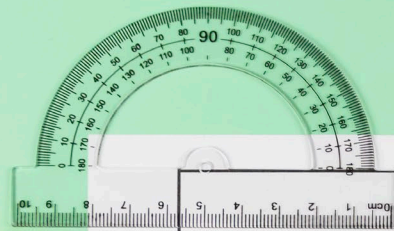


PLAYGROUND ARCHITECT

STEM Project Based Learning

4th Grade Print & Google Slides



MODEL MAKING

PLAYGROUND FEATURES

Now that your playground model has been fenced in, you can decide which other playground features you would like to include in your proposal. Read the information and follow the steps below.

1. The table below shows the different features some of these features on your model, so you can decide which other playground features you would like to include in your proposal. Read the information and follow the steps below.

| Feature | Actual | | |
|------------------|--------|-------|-----------------------|
| | Length | Width | Area |
| Climbing wall | 20' | 10' | 200 ft ² |
| Basketball court | 30' | 50' | 1,500 ft ² |
| Sandbox | 15' | 20' | 300 ft ² |
| Swings | 30' | 15' | 450 ft ² |
| Jungle gym | 20' | 15' | 300 ft ² |
| Butterfly garden | 25' | 15' | 375 ft ² |
| Roundabout | 10' | 10' | 100 ft ² |
| Slides | 15' | 15' | 225 ft ² |
| Blacktop | 40' | 20' | 800 ft ² |
| Picnic pavilion | 25' | 25' | 625 ft ² |

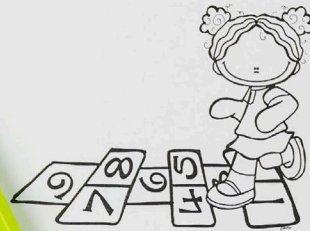












Your school is getting a new playground!
Work on a plan to submit to your
principal for the new playground.

MODELING SUPPLIES

As you brainstorm and plan out your idea for a new playground, you will be making various models.

During the course of this project, you will need the materials shown on the clipboard to make your models and answer questions about them.



-  Five sheets of 8.5" x 11" printer paper
-  Pencil
-  Ruler
-  Scissors
-  Glue
-  Markers, colored pencils, or crayons
-  35 toothpicks
-  About 20 mini marshmallows, gumdrops, small balls of play dough, or anything you can use to stick toothpicks in that will hold up and connect the toothpicks
-  Paperclip
-  Protractor (if completing Challenge #1)

© Julie Baker

JUNGLE GYM

LET'S GET BUILDING

4. Each of the three fence options comes in sections. The length of each section is different depending on the type of fence. Using the total amount of fence you found in question #1, determine how many sections of each fence type you will need. Fill in your answers on the table below.

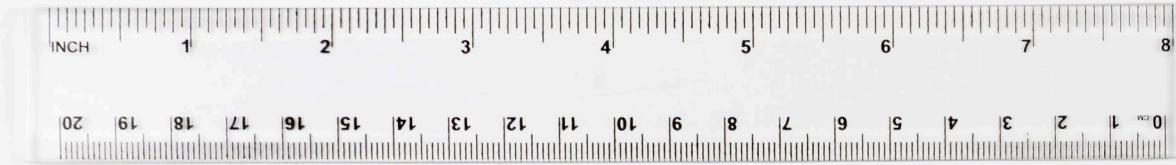
| FENCE OPTION | SECTION LENGTH | # OF SECTIONS NEEDED | PRICE PER SECTION | TOTAL PRICE |
|--------------|----------------|----------------------|-------------------|-------------|
| Wood | 10 feet | 32 | \$85 | \$2,720 |
| Metal | 4 feet | 80 | \$37 | \$2,960 |
| PVC | 8 feet | 40 | \$56 | \$2,240 |

5. The price per section of fence is shown in the table. Determine the total price for each type of fence. Fill in your answers on the table.
6. Based on the pros and cons you listed in question #3 and the total prices you found, which fence do you choose for your playground? Justify your answer.

Wood. Medium price, beautiful and easy to shape

Use measurement and budgeting skills to create your design.

