



UNDERSTANDING
SACRIFICE

Activity: Flight Plans and Rescues: Using Math to Explore the World War II Strategic Bombing Campaign



Guiding question:

How does the military use math and map skills to perform important duties?

DEVELOPED BY JARRED STEWART

Grade Level(s): 6-8, 9-12

Subject(s): Social Studies, Math

Cemetery Connection: North Africa American Cemetery

Fallen Hero Connection: Captain Walter C. Swarner, Jr.



NHD
NATIONAL
HISTORY DAY

Overview

Using maps of the Mediterranean region and primary sources, students will identify important places and individual contributions to the Allied effort in World War II. After reading a primary source document, students will write a response to a discussion question. With maps superimposed with a graph, students will utilize algebraic functions to find specific locations that follow the story of Captain Walter Swarner and other bomber pilots.


Historical Context

The early American bombing campaign in Europe focused on destroying Axis infrastructure and industrial capacity as well as softening up Sicily for the coming Allied invasion, codenamed Operation Husky. Captain Walter C. Swarner, Jr. was part of Operation Tidal Wave which directed American bombers against the Axis oil refineries in Ploesti, Romania. As with many bombing missions, this one saw the loss of several bombers and their crews. The success of bombing missions relied on quality planning, precise calculations, coordination with fighter planes, and the skills and courage of Allied crews. Bombing raids on Axis positions would continue throughout the war and eventually include targets on civilians to remove their support for the war. Despite improvements in technology, the effects of bombing rarely matched the promises made by air power advocates.

Objectives

At the conclusion of this lesson, students will be able to

- Identify the countries involved in the North African and Mediterranean campaigns;
- Solve algebraic functions with two variables; and
- Plot coordinates on a graph.



“The crews of the bombers ventured over large swaths of continents searching for precise points; however, precision was rarely attainable. Finding bombing locations, paths home, and rescue coordinates required many calculations in the air and on the ground. It is important to celebrate the bravery of the crews and the mathematical skills needed for their jobs.”

— Jarred Stewart

Stewart teaches at Lebanon Trail High School in Frisco, Texas.

Documents Used ★ indicates an ABMC source

Primary Sources

Letter from Sergeant John Gaffney to Mr. & Mrs. Swarner, December 29, 1943
376th Bomb Group Veterans Association
armyaircorps-376bg.com/gaffney_john.html

Secondary Sources

Captain Walter Swarner, Fallen Hero Profile ★
National History Day
nhsilenthheroes.org/profiles/walter-c-swarner/

World War II European Theater Historical Maps
The United States Military Academy at West Point
westpoint.edu/history/sitepages/wwii%20european%20theater.aspx

Materials

- Map of the Mediterranean
- Flight Plans and Rescues Handout
- Flight Plans and Rescues Answer Key
- Plotting the Rescue Assessment
- Plotting the Rescue Assessment Answer Key
- Computer with internet capability
- Projector and speakers
- Colored pencils
- Rulers

Lesson Preparation

- Print one copy of the Flight Plans and Rescues Handout for each student.
- Print two copies of the Mediterranean map with grid for each student (in the event of mistakes).
- Review Captain Swarner’s Fallen Hero Profile to share a few key details with the class.
- Set up classroom technology, if necessary.
- Set out rulers and colored pencils for students.

Procedure

Activity One: Mapping the Mediterranean (20 minutes)

