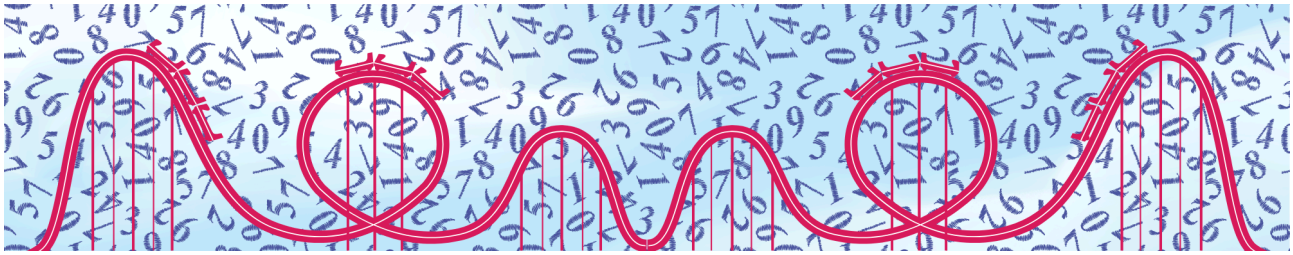
artsNOW
Integrated learning solutions

UNIT: ROUNDING THROUGH THE ARTS
ROUNDING ROLLER COASTERS–EXPLORING ROUNDING THROUGH ROLLER COASTER DESIGN
Grade Band: 3
Content Focus: Visual Arts & Math



LEARNING DESCRIPTION

This project-based, arts-integrated lesson will explore the mechanics of roller coasters. Students will review their understanding of place value and apply it to the concept of rounding whole numbers to the nearest 10 or 100 using the engineering design process. Students will design and build a roller coaster to model the concept of rounding. Students will label the roller coaster like a number line and demonstrate what happens when a marble is placed on various points. Designing the slope of the roller coaster will reinforce when the marble rolls forward “rounded up” or rolls backwards “rounded down” based on its pathway of movement.

LEARNING TARGETS

Essential Questions	“I Can” Statements
How can I design a roller coaster that models the concept of rounding multi-digit whole numbers to the nearest 10 and 100?	I can apply my understanding of place value to the concept of rounding whole numbers.

How does place value relate to rounding multi-digit whole numbers?	I can determine when a multi-digit whole number should be rounded up and when it should be rounded down. I can use materials to design and engineer a roller coaster that models the concept of rounding whole numbers to the nearest 10 or 100.

GEORGIA STANDARDS

Curriculum Standards	Arts Standards
3.NR.1.3: Use place value understanding to round whole numbers up to 1000 to the nearest 10 or 100.	VA3.CR.4 Understand and apply media, techniques, processes, and concepts of three-dimensional art. VA3.CN.3 Develop life skills through the study and production of art (e.g. collaboration, creativity, critical thinking, communication).

SOUTH CAROLINA STANDARDS

Curriculum Standards	Arts Standards
3.NSBT.1 Use place value understanding to round whole numbers to the nearest 10 or 100.	**Anchor Standard 1:** I can use the elements and principles of art to create artwork. **Anchor Standard 2:** I can use different materials, techniques, and processes to make art.

KEY VOCABULARY

Content Vocabulary	Arts Vocabulary
• Rounding - Making a number simpler but keeping its value close to what it was. The result is less accurate, but easier to use. Example: 73 rounded to the nearest ten is 70, because 73 is closer to 70 than to 80 • Place value - the numerical value that a digit has by virtue of its position in a number	• Form - An object that is three-dimensional and encloses volume (cubes, spheres, and cylinders are examples of various forms) • Engineering design process - A process that designers and engineers use to arrive at a solution: Ask, imagine/brainstorm, plan/design, create/build, test, evaluate, and improve

- Place value - the numerical value that a digit has by virtue of its position in a number.
- Thousands place - The value of where the digit is in the number. Example: In 1,352, the 1 is in the "thousands" position, so it shows a value of 1,000
- Hundreds place - The value of where the digit is in the number. Example: In 1,352, the 3 is in the "hundreds" position, so it shows a value of 300
- Tens place - The value of where the digit is in the number. Example: In 1,352, the 5 is in the "tens" position, so it shows a value of 50
- Ones place - The last or right digit. Ex: In 784, 4 is in the ones place
- Whole number - A number without fractions or decimal parts
- Greater than - A symbol used to compare two numbers, with the greater number given first. Ex: 5 > 3 shows that 5 is greater than 3
- Less than - A symbol used to compare two numbers, with the lesser number given first. For example: 5 < 9 means 5 is less than 9
- Number line - A line with numbers placed in their correct position. Useful for addition and subtraction and showing relations between numbers

