

Learning About Pittsburgh in Algebra Class

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Rationale

Algebra I is a linear model mathematics course taken by all ninth grade students at Langley High School. The only exceptions are the Gifted and Scholar students who have successfully completed such a course at the Middle School. The curriculum used is from Carnegie Learning Company. It is an innovative mathematics course in which students spend two days each week in the computer room working at their own pace on problems similar to those they encounter in the classroom the other three days of the week. In the classroom, students are presented with different problem situations each day. From the given problem scenario, they are required to derive an equation, solve the equation by either evaluating or "working backwards", set up a table of appropriate values, explain the significance in the problem of the slope, y intercept and x intercept, and finally make a graph using one of three methods taught. Students then communicate the problem situation, their findings and their conclusions in written form via a letter, a memo or a report. They must also make presentations to their classmates about their work. At the beginning of the semester, students are somewhat reluctant to be doing "word problems". However after a very short period of time they come to resent performing mathematical operations that are not presented in the context of a problem situation.

Many students do not demonstrate desired mastery of Algebra I after only one year. For this reason, a new subject was introduced into our curriculum four years ago. It exists only at Langley High School and is intended for those students who received a D' grade in Algebra 1. The title of this course is Applications of Algebra and Geometry. One semester concentrates on a review of Algebra I and the second semester is an introduction into topics of Geometry such as Area and Perimeter, Pythagorean Theorem, and Angle Theorems. Students then take Geometry in the next academic year. This course has been very successful and has enabled the teacher much leeway in topics to be taught.

It is in this course that I intend to teach this unit. Students will already have knowledge of the main ideas needed to be successful. Since there is no established curriculum, I am free to review material however I wish. This will allow me to provide my students with an interdisciplinary view of Algebra and Geometry. Since it is something they have never done before, it should also eliminate the phrase 'this again'.

Because students deal solely with linear models in Algebra 1, traditional topics of probability, time lines and bar or circle graphs are addressed in the curriculum to a far lesser degree and often not at all. Despite this,

these topics are included in the standards all students are expected to master. I plan to incorporate these topics into some of the problems I will create for this unit of study.

I have always been interested in history. I was born in New York City and came to Pittsburgh when I was married. For the past twenty-two years, Pittsburgh has been my home. While I know much about the recent history of this city, how Pittsburgh has evolved into its present form is not something with which I am familiar. Thus my interest in this particular seminar. This seminar exposed me to pieces of Pittsburgh's history I never would have investigated on my own. The guest lecturers provided vivid and often compelling testimony that I hope to instill in my students. This seminar examined so many different aspects of the history of this city that I am able to present a mini-course to my students. I'm sure many of them will be astonished at how much mathematics can be found in history. Since they are in a class with such a teacher-oriented curriculum, I am free to review topics of Algebra however I choose. I believe reviewing Algebra through the history of Pittsburgh will be a useful and less boring approach.

My students, although most of them were born in Pittsburgh, lack knowledge of their city. Many of them think of Pittsburgh as the West End and Downtown. I am always surprised when students ask me where I live and my reply is Shadyside, that many of them believe my journey to school each day is a long one. When I tell them that I live fifteen minutes from school, many of them think I must speed to work. Because Pittsburghers often describe where they live by their specific neighborhood, many of my students are unaware of which areas are the city and which areas are the suburbs. They are not required to take a History of Pittsburgh course and it is my understanding that depending on who their Social Studies teacher is, will determine if Pittsburgh is even addressed in class. Students are exposed to World Cultures, the United States as a whole and the workings of the Federal Government. In order to understand the present, I believe it is imperative to look at the past. Students are unable to understand what has occurred in Pittsburgh unless they understand its history. The geography and economics of this city is important to all young people. Learning about Pittsburgh in a Mathematics class will help students discover the relationship of Mathematics to other subjects. Hopefully, this unit of study will serve several purposes: to integrate mathematics and history; to give students some insight into Pittsburgh of the past and present; to enable students to solve problem situations in nontraditional scenarios.

My curriculum unit will present problems examining Pittsburgh as a geologic, historic and social city. The mathematical topics will include probability problems when looking at the ethnic breakdown of the population and its neighborhoods, time lines of when the different Indian tribes inhabited the area, linear equations regarding the Underground Railroad and Industrial Pittsburgh, systems of equations involving both the Railroad Strike and the Homestead Strike, classification of triangles when determining, the dimensions of the Golden Triangle and lines of best fit when dealing with the topography of Pittsburgh.

