

PLAYGROUND ARCHITECT

& STEM Project Based Learning

3rd 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 must 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 | | \$100 | |
| Plastic | 4 feet | | \$30 | |
| PVC | 8 feet | | \$70 | |

The price per section of fence is shown in the table. Determine the total price for each type of fence. Answer questions 5 and 6 on the table.

5. Using the total 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.

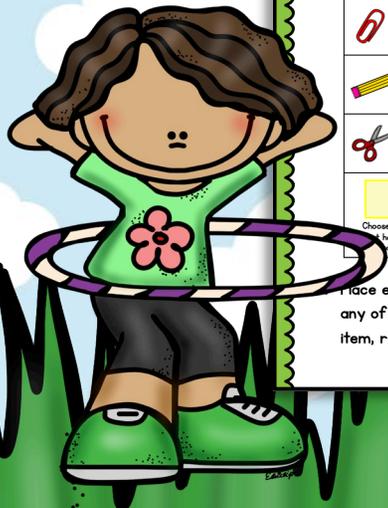


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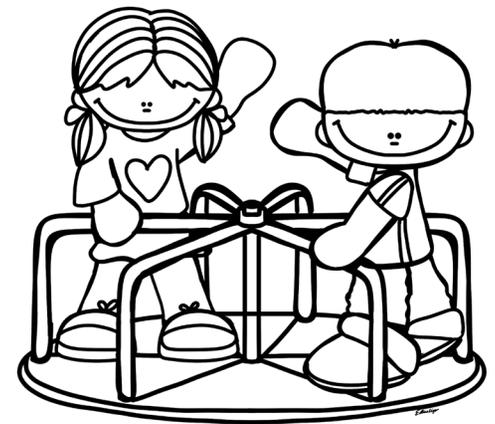
FOR THE TEACHER

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

- 3.OA.B.6 Understand division as an unknown-factor problem.
- 3.OA.C.7 Fluently multiply and divide within 100.
- 3.NBT.A.2 Fluently add and subtract within 1000.
- 3.NBT.A.3 Multiply one-digit whole numbers by multiples of 10 in the range 10–90.
- 3.NF.A.3 Explain equivalence of fractions in special cases and compare fractions by reasoning about their size.
- 3.MD.A.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l).
- 3.MD.C.5 Recognize area as an attribute of plane figures and understand concepts of area measurement.
- 3.MD.C.7 Relate area to the operations of multiplication and addition.
- 3.MD.D.8 Solve real-world and mathematical problems involving perimeters of polygons.
- 3.G.A.1 Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides) and that the shared attributes can define a larger category (e.g., quadrilaterals).

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 third 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:

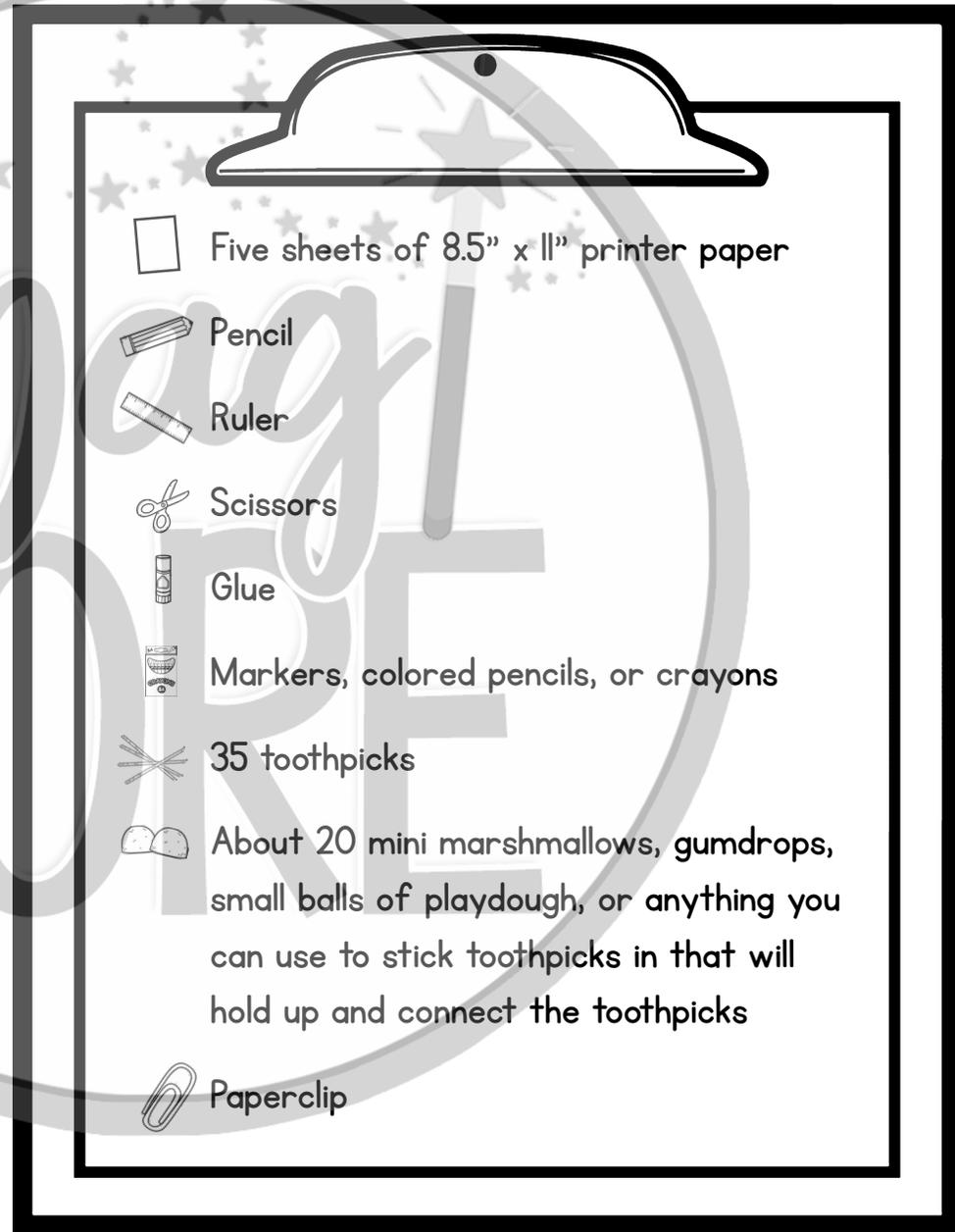
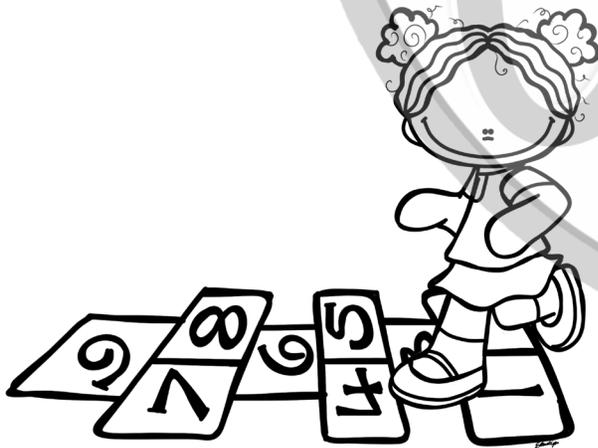
- Read through the entire packet before beginning.
- Determine the type, amount, and cost of a fence to go around your playground.
- Decide which playground features you want to include in your playground proposal.
- Make a model of your playground layout on a piece of paper.
- Sketch, build, and test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

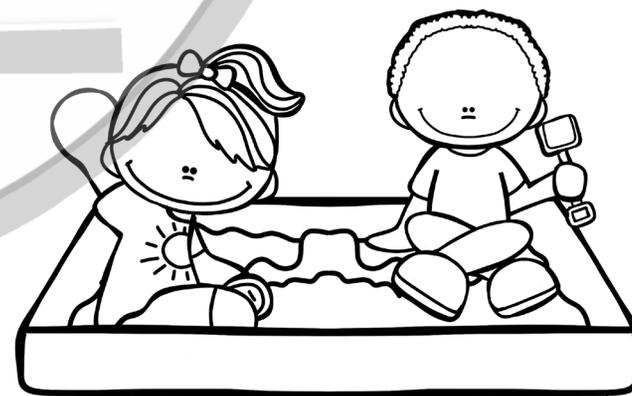
During the course of this project, you will need the materials shown on the clipboard to make your models and answer questions about them.