- Distribute one copy of the Flight Plans and Rescues Handout to each student.
- Ask students to use the World War II European Theater Historical Maps to neatly label the following on their map: Spain, Great Britain, France, Italy, Sicily, Algeria, Austria, Hungary, Yugoslavia, U.S.S.R., Romania, Bulgaria, Albania, Turkey, Tunisia, Libya, Egypt, Germany, Morocco and Switzerland.
 - Ask students, *Which countries were a part of the Axis powers?*
 - Answer: Germany, Italy, Japan (not on the map)
 - Ask students, *Which countries were allied with the United States?*
 - Answer: U.S.S.R. and Great Britain
 - Ask students, *Which countries had been invaded and taken over by the Axis Powers before America’s entry in December 1941?*
 - Answer: France, Sicily, Algeria, Hungary, Yugoslavia, Romania, Albania, Tunisia, Libya, Morocco
 - Ask students, *Which countries were neutral during World War II?*
 - Answer: Turkey, Switzerland, and Spain
 - Explain to the students how America’s first invasion of the war was into North Africa, starting in Morocco and Algeria and spreading to Tunisia.
 - Ask students, *Once the Americans and the British had won back North Africa, where would you attack next?*
 - Help students understand Sicily as the next logical step in the invasion and the importance of controlling the Mediterranean and Italy.
 - Ask students, *As you prepare to invade Europe and attack Germany, what are some of the things you should do to ensure victory?*
 - Help students understand the steps involved in planning an invasion and the role aerial reconnaissance and bombing played.

Activity Two: Letter to Captain Swarner's Parents (25 minutes)

- Project a picture of Captain Walter C. Swarner, Jr. from his Fallen Hero Profile to the class and provide a few details of his life. Students may read the profile or watch the eulogy video.
- Ask students to take turns reading aloud the letter from John Gaffney to Captain Swarner's parents. Stop students at difficult words and ask the class to help define using context clues.
- Ask students to complete part two of the activity which asks students to analyze and respond to the document.

Assessment: Plotting the Rescue (50 minutes)

- Ask a student to read aloud the scenario that sets up the problem to solve in this activity.
 - Ask students, *Explain the problem in your own words.*
 - Ask students, *What are the real-world reasons solving this problem would be important?*
- Work through the two practice questions with students on a whiteboard or overhead projector.
 - **Teacher Tip:** *An answer key is provided.*
- Ask the students to solve the first problem which locates the Allied airfield in Egypt. Check to see if everyone correctly solved the problem, and ask a student to demonstrate how to plot that on the chart with a colored pencil.
- Assign the rest of the problems, reminding students to read as they go along and look for clues to help them check their work.
- The overlay key can be printed on printable transparency paper to quickly check student work.

