

Discovering the Story: A City and Its Culture

Solving a Problem to Tell the Story

A Mathematics Lesson for
Grades 4-8

Based on *The Underground Railroad, 1893*
by Charles T. Webber



Charles T. Webber (1825-1911)
United States (Cincinnati)
The Underground Railroad, 1893
Subscription Fund Purchase, 1927.26

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CONCEPT STATEMENT

Fleeing enslaved persons from southern and other states throughout the United States in the 1800s traveled miles, faced hardships and risked dangers in hopes of reaching destinations for personal freedom. Recreated mini-scenarios provide a unit of study for students to examine mathematical problem-solving possibly faced by Underground Railroad participants – enslaved persons, abolitionists, “conductors” and slave owners. Observations and study of the C.T. Webber painting [The Underground Railroad](#) will aid teacher and students in their understanding of this historical undertaking. (*The teacher will reinforce the fact that hearsay, oral traditions and transcribed stories are sources for many statistics and information about the Underground Railroad, as many slaves did not know how to write or read, and therefore did not keep specific logs or journals of all their experiences.*)

OBJECTIVES

- Students will understand the concept of the Underground Railroad and its impact on personal freedoms.
- Students will draw conclusions about the hardships of freedom seekers through observations of the C.T. Webber painting *The Underground Railroad*.
- Students will identify and use relevant information found in visual art forms to confirm their conceptual understanding of the Underground Railroad.
- Students will employ mathematical processing skills for calculation of various word problems and visual representations based on Underground Railroad scenarios.

TEACHER PREPARATION

CLASS PERIODS REQUIRED

- 1 to 2 (20–30 mins.) class periods for Pre-Videoconference Lesson Activities
- 1 (50 min.) class period for the Videoconference
- 1 to 2 class periods (45–60 mins.) for Post-Videoconference Lesson Activities
- 1 to 2 (45–60) periods for Art Enrichment Activity (optional)

BACKGROUND INFORMATION

Refer to [Background Information](#) for more on the painting *The Underground Railroad* and the artist who created it. This information also provides an historical background for the

Underground Railroad and Cincinnati's involvement in this movement. This resource has been written for teachers to review before the lesson and then share with students.

VIDEO

Share the [video](#) that accompanies this lesson with your students prior to the videoconference. The video depicts the installation of an exhibit at the Cincinnati Art Museum that was inspired in part by C.T. Webber's *The Underground Railroad* and the overarching concepts of courage and freedom.

Video Duration: approx. 6 minutes.

PRE- VIDEOCONFERENCE LESSON ACTIVITIES

VOCABULARY

Definitions can be found in the [Glossary](#) on the [Discovering the Story](#) Website.

Abolitionist
Conductors
Courage
Escape
Freedom
Freedom Seekers
Fugitive
Fugitive Slave Act of 1850
Safe-house
Slave/Enslaved Person
Slave Owners
Underground Railroad

GUIDING QUESTIONS

- What is freedom?
- What is a slave?
- What are civil and personal rights?
- What can we learn from the Underground Railroad?

MATERIALS

- Print reproduction of [*The Underground Railroad*](#) – class set downloaded and printed from the *Discovering the Story* website

PROCEDURE

Teacher will:

- Facilitate class discussion to examine the questions, “What is slavery?”
- Introduce the concept of enslaved persons in the United States, and the Underground Railroad.
 - Emphasize:
 - Beginning in the 1600s, people from the continent of Africa were brought to the Americas against their will and sold as slaves to be the property of and owned by others.
 - Enslaved persons yearned for freedom. They were willing to risk many dangers, even losing their lives, to live as free men and women.
 - Abolitionists were white people and free black people who believed that all enslaved persons should live as free human beings.
 - Many abolitionists and others helped enslaved persons to freedom through a secret system known as the Underground Railroad.
 - Underground Railroad participants and elements--conductors, safe houses, etc.
- Facilitate class discussion to examine the questions, “What is freedom?” “What are civil and personal rights?”
- Introduce a reproduction of the C.T. Webber painting *The Underground Railroad*.
 - Emphasize:
 - That the painting is one of many artist interpretations of the Underground Railroad.
 - (2nd and 3rd grades) Introduction of identifiable characters--Levi Coffin, Catharine Coffin, Hannah Haydock and Thomas Haydock, and discuss their roles in the Underground Railroad.
- Facilitate class discussion on the use of visual artifacts, as primary or secondary sources, to gather and obtain relevant information to aid one’s understanding of a person, event, place or topic.
- Instruct students to observe the painting and infer information gained from pictorial depictions in the painting.
- Have students identify concepts about the Underground Railroad suggested in the painting’s depictions.
- Have students discuss how information gathered from the painting can be used to further examine the concept of the Underground Railroad from a mathematical perspective.
- Tell the students that they will learn more about this painting in a videoconference with the Cincinnati Art Museum.
 - Teacher will need to explain and describe the function and process of videoconferencing.