Google Slides Option



3. The walkway leading from the school to the playground gate is 84 feet long. Find the length of the walkway in inches and yards.



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FINISHING TOUCHES

4. You want to plant tulips along the fence on the inside of the playground. You find a local garden center that sells tulip bulbs in bulk. Use the information below to determine how many of each color bulb come in one lot of tulip bulbs. Fill in the missing information in the table. Use the textbox to show your work.

| Color | Red | Yellow | Pink | Orange | Purple | White | Fuchsia |
|-----------------|-----|--------|------|--------|--------|-------|---------|
| Number of bulbs | | 36 | | | | | |

- A. There are 8 times as many pink bulbs as yellow bulbs.
B. There are 12 times as many pink bulbs as there are white bulbs.
C. There are 5 times as many red bulbs as white bulbs.
D. There are as many purple bulbs as red and white bulbs put together.
E. The number of fuchsia bulbs is one-third of the difference between the number of pink and purple bulbs.
F. The number of orange bulbs is more than the number of yellow bulbs but less than the number of fuchsia bulbs, and the sum of its digits is 5.

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CHALLENGE #1: MURAL

There is a large, empty wall of the school that faces the playground. As part of the playground design contest, the principal has requested that contestants submit proposals for murals to be painted on the wall. The theme of the mural must be friendship. Use the line , shape , or scribble tools to draw your mural in the space below or sketch your idea on a piece of paper. Be sure to include all the shapes and elements listed in the table below.

SELF-REFLECTION

Write a reflection of your experience with this project. How did you feel about the math problems and activities? Explain what you found easy to do and any difficulties you had while working on this project. Did you enjoy this activity? Why or why not?

I really enjoyed working on this project. It was hard, but I loved it.

SELF-EVALUATION

Circle one box per row on the rubric that expresses how you rate yourself on this Project Based Learning Activity.

| + | ✓ | - |
|--|---|---|
| I felt very confident about the math in this project. | I felt pretty good about my ability to complete the math in this project. | I felt a lot of the math in this project was too hard for me to do alone. |
| I understood all of the math and did not need help to complete the problems. | I understood most of the math but needed a little help to solve some of the problems. | I understood some of the math but needed help to complete most of the problems. |
| I easily used many strategies to solve the math problems efficiently. | I needed some help to use the best strategies for solving the math problems. | I had trouble understanding the best way to solve many of the math problems. |
| I feel I am ready for a harder math project. | I feel I would like to spend more time practicing similar math problems. | I feel I need assistance to work on similar math problems. |

Student rubric and reflection for easy assessment.

TABLE OF CONTENTS

- I. Teacher Directions & Standards Addressed
2. Student Directions
3. Modeling Supplies
4. Model Making (Measurement, Area & Perimeter)
5. Let's Get Building (Area & Perimeter, Multiplication & Division)
6. Playground Features (Area & Perimeter, Converting Measurements)
7. Jungle Gym (Model Building)
8. Finishing Touches (Word Problems)
9. Challenge #1: Mural (Geometry, Measurement)
10. Challenge #2: More Models (Building Models)
- II. Self-Reflection & Evaluation
12. Answer Key



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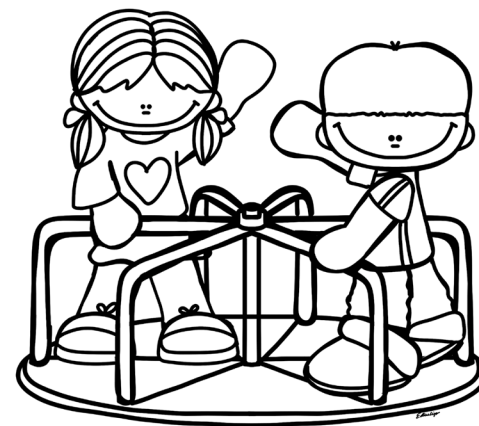
FOR THE TEACHER

PLAYGROUND ARCHITECT is a STEM project-based learning task that involves using fourth-grade math standards to build a model for a playground. It was created for students in fourth grade. The following math standards are addressed:

- 4.OA.A.2 Multiply or divide to solve word problems involving multiplicative comparison.
- 4.NBT.A.1 Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.
- 4.NBT.B.4 Fluently add and subtract multi-digit whole numbers using the standard algorithm.
- 4.NBT.B.5 Multiply a whole number of up to four digits by a one-digit whole number and multiply two two-digit numbers.
- 4.NBT.B.6 Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors.
- 4.MD.A.1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit.
- 4.MD.A.2 Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit.
- 4.MD.A.3 Apply the area and perimeter formulas for rectangles in real-world and mathematical problems.

DIRECTIONS:

1. Review the supplies needed on slide 5 to ensure students will have access to all necessary materials.
2. Assign students to work alone or in small groups.
3. Preview the activity with your students.
4. Allow students class time to complete the activity. This can span several days.
5. Allow students an opportunity to complete extra challenge activities. (Optional)
6. Allow students to complete the self-reflection and evaluation rubric.
7. Allow students an opportunity to share their completed projects.



PLAYGROUND ARCHITECT

Your school is getting a new playground, and the principal has announced an exciting contest for the students. Each student in fourth grade will submit their idea for the new playground. The winner of the contest will have their proposed playground built. You are going to brainstorm your playground idea, design the important playground elements, build models of your playground, and determine the cost of your playground proposal. May the best playground win!

Here are your tasks:

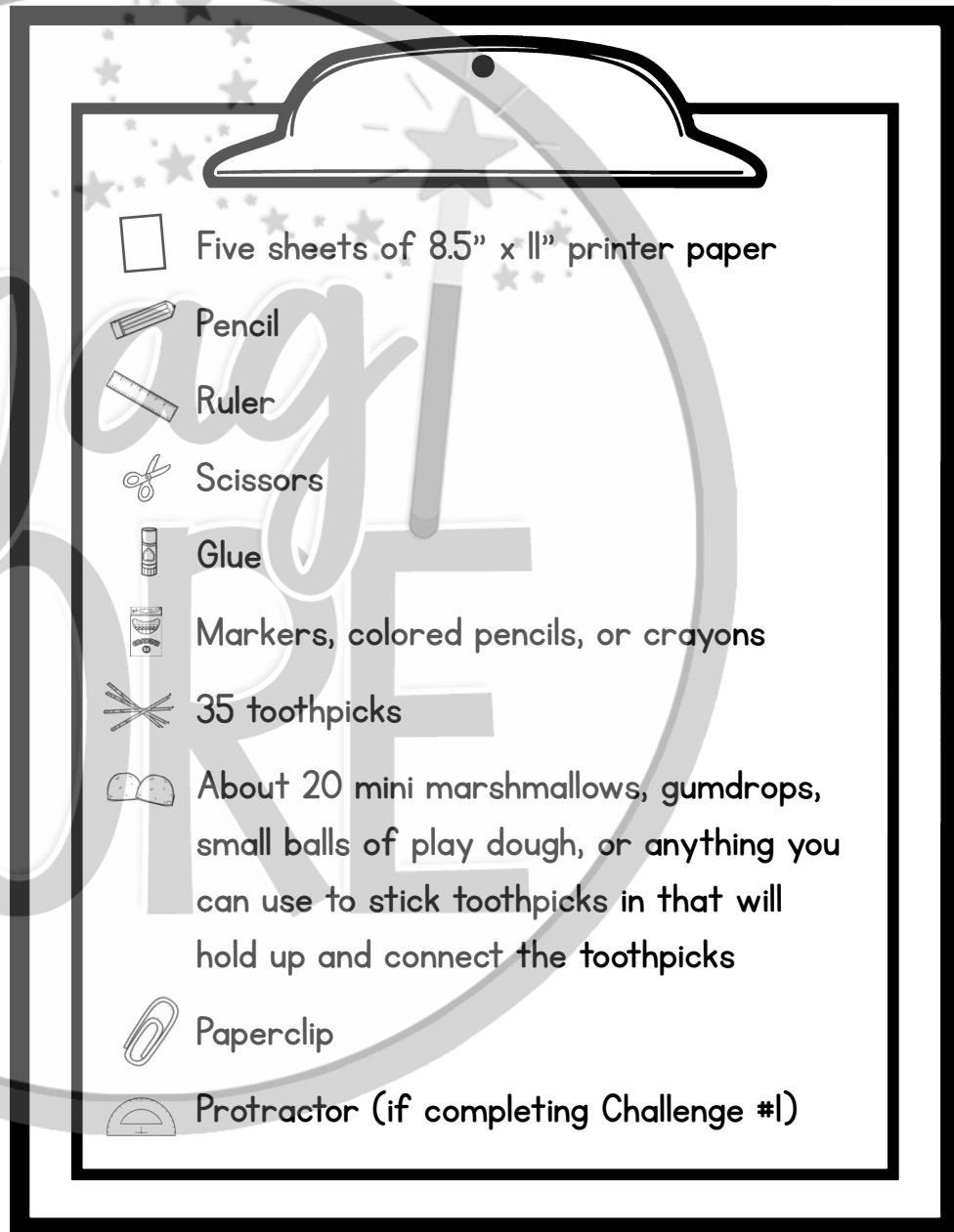
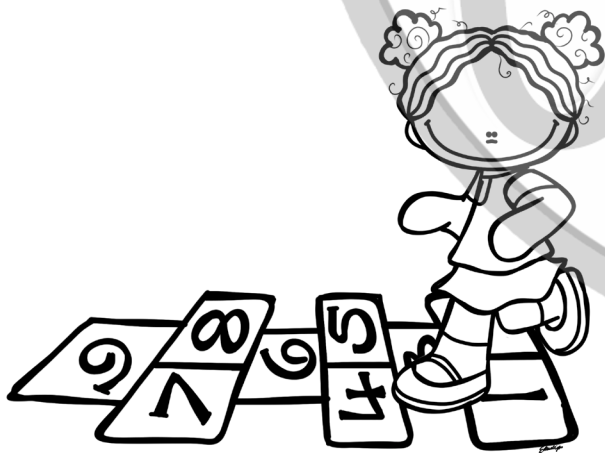
- Read through the entire packet before beginning.
- Determine the type, amount, and cost of a fence to go around your playground.
- Decide which playground features you want to include in your playground proposal.
- Make a model of your playground layout on a piece of paper.
- Sketch, build, and test a model of a jungle gym for your playground.
- Solve word problems about the finishing touches for your playground including mulch, flowers, and walkways.
- Complete the challenge pages. (Optional)
- Complete the self-reflection and evaluation rubric.



MODELING SUPPLIES

As you brainstorm and plan out your idea for a new playground, you will be making various models.

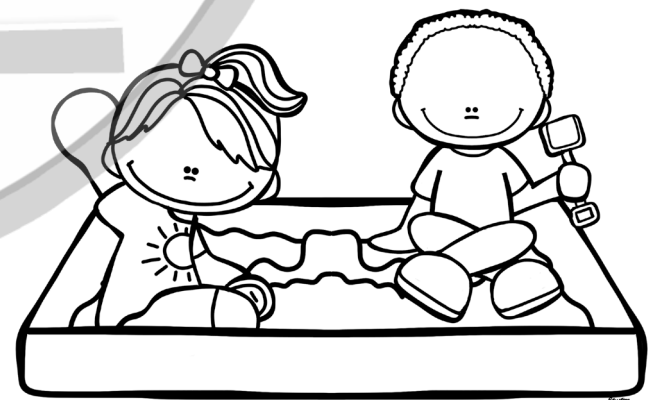
During the course of this project, you will need the materials shown on the clipboard to make your models and answer questions about them.



MODEL MAKING

To help you with brainstorming, you want to make a model of the playground to scale on a piece of paper. Follow the steps and answer the questions below to set up your playground model.