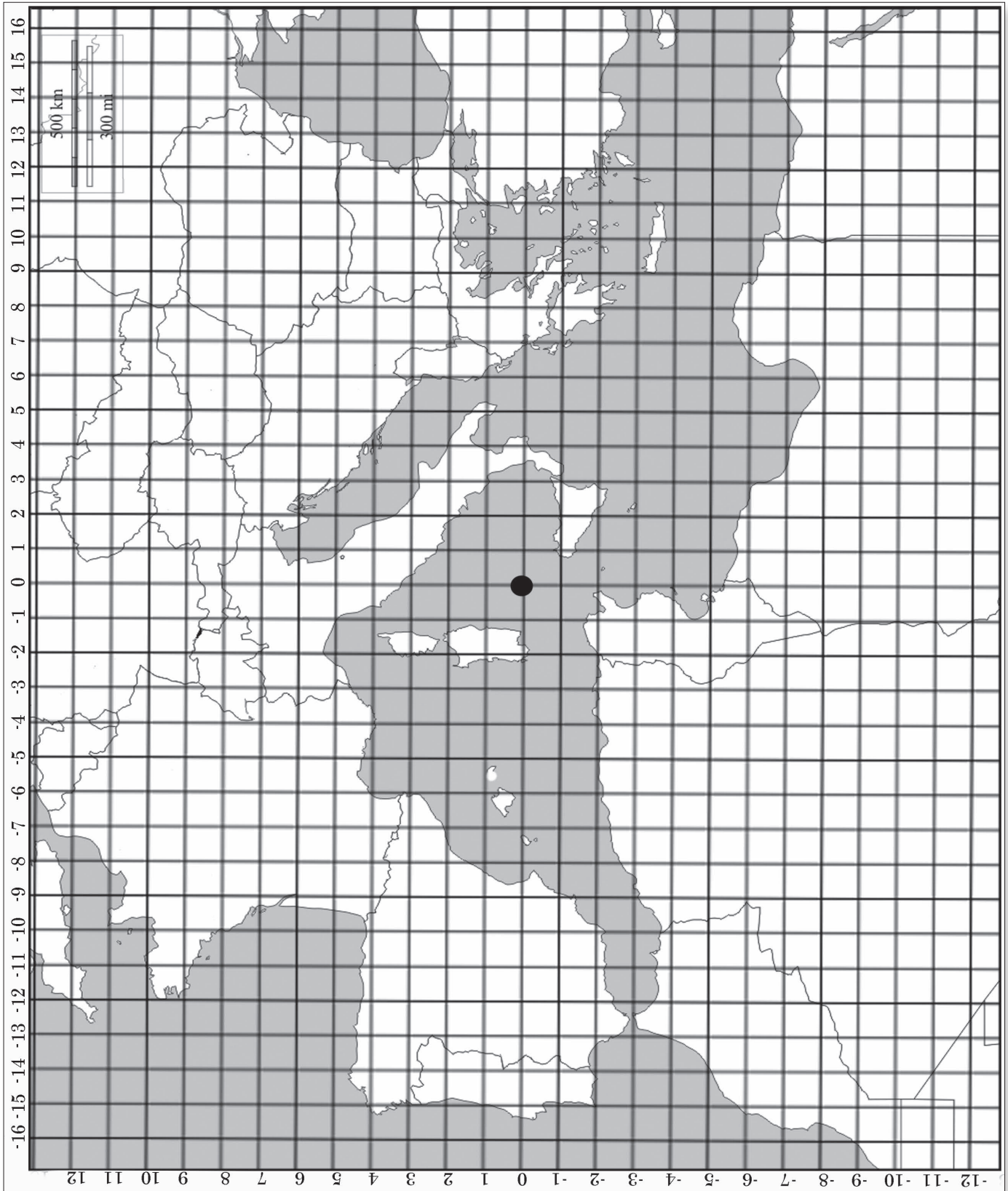
Methods for Extension

- Students can be given an additional map grid and asked to plot a course from Tunis to each of the following cities: Palermo, Rome, Paris, Berlin. Students should use direct line courses to each location. Students then will write equations for each point along the path.
- The American Battle Monuments Commission maintains U.S. military cemeteries overseas. These cemeteries are permanent memorials to the fallen, but it is important that students know the stories of those who rest here. To learn more about the stories of Americans who made the ultimate sacrifice, visit abmc.gov/education and NHDSilentHeroes.org.
- Teachers can enhance students' interest in the role of mathematics in World War II by exploring these related lesson plans:
 - [The Math of War: The Numbers Behind Minesweeping in the Mediterranean](#)
 - [RADAR: Innovating Naval Warfare](#)

Adaptations

- Teachers can adapt the project to English Language Learners by simplifying the language in the instructions and letter and by having the class read aloud each of the three steps of the activity.
- Teachers can adapt this lesson to younger students by providing coordinates and focusing purely on the skill of plotting points on a graph and drawing lines.