The unit will be taught at the end of the school year and will serve as a final review of all topics learned. Traditionally this is the hardest time of the year to maintain student motivation. By teaching my unit at this time I will be reviewing for their semester exam in a new and exciting way.

I hope to make mathematics and history real to my students. By doing this, I feel they will eventually improve their mathematics scores on the New Standards and Pennsylvania Assessment tests. Both of these testing vehicles use unconventional means to test students' math abilities. Students are required to solve non-routine problems that they have not seen before. By working through my unit, my students will be given access to problems that they would not find in any textbook.

Content Standards Addressed

Mathematics

1. All students use numbers, number systems and equivalent forms to represent theoretical and practical problems.
2. All students apply the concepts of patterns, functions and relations to solve theoretical and practical problems.
3. All students formulate and solve problems and communicate the mathematical processes used and the reasons for using them.
4. All students understand and apply basic concepts of algebra, geometry, probability and statistics to solve theoretical and practical problems.
5. All students evaluate, infer and draw appropriate conclusions from charts, tables and graphs showing the relationships between data and 'real world' situations.

Communications

1. All students read and use a variety of methods to make sense of various kinds of complex texts.
2. All students respond orally and in writing to information and ideas gained by reading narrative and informational texts and use the information and ideas to make decisions and solve problems.
3. All students write for a variety of purposes, including to narrate, inform and persuade in all subject areas.
4. All students exchange information orally, including understanding and giving spoken instructions, asking and answering questions appropriately and promoting effective group communications.
5. All students compose and make oral presentations for each academic area of study that are designed to persuade, inform or describe.

Social Studies

1. All students demonstrate an understanding of major events, cultures, Groups and individuals in the historic development of Pennsylvania, the United States and other nations, and describe themes and patterns of historical development.
2. All students demonstrate an understanding of themes of geography, and describe the relationships between geography and historical, economic and cultural development.

Lesson 1: Immigrants

Time: 1 day

This lesson will provide students the opportunity to learn the different neighborhoods in the City of Pittsburgh and their location. We will examine areas on the North Side, the South Side and those located between the Allegheny and Monogahela Rivers.

The objective of this lesson will be for students to solve probability problems based on the numbers of immigrants and the neighborhoods in which they settled. Students will research the German, Irish, English, Italian, European (Polish, Russian, Hungarian and Ukrainian), African American, Spanish and Asian influence on the city of Pittsburgh. They will concentrate on population data, percentage of population and neighborhoods in which the different ethnic groups settled. Students will then be asked to solve simple probability problems, unions and intersections.

Some examples could be:

1. What is the probability of being Italian and living in Bloomfield?
2. What is the probability of a person of Irish descent and a person of African American descent living in Hazelwood?
3. What is the probability of a Polish person living in Polish Hill or a German person living in Lawrenceville? Students will also be asked to solve similar type problems at various years from 1800 to the present.

Materials Needed:

Reference books, the Internet, the Atlas, the 1990 Census, the 2000 Census (if available), dittos with prepared questions.

Lesson 2: Indian Tribes

Time: 2 days

So many of the names we encounter daily in Western Pennsylvania have an Indian influence. So many of the streets in Pittsburgh can be traced to Indian tribes. Before beginning the lesson, the students will have the opportunity to make lists of such street names and have the opportunity to research the origin of the names on their list.

The objective of this lesson will be for students to discover the Indian influence on the city of Pittsburgh. Through research, they will learn more about the following tribes: Iroquois, Seneca, Delaware, Monogahela, and Shawnee. After completing their investigations, students will be asked to create a time line and a bar graph. The time line will be used to indicate when the various tribes were most prevalent in the area. The bar graph can be used to easily show the Students the populations of the different tribes thus becoming a vehicle to discover which tribe had the most members. Students will then write several paragraphs about their findings. They will be asked to address several issues:

Which Indian tribe influenced this city the most? Justify your answer.

What effects of the different tribes are still visible in Pittsburgh today? Justify your answer.

Students will present their results to their classmates and other teachers.

Materials needed:

Reference books, Atlas, graph paper, rulers, dittos with prepared questions.

Lesson 3: Underground Railroad

Time: 1 day

Many of the students I teach believe the Underground Railroad to be just that: a mode of transportation. If possible, I hope to have Mr. John Burt as a guest lecturer before the students start their lesson.

The objective of this lesson will be to deal with the trip taken by the slaves. Students will be given a narrative describing the Underground Railroad. They will be given certain information regarding the rate at which people were able to travel. They will be given a map with destinations and be asked to determine how long it would take to reach these places. They will also be given times traveled and asked at what location they will finish. Students will be required to answer questions about the slope, x intercept, y intercept and their significance in this particular problem. They will also be required to draw a graph of their equation.

