Unit 26 "Search and Rescue"

Text: Cord Applied Math
Volume: __1994_____ Chapter: _Systems of Equations___
Unit number: _26___ Title of unit: _System of Equations_____
Developed by: _CPM Algebra Connections – Used by Hugh Prentice
Date: _6/28/2012_____

Attach the Following Documents:

1. **Lab Instructions**
2. **Student Handout(s)**
3. **Rubric and/or Assessment Tool**

Short Description (Be sure to include where in your unit this lab takes place):

Inequalities are part of State Standards but not a stated objective of Unit 26. This will be the last concept taught after the objectives for the Unit. They should have also been introduced to inequalities on a number line and linear inequalities previously.

Following guided notes and assessment on solving systems of inequalities. This is a practical application Group Lab effort to cement concepts and discuss number sense.

Unit 26 "Search and Rescue"
LAB PLAN

TEACHER: *(Teacher Prep/Lab Plan)*

- **Lab Objective**

  Provide a "Real Life" contextual problem for solving a system of inequalities.

  System of 3 inequalites produce a triangle area for answer. However, context of problem presents opportunities for discussion about number sense.
  Triangulated area is very large while appearing small on the map. How could students localize the search area.

  Instead of just performing the work individually and as a group, how can the class attempt to re-enact a "Response Team Setting" and direct the Rescue Teams to the best area.

  Open discussion on other issues rather than the pure math.

- **Statement of prerequisite skills needed** *(Vocabulary, Measurement Techniques, Formulas, etc.)*

  Solve systems of equations by graphing; point of intersection is solution.
  Understand inequality symbols and graphing on a number line.
  Use of open and closed circle relationships to inequality symbols.
  Solving inequalities to rearrange to graph properly (so in y=mX+b format)
  Understand what causes flipping of inequality (divide by "-" to isolate X)
  Use of TI-84 Graphing Calculator for solving systems

- **Vocabulary**

  Less than; Greater than; Less than or equal to; Greater than or equal to;
  Intersection; Region; System; Linear
  Line, slope-intercept form (Y=mX +b); Line, standard form (aX+bY=c)

- **State Standards addressed:** *(Highlight "Green" Standards, you may use your District's Power Standards if applicable)*
  - **Math:**

    A1.1.B Solve problems that can be represented by linear functions, equations, and inequalities.

    A1.1.C Solve problems that can be represented by a system of two linear equations or inequalities.

    A1.2.D Determine whether approximations or exact values of real numbers are appropriate, depending on the context, and justify the selection.

    A1.4.D Write and solve systems of two linear equations and inequalities in two variables.

    A1.6.B Make valid inferences and draw conclusions based on data.

    A1.8.A Analyze a problem situation and represent it mathematically.

    A1.8.C Evaluate a solution for reasonableness, verify its accuracy, and interpret the solution in the context of the original problem.

  - **Reading:**

    WA State EALRS: 3.2
  - **Writing:**

    WA State EALRS: 3.3
  - **Leadership:**

    Outline of Qualities from 21st Century Skill-Leadership

    Critical Thinking and Problem Solving

    Reason Effectively **Use Systems Thinking**
    Make Judgments and Decisions **Solve Problems**

    Communication and Collaboration

    Communicate Clearly **Collaborate with Others**

    Flexibility and Adaptability

    Adapt to Change **Be Flexible** **Manage Goals and Time**
    Work Independently **Be Self-Directed Learners**

    Social and Cross-Cultural

    Interact Effectively with Others **Work Effectively in Teams**

    Productivity and Accountability

    Manage Projects **Produce Results**

    Leadership and Responsibility

    Guide and Lead Others **Be Responsible to Others**

- **SCAN Skills/Workplace Skills:**
  - **Basic Skills**

    Writing Arithmetic Mathematics Listening Speaking
  - **Thinking Skills**

    Creative Thinking Decision Making Problem Solving
    Reasoning Seeing Things in the Mind's Eye Knowing How to Learn
  - **Personal Qualities**