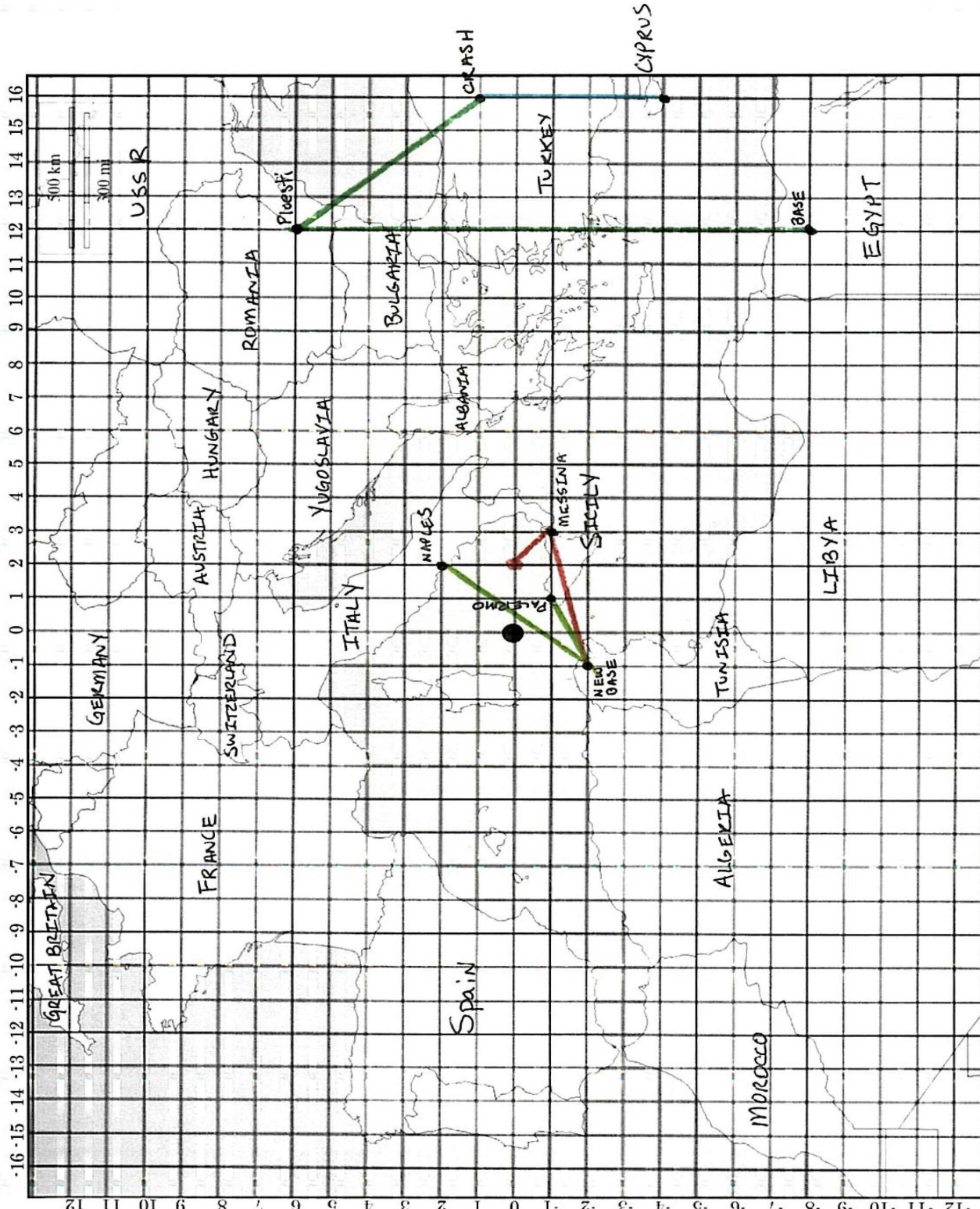
Map of the Mediterranean



Flight Plans and Rescues Answer Key

Flight Plans Student Activity Map Grid.png

8/21/2016



Plotting the Rescue Assessment

Scenario: American bombing of Nazi-controlled Europe began from bases in North Africa. Bombers manned by America's young men flew across the Mediterranean Sea to bomb military bases and industrial centers that provided war materials to the Nazis. Due to anti-aircraft guns and enemy fighter planes, many American and Allied crews were shot down, lost at sea, or forced to land in enemy territory. Your job is to chart their locations to ensure rescue efforts get to them.

Practice Questions:

Solve for y

$$\frac{1}{2}y = 3x - 4$$

$$-4y = 2(x + 8)$$

$$3(y + 4) = 2 + 4x$$

$$y + \frac{3}{9} = 2x + 3$$

Solve for x

$$-y = 4x + 2$$

$$2 + y = 4x - 10$$

$$4(y + 3) = 4(x - 3)$$

Plotting the Rescue Assessment cont.