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 | | Pros | Cons | | Pros | Cons |
|------|------|------|-------|------|------|-----|------|------|
| Wood | | | Metal | | | 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 | 10' | 20' | | | | | | |
| Swings | 30' | 10' | | | | | | |
| Jungle gym | 20' | 10' | | | | | | |
| Butterfly garden | 30' | 10' | | | | | | |
| Roundabout | 10' | 10' | | | | | | |
| Slides | 10' | 10' | | | | | | |
| Blacktop | 40' | 20' | | | | | | |
| Picnic pavilion | 20' | 20' | | | | | | |

PLAYGROUND FEATURES

2. Which playground features did you choose?
3. Explain why you chose each playground feature.
4. The cost to install each playground feature is below. Calculate the total cost of all your proposed playground features.

| FEATURE | COST | FEATURE | COST |
|-----------------|---------|------------------|---------|
| Jungle gym | \$2,910 | Climbing wall | \$1,885 |
| Swings | \$3,012 | Basketball court | \$4,244 |
| Sandbox | \$967 | Butterfly garden | \$523 |
| Picnic pavilion | \$1,563 | Blacktop | \$1,109 |
| Roundabout | \$845 | Slides | \$938 |

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

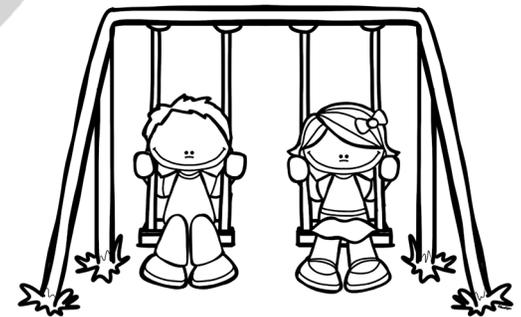
Length: _____ inches

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. Do you estimate you will need 350 grams of mulch to cover the entire playground or 350 kilograms? Explain your answer.
2. To get the quantity of mulch in your answer to question #1, you need to buy 7 bags of mulch. How much mulch is in each bag?
3. The walkway leading from the school to the playground gate is 9 feet long. Find the length of the walkway in inches and in yards.



CHALLENGE #1: MURAL

1. Label the following shapes in your mural. Identify two characteristics of each shape in the table below.

| Shape | square | parallelogram | hexagon | right triangle | pentagon | rectangle |
|-----------------|--------|---------------|---------|----------------|----------|-----------|
| Characteristics | | | | | | |

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. Each color paint is in a one-gallon bucket. Compare the amounts of each color paint by completing the number comparisons with the symbols $<$, $>$, or $=$.

 $\frac{1}{3}$ gallon
 $\frac{1}{4}$ gallon
 $\frac{2}{4}$ gallon
 $\frac{3}{4}$ gallon

 $\frac{1}{2}$ gallon
 $\frac{3}{6}$ gallon
 $\frac{1}{3}$ gallon
 $\frac{2}{3}$ gallon

 $\frac{3}{4}$ gallon
 $\frac{3}{5}$ gallon
 $\frac{3}{4}$ gallon
 $\frac{1}{4}$ gallon

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.

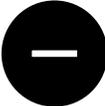
I am ready for something harder.

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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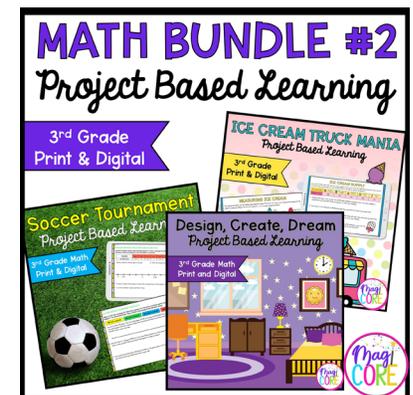
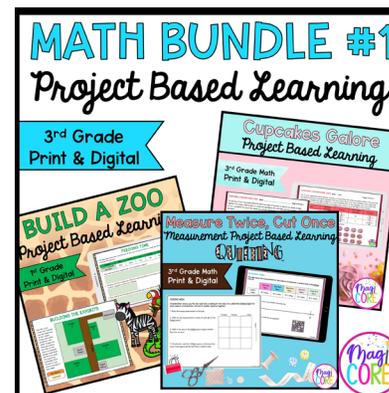
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