  $A=a^2$	**Rectangle**  $A= ab$	**Parallelogram**  $A= hb$
Trapezium  $A= 0.5h(a+b)$	**Triangle**  $A= 0.5bh$	**Equilateral triangle**  $A= b^2\times¼\times\sqrt{3}$
Pentagon  $A= 5/8\times r^2\times\sqrt{(10+2\sqrt{5})}$	**Hexagon**  $A= 1.5a^2\sqrt{3}$	**Octagon**  $A= 6.64a$
Circle  $A= \pi r^2$	**Annulus**  $A= \pi/4\ (D^2-d^2)$	**Sector of a circle**  $A = \frac{\pi r^2}{360^\circ} = 0.5sr$
Segment of a circle  $A = 2r\bullet\sin 0.5a$	**Ellipse**  $A = \pi/4yx = \pi mn$	