Grade 3-5<sup>th</sup> Activities

Thank you for choosing the Under Construction: Building Careers exhibition for your class field trip experience. Choose from these activities to expand upon and reinforce your students’ learning. The activities and worksheets below can be adapted to meet your students’ interests and abilities.

Activities are organized by: Before Your Visit, During Your Visit, and Back in the Classroom.

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**Before Your Visit**

- **Pre-Visit Activity**
  - Close Reading on Green Roofs

**During Your Visit**

- **Construction Journals**
  - Choose what to use to differentiate for your students and to correlate with your class unit.

**Back In the Classroom**

- **Activity 1**
  - **Carrers & Literacy**
    - Build a Better School
    - Research jobs needed to build a new school and create a written or oral presentation.

- **Activity 2**
  - **Carrers & Math**
    - Construction Workers Use Math
Before Your Visit

Before visiting the exhibit, introduce the students to sustainability, construction safety, and construction careers using the Front Matter of this Educator Guide, especially the Essential Questions.

Pre-Visit Close Reading Activity:


During Your Visit

Ask your chaperones to help guide your students in an exploration of safety equipment, simulated building materials and tools. Children can work together to build a structure, work on simple patterning and manipulate pipes and wires as they explore plumbing and simple circuitry.

To focus student learning, you may choose to have students work with some of the Construction Journals. Choose pages as they are or feel free to modify these to meet the differentiation and curricular needs of your students. (Refer to the Teaching in the Exhibition section of the Front Matter of the Educator Guide for description of the exhibition components and suggested grade levels.)

Back in the Classroom

There are two sets of post-visit activities included:

Activity 1: Build a Better School

**Careers& Literacy**

Tell students the whole class is going to build a better school. Let them divide into groups and choose what jobs each group will be (Architect, Electricians, Engineer, Foremen, Plumbers, Landscape Architect, etc.) and have them research and give an oral or written presentation as a group on what their group would do. Have them discuss the importance of team work, safety, and mathematics to their project. For inspiration, you and/or your students may wish to watch a video of a 3rd grade class at Green Woods Charter School in Philadelphia doing a green architecture project, https://www.youtube.com/watch?v=43rK2xnhgJM.

Activity 2: Construction Workers Use Math

**Careers& Math**

Choose from the applied math problems to do with students. Help students learn that mathematics is used in many areas of real life.
COOL ROOFS

Read the passage below and mark important words and sentences which can help you answer the questions.

Who gets to plan the cities of the future? You do! It may all start with the roof over your head. Roofs of future cities will look and feel cooler. "Green," plant covered and "Cool," white or pastel roofs have long been popular in Europe, the Middle East, and Canada. Now roofs that look more like meadows than asphalted streets, plus those that paint a pretty pastel picture, are becoming part of The "Greening" of America.

Cities have problems. They have increasing levels of pollution, which make people sick, and rainwater from roofs washes through city streets without becoming part of our needed watershed. How can the 33 billion people now living in our cities survive in the future as temperatures climb higher due to global warming? Bob Fittro, of DesignandBuildwithMetal.com, says green roofs--those with a plant covering--can certainly help. "Where roofs are flat, plant-covered systems have been shown to keep buildings cooler inside, and as an added benefit they turn roofs into enjoyable park-like spaces," he says.

On a summer day, the temperature of a roof can reach 140 to 190 degrees F. Think about it: an egg fries on a 158-degree F pan! Covered with grass to absorb sunlight, the temperature of that same roof wouldn't rise above 77 degrees F. After a couple of years, plant roots get so dense that they act like a warm coat, lowering heating costs in winter, even when that coat is more brown than green. You can breathe deeply with a green roof, too, because they clean the air by catching particles of pollution, and use carbon dioxide to make more oxygen. They also absorb traffic, machine, and airplane noises. So future cities with Green Roofs will be cooler, cleaner, and quieter. Storm water is stored by a green roof and its plants return water to the air. Extra water is cleaned and cooled by plants before it leaves the roof.
On a hot summer day do you wear dark clothing? No, you pick light-colored clothes to reflect sunlight and let heat escape your body! A white-coated, "Cool" roof uses the same tricks. Cool roofs cost less than planted ones, and are easier to use on houses with slanted roofs. Many asphalt (shingled) roofs are being replaced with cool white ones that reflect both sunlight and heat. Since the same UV rays from the Sun that give us a tan cause roofs to get old and fall apart, both green roofs and cool roofs are long lasting. This means they're less likely to be dumped into a landfill. Some cool roofs have been around for a long time. Joe Jenkins, founder of the Slate Roofing Contractors Association of North America, says, "The best roof wouldn't need fossil fuels to be made. It would be found in nature, reusable, long-lasting, and nontoxic. Slate (stone) roofs take care of all those needs."