1. First locate the Royal Air Force Base in Egypt. Solve for x and determine the coordinates for the map. Label the base on your map.

$$\frac{x - 3}{3} = y + 11 \quad \text{where } y = -8$$

2. In 1942, one of the first missions Captain Swarner and other American crews undertook was a bombing raid on Ploesti in Romania. Solve for x and draw a green line between the airbase in Egypt and the bombing location in Romania.

$$\frac{2x - 3y}{3} = 2 \quad \text{where } y \text{ is a whole number between } 6 \text{ and } 9$$

3. The bombing raid was a good first try, but failed to stop most of the fuel production for the Nazis. Several of the planes, including Captain Swarner's plane, The Boston Rambler, were hit by anti-aircraft fire and forced to land in Turkey. Solve for y and draw another green line from Ploesti to the crash site.

$$2(x + 9) = 5(-y + 11)$$

where x is a whole number longitude (vertical) line that runs through Turkey

Plotting the Rescue Assessment cont.

4. After several months of internment by the Turkish military where the men were forced to train Turkish pilots and work on the planes, the men were able to escape in one of the planes. Using the equation below, solve for y to locate the country to which they escaped. Place a blue dot on the location and draw a blue line from internment to safety.

$$4x - 5x + 13 = \frac{12}{y}$$

where y is a whole number latitude line (horizontal) between -2 and -4

When the men left Turkey, they escaped to _____

5. The men were given several months to recover as the Allied liberation of North Africa continued. Captain Swarner and his men would then fly out of a new base, located closer to the Allies' next objective, Italy. Use the equation below and solve for y to find the new location of their base.

$$2(x - 3) = 9y - 5y \quad \text{where } x = -1$$

From what country are Captain Swarner and his crew now flying? _____

Plotting the Rescue Assessment cont.

6. Captain Swarner and his men flew in the *Widdle Wed Wabbit* to bomb the German and Italian armies in Italy. Specifically they bombed Palermo, Sicily and Naples, Italy. Solve both equations for x , and label each city correctly. Draw one green line from Tunis to each of the cities.

Location Name	Equation	Coordinates
Palermo	$y - 2 = 4x - 7$ ($y = -1$)	
Naples	$4y = 3x - 4x + 10$ ($y = 2$)	

7. Captain Swarner's final mission was a bombing run over Sicily to the important position of Messina. Solve for y and label the city of Messina. Draw one red line from Tunis to Messina.

$$4x - 5 = 2y + 3x \quad \text{where } x = 3$$

Coordinates _____

Plotting the Rescue Assessment cont.

8. Captain Swarner called in an S.O.S. after being attacked by German fighter planes. The plane was severely damaged and was reported disappearing into the ocean. Use the following data to plot on your map the location to send a rescue ship.

- a. The crash location was reported to be 100 miles northwest of Messina.
- b. Plug in your estimated coordinates into the following equation to check your answer.

$$5x - 10 = \frac{3y+4y}{4}$$

Coordinates of Captain Swarner's Plane _____

Plotting the Rescue Assessment Answer Key

Scenario: American bombing of Nazi-controlled Europe began from bases in North Africa. Bombers manned by America's young men flew across the Mediterranean Sea to bomb military bases and industrial centers that provided war materials to the Nazis. Due to anti-aircraft guns and enemy fighter planes, many American and Allied crews were shot down, lost at sea, or forced to land in enemy territory. Your job is to chart their locations to ensure rescue efforts get to them.

Practice Questions:

Solve for y

$$\frac{1}{2}y = 3x - 4$$

$$y = 6x - 4$$

$$-4y = 2(x + 8)$$

$$y = -\frac{1}{2}x - 4$$

$$3(y + 4) = 2 + 4x$$

$$y = 1\frac{1}{3}x - 3\frac{1}{3}$$

$$y + \frac{3}{9} = 2x + 3$$

$$y = 2x + 2\frac{1}{3}$$

Solve for x

$$-y = 4x + 2$$

$$x = -\frac{1}{4}y - \frac{1}{2}$$

$$2 + y = 4x - 10$$

$$x = \frac{1}{4}y + 3$$

$$4(y + 3) = 4(x - 3)$$

$$x = y$$

Plotting the Rescue Assessment Answer Key cont.