- Teacher will collect student questions to ask museum staff during the videoconference.
- Teacher will email questions to Museum staff prior to the videoconference.

VIDEOCONFERENCE

OBJECTIVES

- Students will interact with the Cincinnati Art Museum staff through a sixty-minute [videoconference](#).
- Students will learn about Cincinnati's contribution to the Underground Railroad.
- Students will use Museum objects to reinforce activities completed in preparation for this [videoconference](#).

CONCEPT

A [videoconference](#) conducted by the Cincinnati Art Museum staff extends student learning through emphasis on the viewing and discussion of art objects. During this [videoconference](#) with the Museum, students will explore Cincinnati's place in the story of the Underground Railroad movement and major tristate figures, such as Levi and Catharine Coffin, John Parker and John Rankin.

SCHEDULE

- **5 minutes** Introduction to CAM staff (*This is also buffer time in case of connection complications*)
- **10 minutes** Brief discussion of student pre-videoconferencing activities.
- **10 minutes** Museum staff will lead students in an in-depth investigation of C.T. Webber's painting *The Underground Railroad*
- **15 minutes** Museum staff will lead an interactive discussion with students on Cincinnati's place in the story of the Underground Railroad movement.
- **10 minutes** Questions and student sharing of art projects.
- **5 minutes** Closing (*This is also buffer time in case of connection complications*)

POST- VIDEOCONFERENCE LESSON ACTIVITIES

MATERIALS

- Word problems
- Pencil
- Colored Markers
- Rulers
- Paper
- Underground Railroad reference materials for students to use
- Reproduction of [*The Underground Railroad*](#) – class set downloaded and printed from the [*Discovering the Story*](#) website

PROCEDURE

Students will:

- Problem-solve and calculate answers to word problem scenarios based on the concept of the Underground Railroad and the C.T. Webber painting.
- Understand how a visual art object as primary and secondary sources contains useful and relevant information to help one's understanding of a person, event, place or topic.
- Organize, represent, identify and create appropriate ways to display data.

Problem Scenarios:

1. After studying the painting, calculate the monetary value of the “enslaved persons” if each enslaved child was worth \$300, each woman was worth \$900 and each man was worth \$1000.
2. Imagine that one of these young men is caught and brought back to his owner. The owner then sells him to an old woman for \$300 to work as a blacksmith. She offers the young man the opportunity to buy his freedom. How long would this take the young man to buy his freedom if he was able to earn \$1.50 per day?
3. According to the Fugitive Slave Act of 1850, if one was caught aiding and assisting a runaway slave, he or she could pay a fine up to \$1000 and receive jail time. If Levi Coffin had been caught aiding the fugitives in this painting and he was fined \$500 per person, how much in fines would he have had to pay?
4. Between the years 1850 and 1860, approximately 12,000* enslaved persons escaped from Kentucky. What was the average number of escaped slaves per year?
5. In 1850, there were 220,992* African Americans living in Kentucky. This accounted for 22.5% of Kentucky's population. What was the total population of Kentucky then?