1. To get your creative juices flowing, you want to create a scaled model of your playground proposal on a sheet of paper. Find a standard piece of printer paper that is $8\frac{1}{2}$ inches wide by 11 inches long. Use scissors to trim $1\frac{1}{2}$ inches off the width and two inches off the length. What are the dimensions of the paper now?
2. What is the perimeter of the paper?
3. What is the area of the paper?



LET'S GET BUILDING

Your next step is to start envisioning the different elements you want to build on your playground. Read and answer the questions below.

1. First, you want to build a fence around the playground. To determine how much fence you need, do you need to use the perimeter of the playground or the area? Explain. How much fence will you need?
2. The principal has given some requirements for different elements of the playground. One of the requirements is that the fence is at least $4\frac{1}{2}$ feet tall. What is the minimum fence height in inches?
3. You find three different options for fences. One fence is made of wood, one is made of metal, and one is made of PVC, a type of plastic. Think of some pros and cons for each material.

| | Pros | Cons |
|------|------|------|
| Wood | | |

| | Pros | Cons |
|-------|------|------|
| Metal | | |

| | Pros | Cons |
|-----|------|------|
| PVC | | |

PLAYGROUND FEATURES

Now that your playground model has been fenced in, you can decide which other playground features you would like to include in your proposal. Read the information and follow the steps below.

- I. The table below shows the different features you can include in your playground. You want to draw some of these features on your model, so you need to determine their dimensions according to the scale of your model (10 feet = 1 inch). Fill in the missing dimensions. Find the areas and perimeters.

| Feature | Actual | | | | Model | | | |
|------------------|--------|-------|---------------------|-----------|--------|-------|-------------------|-----------|
| | Length | Width | Area | Perimeter | Length | Width | Area | Perimeter |
| Climbing wall | 20' | 10' | 200 ft ² | 60' | 2" | 1" | 2 in ² | 6" |
| Basketball court | 30' | 50' | | | | | | |
| Sandbox | 15' | 20' | | | | | | |
| Swings | 30' | 15' | | | | | | |
| Jungle gym | 20' | 15' | | | | | | |
| Butterfly garden | 25' | 15' | | | | | | |
| Roundabout | 10' | 10' | | | | | | |
| Slides | 15' | 15' | | | | | | |
| Blacktop | 40' | 20' | | | | | | |
| Picnic pavilion | 25' | 25' | | | | | | |

JUNGLE GYM

3. Next, you will build a model of your jungle gym using toothpicks. Use mini marshmallows, gumdrops, small balls of clay or playdough, or any similar material to connect the toothpicks to one another as you build. Your jungle gym model must be at least four inches tall, six inches long, and four inches wide.
4. What are the approximate dimensions of your jungle gym model? Note: your jungle gym model is not made to the same scale as your playground model.

Height: _____ inches

Width: _____ inches

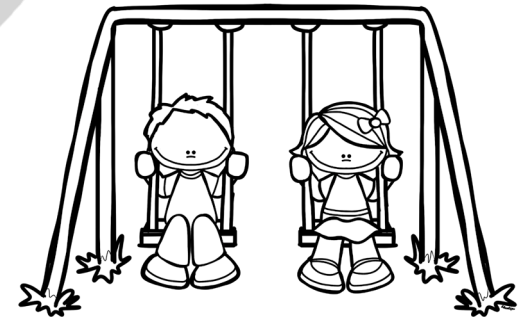
Length: _____ inches

5. How do you feel about your jungle gym model? Does it look like you intended? Was there any part that was particularly difficult to build? Did you have to change your plans from your original sketch at all? If so, why?

FINISHING TOUCHES

Your playground proposal is almost complete! You just need to make a few more decisions about the finishing touches. Answer the questions below.

1. You want to put down mulch in the playground. Each bag of mulch weighs 15 kilograms. How many grams does each bag of mulch weigh?
2. You calculate you need 64 bags of mulch to cover the whole playground. How many kilograms of mulch will you need?
3. The walkway leading from the school to the playground gate is 84 feet long. Find the length of the walkway in inches and yards.