Materials needed: Reference books, narrative about the topic, detailed map of Western Pennsylvania, graph paper, rulers, ditto of prepared questions.

Lesson 4a: Industrial Pittsburgh

Pittsburgh is a city that has changed dramatically over the last few decades. Gone is the dark, dirty image of an industrial milltown, what has come is a leader in computer technology and health careers. The next two lessons examine these phenomena.

(This is the lesson plan that will be used.)

Time: 1 day

Objective: To investigate the influence of industry on the job market of Pittsburgh.

Problem Scenario:

Between 1981 and 1984, more than 400 high tech firms set up operations in the Pittsburgh area, adding 40,000 new jobs to the economy.

Answer all questions based on the problem scenario.

1. Find an equation for this situation that gives the number of new jobs each year if this trend continues. Indicate what each variable stands for.
2. Use your equation to answer the following questions. Be sure to write your answers in complete sentences.
 - a. How many new jobs are added each year?
 - b. How many new Jobs will be added in five years?
 - c. How many new jobs will be added in ten years?

3. Use your equation to find the slope, x intercept and y intercept. State whether the graph of the equation increases or decreases.

Use complete sentences to answer the following questions.

- a. What does the slope represent in this problem situation?
- b. What does the x intercept represent in this problem situation?
- c. What does the y intercept represent in the problem situation?
- d. Explain why the graph of this equation increases or decreases?

5. Graph the equation of this problem situation using any of the three methods taught.

Materials Needed: Dittos of the problem scenario, graph paper, and rulers.

Lesson 4b: Industrial Pittsburgh

Time: 1 day

Problem Scenario:

In 1990 there were 85,000 health care employees working in the city of Pittsburgh. This is a 50% increase in the number of workers over the last ten years.

Answer all questions in complete sentences.

1. Find an equation for this situation that gives the relationship of the number of health care employees working each ten-year period. Indicate what each variable stands for.

2. Use your equation to answer the following questions.

- a. At this rate, how many health care employees will there be in the year 2000?
- b. In what year will the number of health care employees be 200,000?
- c. How many health care employees were there in the year 1980?

3. Use your equation to find the y intercept. State whether the graph of your equation is increasing or decreasing.

4. Use complete sentences to answer the following questions.

- a. What is the significance of the y intercept in this problem situation?
- b. Explain why the graph of this equation increases or decreases?
- c. Explain why the graph of this equation is not a straight line?

5. Graph the equation of this problem situation.

Materials Needed:

Dittos of the problem situation, graph paper, rulers Note:

Since this is an exponential function, it might be more appropriate for an Algebra 2 class. Algebra I students are taught however that not every situation results in a linear model. This problem is an excellent example of that fact.

Lesson 5: Union Strikes

Time: 2 days

The railroads and/or the steel mills employed many of the residents of the West End of Pittsburgh. In some families as many as three generations found work in the mills. A typical scenario was to attend school until old enough to work, go to the employment office and begin a career in the steel mill, usually U.S. Steel or J&L (now L.T.V.). The students will have time to read and discover the reasons behind the formation of the unions and the many obstacles they had to face. They will also be introduced to Andrew Carnegie via the video "The Richest Man in the World".

The objective of these lessons will be to review both the formations of the unions and the two major strikes affecting the workers: the Railroad Strike and the Homestead Strike. The problems created will be problems involving systems of equations. These problems will include meaningful work from both the historical and mathematical points of view. The systems will involve wages from both types of employment and the number of workers left unemployed as a result of the strikes. Another problem will involve the number of jobs lost due to the closing of the mills.

Materials Needed:

Reference books, video "The Richest Man in the World", ditto of prepared problem scenarios, graph paper, rulers.

Lesson 6a: The Rivers of Pittsburgh

Time: 2 days

Most students are aware of the three rivers that are part of Western Pennsylvania. However, most are oblivious to the rivers' importance in the economic and social life of the people of Western Pennsylvania and the United States.

Objective: Students will learn about the three rivers of Pittsburgh, the Allegheny, the Monogahela and the Ohio. Specifically, they will discover their paths and the various landmarks on each river.

Procedure:

1. Students will be divided into three groups. Within each group students will be paired up.
2. Each of the three groups will work on a different river.
3. Students will be given copies of the navigational charts for their river. These charts are scaled and contain all landmarks.
4. Students will be given a starting point for their journey and the speed at which they are travelling.
5. Students will be asked to write an equation defining variables, find the slope, x intercept and y intercept and make a graph of their equation.