6. In 1850, there were approximately 3,638,808* African Americans in the United States. Of these, 434,495* were free. How many African Americans at this time were slaves?
7. In 1850, there were approximately 239,459* enslaved black persons in Tennessee. There were 210,981* enslaved black persons in Kentucky. How many more were enslaved in Tennessee than Kentucky?
8. A fugitive slave escaped from his owner on September 3, from Louisville, Kentucky. At 15 miles a day, traveling at night, how many days will it take this person to travel to a safe house in Cincinnati, Ohio, about 105 miles away? What will be the month and day of his arrival in Cincinnati?
9. Mary, an escaped slave from Tennessee, traveled 25 days on the Underground Railroad in January to get to a safe house in Cincinnati, Ohio. Below are listed the low temperatures for each night that she traveled. What was the average daily low temperature for her journey?

January 4	10 degrees F
5	12
6	15
7	10
8	14
9	20
10	22
11	18
12	17
13	20
14	25
15	19
16	19
17	16
18	22
19	15
20	13
21	16
22	21
23	20
24	18
25	12
26	10
27	11
28	14 degrees F

10. A group of five fugitive slaves have reached the Ohio River. An Underground Railroad conductor waits to row them across the river in his small boat. The boat can hold up to 500 pounds. The conductor weighs 180 pounds. The slaves' weights are as follows:
 Slave #1: 135 pounds

Slave #2: 160 pounds

Slave #3: 170 pounds

Slave #4: 145 pounds

Slave #5: 200 pounds

What is the least amount of trips that the conductor will need to make to get all five slaves across? Group the slaves as they will need to be to get across safely.

11. Levi Coffin and his wife were said to have helped some 3000 slaves gain freedom. If 15 of them are pictured in C.T. Webber's painting, then how many more did they help besides the ones in this picture?

12. Assume there are approximately 3000* safe houses or stations along the Underground Railroad. If there are approximately 15 miles between each of these houses, and all routes are joined together, what is the total mileage?

* From: Hudson, J. Blaine. *Fugitive slaves and the Underground Railroad in the Kentucky borderland*. Jefferson, N.C. : McFarland & Co., 2002

MATH EXTENSION

- Students will conduct their own research on the Underground Railroad and create authentic word problems for classmates to solve.
- Students will organize obtained data from above problem scenarios into visual charts, graphs, line plots and other data displays.

ASSESSMENT OBJECTIVES

- Students will be able to verbalize a personal conceptual interpretation of the Underground Railroad.
- Students will be able to problem-solve mathematical scenarios based on Underground Railroad participants and events.
- Students will organize, represent, interpret and display obtained data from the above problem scenarios in multiple ways.

SUGGESTED TEACHER RESOURCES

Books

Hudson, J. Blaine. *Fugitive Slaves and the Underground Railroad in the Kentucky Borderland*. Jefferson, NC: McFarland & Company, Inc., 2002.

Websites

[About.com](#) on African-American History

[The Fugitive Slave Act](#)

[Safe Passages](#)

[National Underground Railroad Freedom Center](#)

[National Geographic's Underground Railroad website](#)

[Library of Congress/American Memory Collection](#)

ACADEMIC CONTENT STANDARDS

NATIONAL STANDARDS: MATHEMATICS

Standard 3: Uses basic and advanced procedures while performing the processes of computation.

Grades: 3-5

Benchmark 4: Uses specific strategies (e.g., front-end estimation, rounding) to estimate computations and to check the reasonableness of computational results.

Benchmark 5: Performs basic mental computations (e.g., addition and subtraction of whole numbers).

Benchmark 7: Understands the properties of and the relationships among addition, subtraction, multiplication and division (e.g., reversing the order of two addends does not change the sum; division is the inverse of multiplication).

Benchmark 8: Solves real-world problems involving number operations (e.g., computations with dollars and cents).

Grades: 6-8

Benchmark 1: Adds, subtracts, multiplies and divides integers and rational numbers.

Benchmark 4. Selects and uses appropriate computational methods (e.g., mental, paper and pencil, calculator, computer) for a given situation.

Benchmark 5. Understands the correct order of operations for performing arithmetic computations.

Benchmark 6. Uses proportional reasoning to solve mathematical and real-world problems (e.g., involving equivalent fractions, equal ratios, constant rate of change, proportions, percents).

