

PLAYGROUND ARCHITECT

& STEM Project Based Learning

4th Grade
Print & Digital

JUNGLE GYM

6. The final test will test the structural strength of your jungle gym model. Gather the items in the table below. Estimate the mass of each item. Use the approximate mass of a paperclip (1 gram) for reference.

Item	Estimated Mass	Observations
Paperclip	1 gram	
Pencil		
Scissors		

Choose your own item. It should have a greater mass than the scissors.

Place each item on the topmost part of the jungle gym. Observe what happens for five seconds. Do any of the toothpicks bow, twist, or fall? Does the model tilt or remain upright? Then, remove the item, record your observations, and try the next item.

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		\$85	
Metal	4 feet		\$37	
PVC	8 feet		\$56	

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.

Using the amount of fence you listed in question #3 and the total prices you found, which fence do you think is the best? Justify your answer.

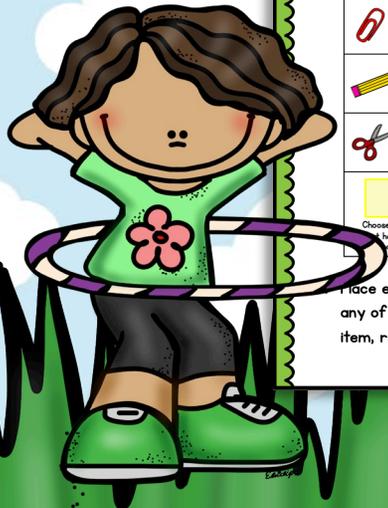


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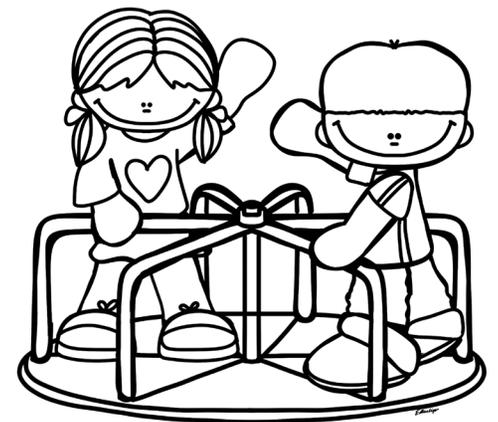
FOR THE TEACHER

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:

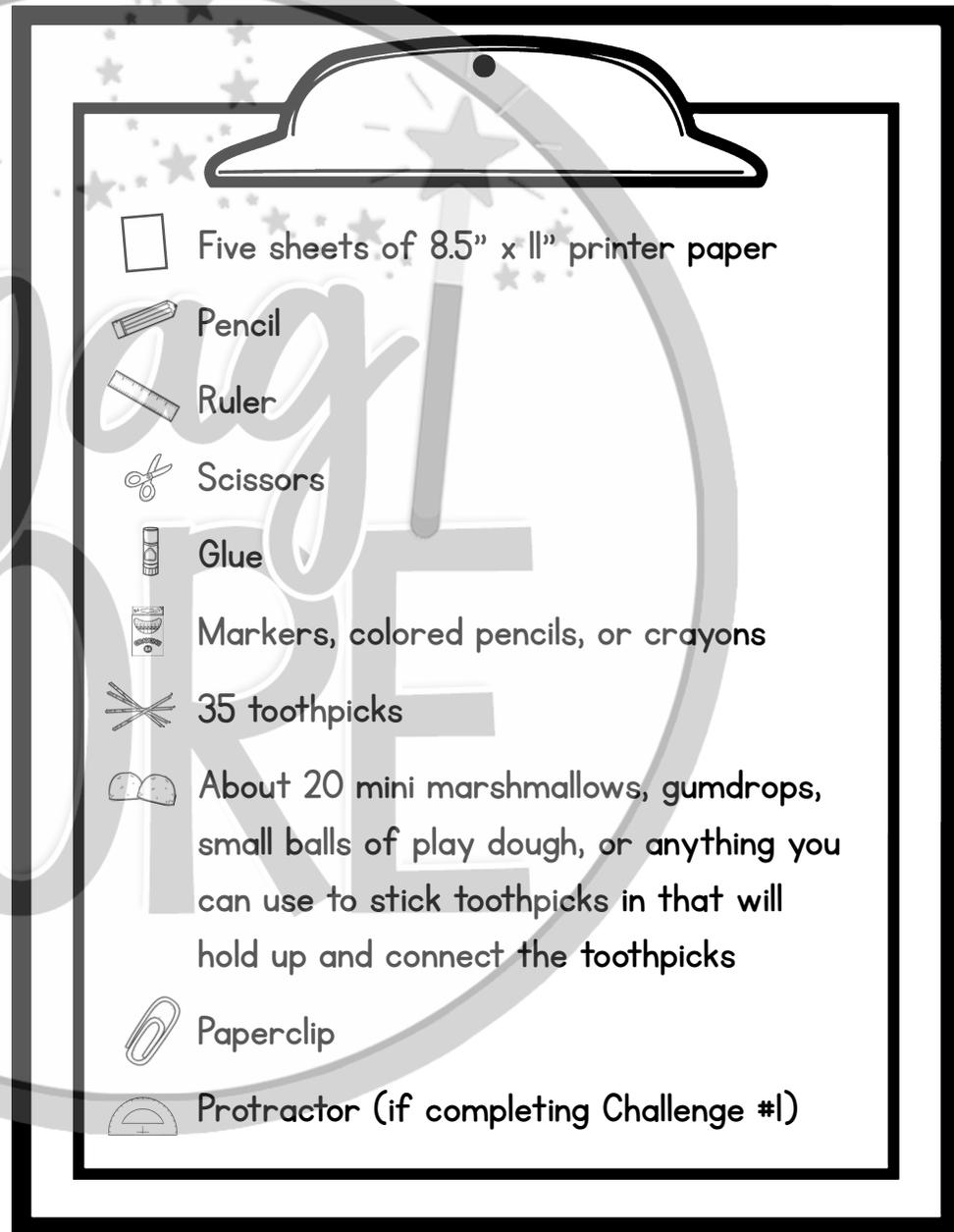
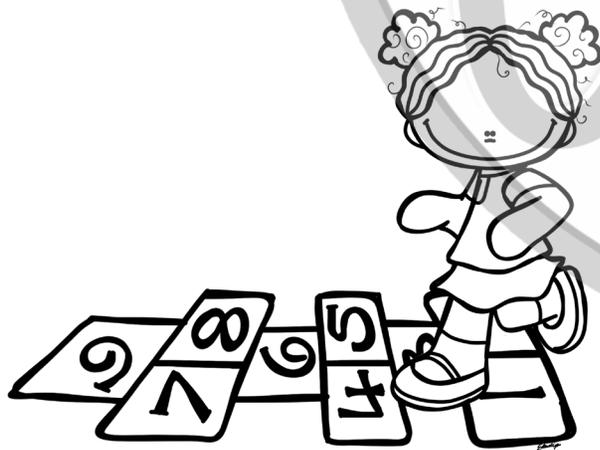
- Read through the entire packet before beginning.
- Determine the type, amount, and cost of a fence to go around your playground.
- Decide which playground features you want to include in your playground proposal.
- Make a model of your playground layout on a piece of paper.
- Sketch, build, and test 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.