6. Students will be asked to answer specific questions relative to the river they are studying. For example:

1. How long will it take before you arrive at the LTV plant?
2. How many miles is it to Beck's Run Road?
3. If you travel two hours on the Ohio, what is the closest landmark?
4. How long will it take to arrive at the 62nd Street Bridge if you are on the Allegheny?

7. On day two, students from each group will be asked to present their results to their classmates so that all students can learn about all three rivers.

Materials Needed:

Navigational charts of the Allegheny, Monogahela and Ohio Rivers, dittos with prepared questions, graph paper, and rulers, measuring tapes.

Lesson 6b: The Hills of Pittsburgh

Time: 1 day

Students are well aware of the terrain of their city. The West End has an abundance of stairs to navigate the hills. Students who walk to school are given a good workout each day. Those who are bussed find the winter ice and sleet particularly challenging.

The objective of this lesson will be to teach the students about the terrain of Pittsburgh. Information included in this lesson will be about the slope of Mount Washington, the Incline System of transportation, how the North Hills and South Hills came to be called and that the shortest distance between two points is not

necessarily a straight line when living in Pittsburgh. Students will research the information needed to answer the questions, write equations, and graph their equations. They will be asked to give meaning to the slope and what it means to truck drivers and pedestrians.

Materials Needed:

Topographical maps, reference books, the Internet, Atlas, ditto of prepared questions, graph paper, and rulers.

Lesson 7: The Golden Triangle

Time: 2 days

Objective: Students will determine the boundaries necessary to make the Golden Triangle an Isosceles, equilateral and scalene triangle in years 1800, 1900, and 2000.

Procedure: Students will work in the library for this exercise.

1. Students will use research to learn what the Golden Triangle means and what it must include.
2. Students will draw a sketch of the city in each of the above mentioned years and will include any important landmarks and distances necessary to make it an isosceles triangle.

3. Students will repeat step 2 for an equilateral triangle.
4. Students will repeat step 2 for a scalene triangle.
5. Students will write a few paragraphs explaining why they chose the boundaries they did. They will also include how the Golden Triangle changed as the centuries changed. They must include a bibliography in their report.

Homework: Why is this area called the Golden Triangle? Why not the Blue Triangle or the Maroon Triangle or the Black and Gold Triangle!

Materials Needed.

Copies of outlines of the city of Pittsburgh in the years 1800, 1900 and 2000, rulers, magic markers, graph paper, books about Pittsburgh, the Internet.

Conclusion

When I began thinking about the different kinds of problems to create, I never imagined the difficulties I would face. Because I am dealing with real life, the numbers are not "nice". Also, very few examples would be totally linear models if I am to be completely accurate. However, I believe the examples I bring my students would give them a better understanding of the city in which they live. Throughout the unit, I plan to have them read important paragraphs from the readings I have done during this seminar. I will also be using notes taken from the various guest lecturers who really helped me to understand more about Pittsburgh. In this way, my students will accomplish my goal for them: to integrate mathematics and history; to give insight into Pittsburgh both past and present; and to solve problem situations in non-traditional scenarios.

Bibliography

Boyer, Richard. Labor's Untold Story. New York: Marzani and Munsell, Inc., 1955.

Demarest, David. "The River Ran Red" Homestead 1892. Pittsburgh: University of Pittsburgh Press, 1992.

Gacyetta, Vince. Pittsburgh Fulfilling its Destin. California: Windsor Publication, Inc., 1986.

Hays, Samuel. City at the Point. Pittsburgh: University of Pittsburgh Press, 1991.

Lorant, Stefan. Pittsburgh The Story of an American City. Massachusetts: Authors Edition, Inc., 1975.

Lubove, Roy. Twentieth Century Pittsburgh. Pittsburgh: University of Pittsburgh Press, 1995.

Shank, William. Indian Trails to Super Highways. York: American Canal and Transportation Center, 1996.

Toker, Franklin. Pittsburgh An Urban Portrait. Pittsburgh: University of Pittsburgh Press, 1986.

Underground Railroad, National Park Service, 1998.

War for Empire in Western. Pennsylvania. Fort Ligonier Association,1993.

U.S.Coast Guard. Navigational Charts Allegheny River. Pittsburgh District, 1991.

U.S.Coast Guard. Navigational Charts Monogahela River. Pittsburgh District, 1991.

U.S.Coast Guard. Navigational Charts Ohio Rive . Pittsburgh District,1991.

Videos:

Domike,Steffi. The River Ran Red. Social Studies SchoolServices,1993.

Hoyt,Austin. The Richest Man in the World. PBS Video, 1997.