Visual Arts

Standard 4: Understands the visual arts in relation to history and cultures.

Grades 5-8

Benchmark 1: Knows and compares the characteristics of artworks in various eras and cultures.

Benchmark 2: Describes and places a variety of art objects in historical and cultural contexts.

Benchmark 3: Analyzes, describes and demonstrates how factors of time and place influence visual characteristics that give meaning and value to a work of art.

OHIO STANDARDS: MATHEMATICS

Number, Number Sense and Operations

Students demonstrate number sense, including an understanding of number systems and operations and how they relate to one another. Students compute fluently and make reasonable estimates using paper and pencil, technology-supported and mental methods.

Grades: 3-4

Benchmark J : Estimates the results of whole number computations using a variety of strategies, and judges the reasonableness.

Benchmark K: Analyzes and solves multi-step problems involving addition, subtraction, multiplication and division of whole numbers.

Benchmark L: Uses a variety of methods and appropriate tools (mental math, paper and pencil, calculators) for computing with whole numbers.

Grades 5-7

Benchmark F: Applies number system properties when performing computations.

Benchmark H: Uses and analyzes the steps in standard and non-standard algorithms for computing with fractions, decimals and integers.

Benchmark I: Uses a variety of strategies, including proportional reasoning, to estimate, compute, solve and explain solutions to problems involving integers, fractions, decimals and percents.

Grade 8

Benchmark G: Estimates, computes and solves problems involving real numbers, including ratio, proportion and percent, and explains solutions.

Mathematical Processes

Students use mathematical processes and knowledge to solve problems. Students apply problem-solving and decision-making techniques, and communicate mathematical ideas.

Grades: 3-4

Benchmark D: Uses mathematical strategies to solve problems that relate to other curriculum areas and the real world; e.g., uses a time line to sequence events; uses symmetry in artwork.

Benchmark K: Uses mathematical language to explain and justify mathematical ideas, strategies and solutions.

Grades 5-7

Benchmark A: Clarifies problem-solving situations and identifies potential solution processes.

Benchmark B: Applies and adapts problem-solving strategies to solve a variety of problems, including unfamiliar and non-routine problem solutions.

Benchmark G: Relates mathematical ideas to other students and to other content areas: e.g., uses area models for adding fractions, interprets graphs in reading, science and social studies.

Grade 8

Benchmark B: Applies mathematical knowledge and skills routinely in other content areas and practical situations.

Visual Arts:

Historical, Cultural and Social Contexts

Students understand the impact of visual art on the history, culture and society from which it emanates. They understand the cultural, social and political forces that, in turn shape visual art communication and expression. Students identify the significant contributions of visual arts to cultural heritage. They analyze the historical, cultural, social and political contexts that influence the function and role of visual art in the lives of people.

Grades: 3-4

Benchmark B: Identifies art forms, visual ideas and images, and describes how they are influenced by time and culture.

Benchmark C: Identifies and describes the different purposes people have for creating works of art.

Grades 5-8

Benchmark D: Researches culturally or historically significant works of art and discusses their roles in society, history, culture or politics.

Creative Expression and Communication

Students create artworks that demonstrate understanding of materials, processes, tools, media, techniques and available technology. They understand how to use art elements, principles and images to communicate their ideas in a variety of visual forms.

Grades: 3-4

Benchmark A: Demonstrates knowledge of visual art materials, tools, techniques and processes by using them expressively and skillfully.

Grades 5-8

Benchmark C: Creates two-three dimensional original artwork that demonstrates personal visual expression and communication.

Connections, Relationships and Applications: Students connect and apply their learning of visual art to the study of other arts areas and disciplines outside the arts. They understand relationships between and among concepts and ideas that are common across subjects in the curriculum. Students recognize the importance of lifelong learning and experience in visual art.

Grades: 3-4

Benchmark A: Demonstrates the relationship the visual arts share with other arts disciplines as meaningful forms of nonverbal communication.

Benchmark B: Uses the visual arts as means to understand concepts and topics studied in disciplines outside the arts.

Grades 5-8

Benchmark C: Uses key concepts, issues and themes to connect visual art to various content areas.