Some cool roofs are made of familiar materials. Bob Fittro says, "Metal roofing is the leading choice in green roofing for buildings with slanted roofs. Most are made of more than 25 percent recycled materials, are long lasting, and can be melted down and reused when old. Cool pigments reflect rather than absorb the Sun's rays." Still other cool roofs are brand new. Rob Keen, in ArmorLite's news release, says, "This advanced material uses little of the Earth's resources and is 100 percent recyclable. It reflects heat back into the air and insulates. ArmorLite is strong, yet about one tenth the weight of other roofs. It won't break, rot, or mildew and can stand up against high winds, earthquakes, and fires."

From “Cool Roofs” Odyssey. (Feb. 2009)
Please answer the questions below based on the reading. Cite the evidence from “Cool Roofs” and give reasons below.

1) How do plants on a green roof help make the building below cooler? How do they make it warmer?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

2) How does a “cool roof” work?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

3) What are some other benefits of a green roof?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
CLOSE READING ACTIVITY

1) How do plants on a green roof help make the building below cooler? How do they make it warmer?

   Answer: Plants absorb sunlight and keep the heat of the building under 77 degrees. When plants grow denser, they keep the heat of the building in instead of allowing it to go out through the roof, creating a warm “blanket” of plants.

2) How does a “cool roof” work?

   Answer: Cool roofs are light-colored in order to reflect light and heat, allowing the building beneath to stay cool on a hot summer day.

3) What are some other benefits of a green roof?

   Answer: The green roof plants help clean the air of pollution by taking in carbon dioxide and releasing oxygen, the dense plants absorb loud noises like planes, traffic and machines, and finally, the green roof provides green space for a city environment.
Each morning construction crews meet to discuss the day’s job and how to stay safe.

For each job below, discuss with your team what equipment would be needed to keep your team safe and circle the equipment below.

**Plumber:** boots / gloves / goggles / harness
hearing protection / helmet / safety vest

**Tile Setter:** boots / gloves / goggles / harness
hearing protection / helmet / safety vest

**Brick Layer:** boots / gloves / goggles / harness
hearing protection / helmet / safety vest

**Electrician:** boots / gloves / goggles / harness
hearing protection / helmet / safety vest

**Crane Operator:** boots / gloves / goggles / harness
hearing protection / helmet / safety vest

**Word Bank:**
- Boots
- Harness
- Gloves
- Helmet
- Goggles
- Safety Vest
- Hearing protection
Draw how to connect the pipes.

Draw arrows to show the direction of water flow.
Construction Journal: Be an Electrician

Wire the house and draw lines below to show how you wired them.

Which elements worked? **Light / Door Bell / Fan / Night Light / Tablet**
*(Circle those that worked.)*

Focus on Safety: Why did the directions ask you to turn the breakers off before you connected the electric wires?

__________________________________________________________________________________________________________________________________________________________
Connect the household elements with the energy transformations occurring.

**Light**
- Electrical energy → Kinetic energy of moving air (wind)

**Door Bell**
- Electrical energy → Light energy

**Fan**
- Electrical energy → Mechanical energy

**Tablet**
- Electrical energy → Sound energy
Be An Electrician: Math Connection

Measuring is very important for Electricians.

How did measuring help you to choose the wires?

____________________________________________

____________________________________________

Use the measuring tool to answer the following:

How long is the longest wire _____________ cm

How long is the shortest wire: _____________ cm

How much longer is the longest _____________ cm wire than the shortest wire?