CHALLENGE #1: MURAL

1. Label the 3 acute and 3 obtuse angles in your mural with the letters in the table below. Use a protractor to measure each angle. Record your measurements.

| Acute angles | Measurement | Obtuse angles | Measurement |
|--------------|-------------|---------------|-------------|
| A | | D | |
| B | | E | |
| C | | F | |

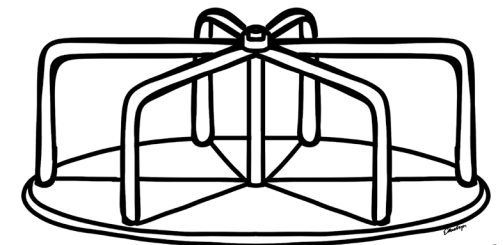
2. To keep costs of the mural down, the principal asks that it be completed only using paint that is already in the art room. You go to the art room to see how much of each color paint is there. The table below shows the quantity of paint in both liters and milliliters. Fill in the missing amounts. Remember that 1 liter = 1,000 milliliters.

| Color | Amount in L | Amount in mL | Color | Amount in L | Amount in mL |
|-------|-------------|--------------|--------|-------------|--------------|
| red | 2.45 | | green | | 2,670 |
| blue | | 1,098 | yellow | 3.756 | |
| black | | 3,221 | white | 0.382 | |

CHALLENGE #2: MORE MODELS

In this challenge, you will have the opportunity to plan and build another model. Answer the questions and follow the instructions below.

1. Choose another feature that you included in your playground other than the jungle gym. If you were to make a model of this feature, what materials might you use that you could find easily in your home or classroom?
2. What process would you follow to create your model? Explain the steps you would take.
3. You performed three tests on your jungle gym model to test its stability and strength. What are two tests that you could perform on this model? What qualities would these tests assess?



SELF-REFLECTION

Write a reflection of your experience with this project. How did you feel about the math problems and activities? Explain what you found easy to do and any difficulties you had while working on this project. Did you enjoy this activity? Why or why not?



RATE THIS PROJECT

Circle the statement you most agree with.



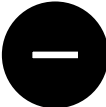
I am ready for something harder.

This was just right.

I found this very challenging.

SELF-EVALUATION

Circle one box per row on the rubric that expresses how you rate yourself on this Project Based Learning Activity.

|  |  |  |
|---|---|---|
| I felt very confident about the math in this project. | I felt pretty good about my ability to complete the math in this project. | I felt a lot of the math in this project was too hard for me to do alone. |
| I understood all of the math and did not need help to complete the problems. | I understood most of the math but needed a little help to solve some of the problems. | I understood some of the math but needed help to complete most of the problems. |
| I easily used many strategies to solve the math problems efficiently. | I needed some help to use the best strategies for solving the math problems. | I had trouble understanding the best way to solve many of the math problems. |
| I feel I am ready for a harder math project. | I feel I would like to spend more time practicing similar math problems. | I feel I need assistance to work on similar math problems. |

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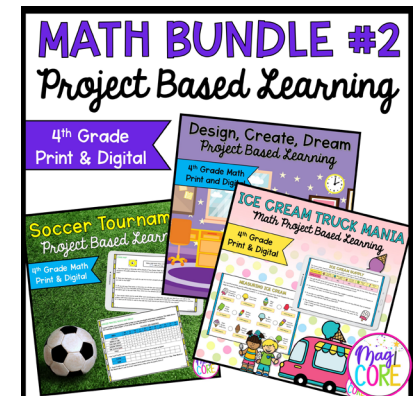
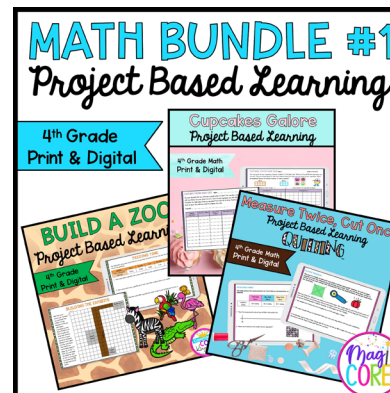
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