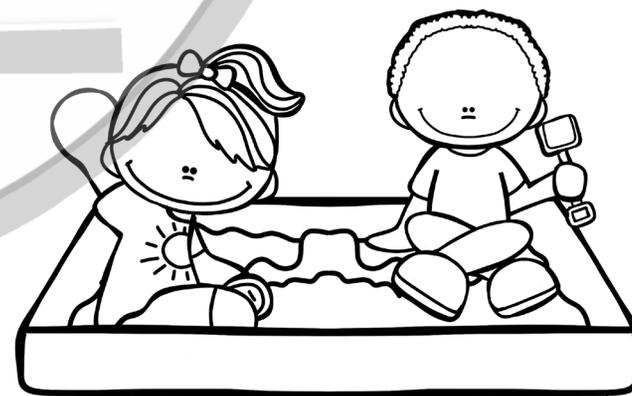
During the course of this project, you will need the materials shown on the clipboard to make your models and answer questions about them.



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.

1. 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

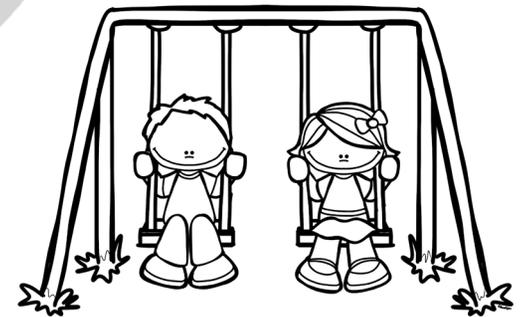
Length: _____ inches

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	

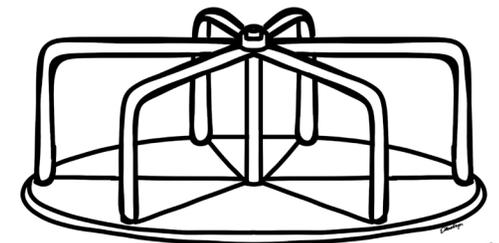
2. To keep costs of the mural down, the principal asks that it be completed only using paint that is already in the art room. You go to the art room to see how much of each color paint is there. The table below shows the quantity of paint in both liters and milliliters. Fill in the missing amounts. Remember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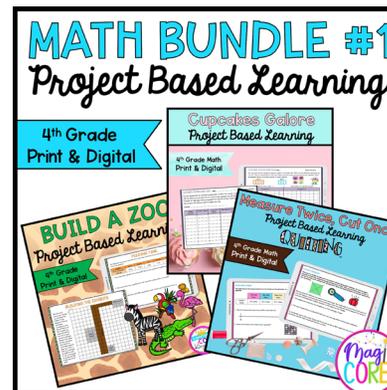
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