How much wire would you need to purchase for this job? _____ cm

Show your work:
Make a fun pattern with black and white planks and draw your pattern below.

Complete the patterns started below in two different ways and draw it below:
What is the Perimeter of the house in units of big bricks?

__________ big bricks

What is the Area of one side of the house in units of big bricks?

__________ big bricks

Read the information about brick-laying on the top of the house.

What do bricklayers need to get the job done besides bricks?

_________________________________________

_________________________________________
ACTIVITY 2A: TILE SETTERS USE MATH

Careers & Math
Common Core in Math: Grade 3, 3.MD.7

Tile setters need to be quick and accurate with math problems involving patterns, geometry, and measurement.

1. Janine is learning to be a tile setter. She tiled a floor yesterday that was 12 feet long and 10 feet wide. She thinks that the area of that floor was 60 square feet. Is she correct? Explain.

Area = length x width

2. Today Janine’s supervisor asked her to tile a floor that is 12 feet long and 10 feet wide. She is thinking that today’s floor will be twice as much, or 120 square feet. Is she right or wrong? Explain.
ACTIVITY 2A: TILE SETTERS USE MATH

Careers & Math

Common Core in Math: Grade 3, 3.MD.7
Relate area to the operations of multiplication and addition.

Tell students that math is needed for many careers, including the skilled craft professions such as construction, architecture, and engineering.

1. A young woman is learning to be a tile setter. She tiled a floor yesterday that was 12 feet long and 10 feet wide. She thinks that the area of that floor was 60 square feet. Is she correct? Yes. Explain.

   Method 1: Area = length x width
   10 ft x 6 ft = 60 ft
   Method 2: Using tiles we get the same result.

   1. Today Janine’s supervisor asked her to tile a floor that is 12 feet long and 10 feet wide. She is thinking that today’s floor will be twice as much, or 120 square feet. Is she right or wrong? She is right. Explain.

   Method 1: Area = length x width
   10 ft x 12 ft = 120 ft
   Method 2: Using tiles we get the same result.

7a. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.

7b. Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.

7c. Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths a and b + c is the sum of a x b and a x c. Use area models to represent the distributive property in mathematical reasoning.

7d. Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real world problems.
ACTIVITY 2B: TILE SETTERS USE MATH

Careers & Math

Math Common Core: Grade 4, 4.MD.3

Tile setters need to be quick and accurate with math problems involving patterns, geometry, and measurement.

1. Your boss has asked you how many square feet of tiles will be needed for a countertop in a new house being constructed in Rochester. The job is behind schedule so you need to calculate it quickly but estimating too much area will result in wasted money.

Find the total square footage of the countertop, and explain how you found it.

You know that:

Area of F = 36 square feet.
Area of E = 180 square feet.
Length of C=8 feet.
Length of D=6 feet.
The area of H is 2 ½ times larger than G.
ACTIVITY 2B: TILE SETTERS USE MATH

Careers & Math
Common Core: Grade 4, 4.MD.3
3. Apply the area and perimeter formulas for rectangles in real world and mathematical problems. For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor.

Tell students that math is needed for many careers, including the skilled craft professions such as construction, architecture, and engineering.

1. Your boss has asked you how many square feet of tiles will be needed for a countertop in a new house being constructed in Rochester. The job is behind schedule so you need to calculate it quickly but estimating too much area will result in wasted money.

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You know that:
Area of F = 36 square feet.
Area of E = 180 square feet.
Length of C=8 feet.
Length of D=6 feet.
The area of H is 2 ½ times larger than G.

Answer:
Total Area= (Area E) + (Area F) + (Area G) + (Area H)
Area of rectangle=(length x width)
Area=(A x (B+A) + (A x A) + (C x A) + (C x D)
Area= (2 feet x (2 feet + 11 feet) + (2 feet x 2 feet) + (3 feet x 2 feet) + (3 feet x 6 feet)
Area= (2 feet x 13 feet) + (2 feet x 2 feet) + (3 feet x 2 feet) + (3 feet x 6 feet)
Area= 26 feet² + 4 feet² + 6 feet² + 18 feet²
Area=54 feet²
ACTIVITY 2C: BRICKLAYERS USE MATH

Careers & Math
Common Core in Math: Grade 5, 5.N.F

Brick layers need to be quick and accurate with math problems involving patterns, geometry, and measurement.