1. First locate the Royal Air Force Base in Egypt. Solve for x and determine the coordinates for the map. Label the base on your map.

$$\frac{x - 3}{3} = y + 11 \quad \text{where } y = -8$$

$$\text{Answer} = 12$$

2. In 1942, one of the first missions Captain Swarner and other American crews undertook was a bombing raid on Ploesti in Romania. Solve for x and draw a green line between the airbase in Egypt and the bombing location in Romania.

$$\frac{2x - 3y}{3} = 2 \quad \text{where } y \text{ is a whole number between } 6 \text{ and } 9$$

$$y = 6$$

$$x = 12$$

3. The bombing raid was a good first try, but failed to stop most of the fuel production for the Nazis. Several of the planes, including Captain Swarner's plane, The Boston Rambler, were hit by anti-aircraft fire and forced to land in Turkey. Solve for y and draw another green line from Ploesti to the crash site.

$$2(x + 9) = 5(-y + 11)$$

where x is a whole number longitude (vertical) line that runs through Turkey

$$y = 1$$

$$x = 16$$

Plotting the Rescue Assessment Answer Key cont.

4. After several months of internment by the Turkish military where the men were forced to train Turkish pilots and work on the planes, the men were able to escape in one of the planes. Using the equation below, solve for y to locate the country to which they escaped. Place a blue dot on the location and draw a blue line from internment to safety.

$$4x - 5x + 13 = \frac{12}{y}$$

where y is a whole number latitude line (horizontal) between -2 and -4

$$x = 16$$

$$y = -4$$

When the men left Turkey, they escaped to _____ Cyprus _____

5. The men were given several months to recover as the Allied liberation of North Africa continued. Captain Swarner and his men would then fly out of a new base, located closer to the Allies' next objective, Italy. Use the equation below and solve for y to find the new location of their base.

$$2(x - 3) = 9y - 5y \quad \text{where } x = -1$$

$$y = -2$$

From what country are Captain Swarner and his crew now flying? _____ Tunisia _____

Plotting the Rescue Assessment Answer Key cont.

6. Captain Swarner and his men flew in the *Widdle Wed Wabbit* to bomb the German and Italian armies in Italy. Specifically they bombed Palermo, Sicily and Naples, Italy. Solve both equations for x , and label each city correctly. Draw one green line from Tunis to each of the cities.

Location Name	Equation	Coordinates
Palermo	$y - 2 = 4x - 7$ ($y = -1$)	(1, -1)
Naples	$4y = 3x - 4x + 10$ ($y = 2$)	(2, 2)

7. Captain Swarner's final mission was a bombing run over Sicily to the important position of Messina. Solve for y and label the city of Messina. Draw one red line from Tunis to Messina.

$$4x - 5 = 2y + 3x \quad \text{where } x = 3$$

Coordinates (3, -1)

Plotting the Rescue Assessment Answer Key cont.

8. Captain Swarner called in an S.O.S. after being attacked by German fighter planes. The plane was severely damaged and was reported disappearing into the ocean. Use the following data to plot on your map the location to send a rescue ship.

- a. The crash location was reported to be 100 miles northwest of Messina.
- b. Plug in your estimated coordinates into the following equation to check your answer.

$$5x - 10 = \frac{3y + 4y}{4}$$

Coordinates of Captain Swarner's Plane (2, 0)

Letter from Sergeant John Gaffney to Mr. & Mrs. Swarner, December 29, 1943

376th Bomb Group Veterans Association

Dear Mr. & Mrs. Swarner:

I have just been reading over your letters to my mother. I realize how anxious you are to have definite news of our skipper. To begin with, Roberto and myself have Lt. Swarner to thank for our lives. His thoughts were forever with the rest of the crew. More so than any pilot I ever flew with. I think you had better understand the whole story.