MATERIALS

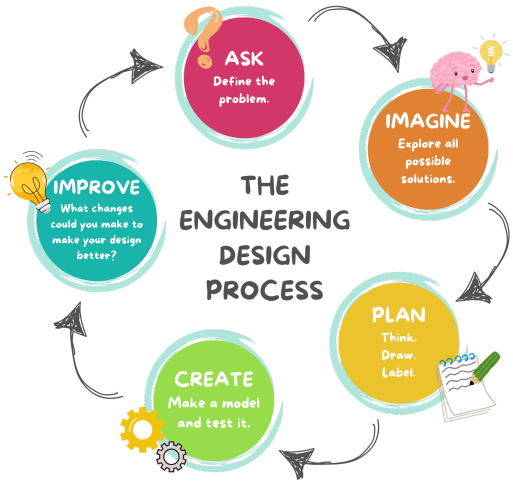
- Marbles (one per group)
- Duct tape
- Scrap cardboard, cardboard tubes
- Plastic cups
- Index cards

- Black marker
- Foam pipe insulation: Each small group should receive a four to six foot long piece (cut tubing in half to create tracks)
- Roller coaster simulation
- History of roller coasters
- How roller coasters work
- Image of the Engineering Design Process (embedded in the lesson)
- Design Process Rubric for Rounding Roller Coasters

INSTRUCTIONAL DESIGN

Opening/Activating Strategy

- Announce to the class that today they will be taking their understanding of rounding whole numbers to the nearest ten and hundred and applying it to designing roller coasters.
- Review prior knowledge of rounding and the rules of rounding whole numbers.
- Watch the video of the roller coaster simulation**.** Encourage students to count when on the slope so they begin to understand how the concept of rounding connects to the slope of a roller coaster.
- Introduce students to the history of roller coasters, how roller coasters work, and the engineering and problem solving that is present in the design.
- Introduce The Engineering Design Process to students.



- Explain that the coaster design should express form and function (aesthetically pleasing and functional).

Work Session

- Give directions on how students will work in small groups to design their own innovative roller coaster that models the concept of rounding.
- Students will work together to engineer their roller coaster.
- Give each group a different multi-digit number (differentiate these numbers based on leveled groups).

- Students will use index cards, tape and black markers to label the coaster with a multi-digit starting and ending number determined after considering the number they are rounding up or down.
- Model this for the whole group by drawing the roller coaster and labeling it.
    - Example: If you model the number 18 and you are rounding to the nearest ten, then the range of numbers labeled on the roller coaster track would be numbers 10-20. If your example is 127 and you are rounding to the nearest hundred, then the range of numbers would be 100-200 (labeling by tens: 110, 120, 130, etc.)
- Students will work in their small groups to design and engineer their roller coasters. Students should create a sketch of their design plan, labeling the parts and expressing the concept of rounding specific to their number.
- Students will use foam pipe insulation, tape, cardboard and plastic cups to build an innovative coaster.
- Students will label their coaster demonstrating the concept of rounding.
- Students will test out the mechanics of their roller coaster by using a marble.
- Encourage students to make revisions to their designs as needed.

Closing/Reflection

- Have students reflect on the following questions:
    - How did the roller coaster help you understand the concept of rounding?
    - How could you have used this same roller coaster to round to the nearest thousand or ten thousand?
    - What are you most proud of after completing this lesson?
    - If you could do this project again, what would you do differently?

ASSESSMENTS

Formative

- Teacher anecdotal notes during small group collaboration when designing, engineering, and labeling the roller coaster
- Student's experimentation with the marble and the roller coaster

Summative

- Roller coaster design and creation (Design Process Rubric for Rounding Roller Coasters)
- Correct labeling of roller coaster to demonstrate how a number will round depending on its value

DIFFERENTIATION

Accelerated:

- Ask students to name their roller coaster and create a brand based on characteristics.
- Ask students to write a story about the process of designing and creating as part of a team.
- Ask students to describe the type of energy used in their coaster. Potential energy as energy at rest and kinetic energy as energy in motion.

Remedial: Use smaller multi digit numbers for students who need additional support.

ADDITIONAL RESOURCES

- *Rounding Rescue, a Rounding Numbers Story* by Eric Lostorto
- *Numbers Elementary: Rounding* by Mike Shuck

CREDITS

U.S. Department of Education- STEM + the Art of Integrated Learning

**This integrated lesson provides differentiated ideas and activities for educators that are aligned to a sampling of standards. Standards referenced at the time of publishing may differ based on each state's adoption of new standards.*