1. You have been asked to build a wall that must be between 46 and 48 inches tall. You know that the modular bricks are about 5 inches high and that the mortar joints are usually no more than an inch thick. Estimate about how many courses of both brick and mortar you will need to build the wall. Explain.

2. Now that you have made your estimate and ordered your materials you need to make more precise plans. Your foreman tells you that the wall needs to be exactly 46 2/3 inches high. You plan to use 8 courses of brick with mortar between each course. The bricks are 5 1/3 inch high. How much mortar should you place in-between each layer of bricks? Explain.

3. The bricks were delivered in the wrong size. Now you need to use bricks with a height of 5 2/3 inch. How will this change the overall height of the wall? Explain.
ACTIVITY 2C: BRICKLAYERS USE MATH

Careers & Math
Common Core in Math: Grade 5, 5.N.F
Use equivalent fractions as a strategy to add and subtract fractions.

NF1. Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. For example, 2/3 + 5/4 = 8/12 + 15/12 = 23/12. (In general, a/b + c/d = (ad + bc)/bd.)

NF2. Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. For example, recognize an incorrect result 2/5 + 1/2 = 3/7, by observing that 3/7 < 1/2.

1. You have been asked to build a wall that must be between 46 and 48 inches tall. You know that the modular bricks are about 5 inches high and that the mortar joints are usually no more than an inch thick. Estimate about how many courses of both brick and mortar you will need to build the wall. 8 layers (“courses”) of brick with 7 layers of mortar. Explain.

2. Now that you have made your estimate and ordered your materials you need to make more precise plans. Your foreman tells you that the wall needs to be exactly 46 2/3 inches high. You plan to use 8 courses of brick with mortar between each course. The bricks are 5 1/3 inch high. How much mortar should you place in-between each layer of bricks? 3/4 inch. Explain.

3. The bricks were delivered in the wrong size! Now you need to use bricks with a height of 5 2/3 inch. How will this change the overall height of the wall? Explain.

It doesn’t need to affect the overall height of the wall at all because I can calculate how thick to make each layer of mortar to make the overall height come out the same.
ACTIVITY 2D: PLUMBERS USE MATH

Careers & Math

Common Core in Math: Grade 5, 5.N.F

1. A plumbing job calls for several lengths of pipe:
   - 5 pieces of 12 ¼ inches
   - 2 pieces of 5 1/8 inches
   - 1 piece of 10 ½ inches
What is the total length of pipe needed for this job? Show your work.
ACTIVITY 2D: PLUMBERS USE MATH

Careers & Math

Common Core in Math: Grade 5, 5.N.F

NF 1. Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. For example, 2/3 + 5/4 = 8/12 + 15/12 = 23/12. (In general, a/b + c/d = (ad + bc)/bd.)

NF 2. Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. For example, recognize an incorrect result 2/5 + 1/2 = 3/7, by observing that 3/7 < 1/2.

Tell students that math is needed for many careers, including the skilled craft professions such as construction, architecture, and engineering.

1. A plumbing job calls for several lengths of pipe:
   - 5 pieces of 12 ¼ inches
   - 2 pieces of 5 1/8 inches
   - 1 piece of 10 ½ inches
   What is the total length of pipe needed for this job? 82 inches. Show your work.

   First convert all lengths into equivalent fractions with like denominators.
   12 1/4 inches = 12 2/8 inches
   10 1/2 inches = 10 4/8 inches

   Then multiply and add:
   (5 x 12 2/8 inches) + (2 x 5 1/8 inches) + (10 4/8 inches)
   Answer: 82 inches

   First convert fractions into decimals.
   12 ¼” = 12.25 inches
   5 1/8” = 5.125 inches
   10 ½” = 10.5 inches

   (5 x 12.25 inches) + (2 x 5.125 inches) + (10.5 inches)
   Answer: 82 inches

   Note: It is easier to convert everything to decimals and add. In fact, decimal inches are used extensively in construction.