I started to fly with Lt. Swarner as his tail gunner and armorer, when he escaped from Turkey. Sgt. Paul & I always flew together. Huska & Romero always flew together. Ruska, Romero, Paul & myself had all flown together before, along with Lt. Longstreth and Lt. Deffner. After the second mission with Lt. Swarner as skipper and Lt. Bley as co-pilot, we were marked up as number two crew. Later we were number one and flying every mission by popular agreement.

Lt. Swarner made a point to get Sgt. Paul and myself out of all our troubles. He used to come to our tent and talk with us, meet us at the mess line to talk, swim with us in Benghazi harbor and inquire after any default in the ships equipment. He was closer to us than any pilot in the outfit was to his crew. We were all out for him. No pilot had a more devoted crew I can assure you. We called him skipper. He could joke and talk with us on our missions to help us out. So many pilots don't think it's necessary, but that's why we were the squadron's first crew.

We took off for Messina with three 2,000 lb. bombs aboard. We made the usual fine takeoff and headed out to sea. Things ran smoothly. I went to the cockpit, then pulled the pins out of the bombs, and went back and climbed in my turret to prevent any surprise attack and report on the formation to the skipper. Lt. Longstreth called in directions, we had our altitude and were near the target. Lt. Deffner opened the bomb bay doors, we made our run and dropped our load. Immediately we got our first anti-aircraft hit. It knocked off our bomb bay door. The second burst in the rear of the fuselage, the third burst in the bomb bay, and the fourth hit our left wing, setting number 3 engine afire and number 4 started to stutter. They threw us far out of formation. Lt. Swarner called in and asked each one separately if we had been hit, everyone said no, but those in the fuselage had been hit by that second ack-ack shell. I was not hit yet. We lost altitude fast and three fighters jumped our tail. Two passed on me and by luck one went down in smoke. One passed on the nose. Longstreth called in "They got Ted this time." Skipper said, "They got Morgan, too." (Ted was Lt. Deffner, bombardier; Morgan new co-pilot) We went into a steep nose dive. The skipper was fighting the controls. I was firing at a fighter at the tail while the remaining one was straffing us repeatedly from nose to tail, using cannon and machine guns. The nose guns were not firing and top-turret was shot out of order. We were helpless, as my guns can only fire from tail to the rear.

Letter from Sergeant John Gaffney to Mr. & Mrs. Swarner, December 29, 1943, cont.

376th Bomb Group Veterans Association

By a superhuman effort, the skipper pulled the ship out of a nose dive that was almost vertical – a thing hitherto thought to be nearly physically impossible. A few seconds later we hit the water, still firing at those fighters. The ship broke up into several pieces. When I got out of the turret and to the surface I saw Romero, then Huska, then Lt. Swarner. The only floating things were oxygen bottles. I swam towards the rest of them and came to Longstreth's body. He had been in the nose of the ship. Romero found Sgt. Paul nearly decapitated. I went over to the skipper who asked if we had been hit or hurt. Everyone said 'No.'" Skipper said that he was OK. The waves kept washing over our heads. Huska was out of his head. Time dragged. We were drowning slowly. I don't know how long the skipper had been gone, but he had drowned. I could not get my stiffened fingers opened to release his hair. We (Romero & I) got them opened and removed his life vest in an effort to save Huska. Romero got it on Huska, giving him two but an hour and a half later, Huska was dead. Just a few minutes later the Red Cross plane came and pulled me in. I was unconscious. Huska was buried in Sicily.

I know how you folks feel. I feel so miserable myself, after the skipper watched over us, he had to go himself. If he had to go he wanted to go down fighting and none ever put up a more gallant fight.

There's only two of us left who really knew him over there and we will never forget him. I'll be flying over there again and the skipper will always fly with me in spirit. He's in Heaven now in a place where all good soldiers go. He'll have smooth flying now.

I'll always remember him as he was, as I have pictured him here. They can praise MacArthur to the skies, but MacArthur will never be what our skipper was.

If there's any more information I can give you or help whatsoever, please call on me. I'd like to feel I was doing something to help. Please forgive me if I haven't been tactful, I've really tried. I sincerely hope I've helped some.

Very Sincerely

Johnny Gaffney