    Responsibility Self Esteem Sociability Self-Management
    Integrity/Honesty

- **Teacher Preparation:** *(What materials and set-up are required for this lesson?)*
  - Materials:
    Individual Handout and graph (each student)
    Group Graph 1 Per Group
    Larger Version for Whole Class (if possible)
    Rulers and colored pencils or markers
  - Set-Up Required:
    Mimimal set up for Individual and Group Work
    Set up for acting out full Class "War Room" (as you want or leave up to students to plan

- **Lab Organizational Strategies:**
  - Grouping/Leadership/Presentation Opportunities:
    Task Manager; Participation Manager and Resource manager opportunities
  - Cooperative Learning:
  - Expectations:
    Students as a group to read problem.
    Split out assignments for individual work (if time sensitive), but better if each students works for 15-minutes on own.
    Following Individual work group discussions to review and check for understanding for each group member.
    Require Group presentations – with all members presenting a part of how the got the solution
  - Time-line:
    Usually can be completed in 1 period, but second period required for each group to present.

- **Post Lab Follow-Up/Conclusions** *(to be covered after student completes lab)*
  - Discuss real world application of learning from lab:
    Check if everyone colored whole triangulated area or suggested that the whole area is larger than necessary because …… (How far would they be able to see the balloon from their path?)
    Need to learn Lat/Long grid or creating a grid for a particular real world situation.
  - Optional or Extension Activities:
    Extension have students develop their own "Treasure Hunt"
  - Career Applications:
    Working as a team to gather information and solve a problem involving uncertainties (inequalities)

Lab Instructions:

1) Resource Manager – get resources
2) Task Manager – Read the problem out loud before starting individual work and think about strategies for individual assignments
3) Participation Manager – Keep group on task to solve problem individually (15-20 min)
4) Task Manager bring group back together to discuss and agree on findings
5) Team -Complete Group Graph and write equations.

Lab Notes – (From CPM Algebra Connections problem 9-69)

More Systems of Inequalities

Lesson Objective:	Students will continue to learn how to graph systems of inequalities and will apply this understanding to solve problems.
Length of Activity:	One day (approximately 50 minutes)
Core Problems:	Problems 9-68 and 6-69
Ways of Thinking:	Applying and extending
Materials:	Lesson 9.3.2 Resource Page ("Search and Rescue"), one per student and on a transparency Rulers or straightedges
Suggested Lesson Activity:	Start this lesson with an overview of the lesson objectives. Then start teams on problem 9-68, which not only requires students to graph a system of inequalities, but it also has them review what they know about absolute value and the standard form of a line. Then start teams on the main goal for the day: applying graphs of inequalities to solve problem 9-69. Distribute the Lesson 9.3.2 Resource Page, one per student. The problem statement carefully gives students information to help narrow a search for a hot-air balloon. With each description, students can draw a flight path on their "map" (the resource page) and can write an inequality to represent the region to search. In each case, either a point or a direction (north or south) is given to help students decide which side of the flight path (boundary line) to search. If time allows, have teams complete problem 9-70, which requires them to consider the solutions for a system of parallel inequalities. Pull the class together and discuss the results. Since the boundary lines are parallel, part (c) cannot have a solution. Be sure that students understand that this is a special case. Ask questions that require students to think geometrically about the different ways regions can intersect, such as, *"Can a system of inequalities have no solution if the boundary lines are not parallel? If so, how?"*
Closure: (10 minutes)	First ask students to respond individually to the Learning Log prompt, problem 9-71. Then students should consult with their teammates to compare responses to the questions given in the prompt. Once students have had time to complete their responses, ask teams to volunteer to share their responses with the rest of the class.

Individual Handout and Graph

SEARCH AND RESCUE

"I'm completely lost… water everywhere I can see… both engines have failed… Wait! I see land. I'm going to try to land. I think it's…"

Those were the last words heard from Harold in his hot-air balloon. The last time the balloon showed up on radar, it was near the Solomon Islands in the Pacific Ocean.

Your Task: Your team must determine where to send the search-and-rescue teams! Use the following reports along with the map on the Lesson 9.3.2 Resource Page (also available at www.cpm.org) and look carefully for information that will help you draw boundary lines. Write a system of inequalities to give to the search-and-rescue team. Be sure to identify the probable landing site on the map. **[$y \le -\frac{1}{2}x + 2000$, $y \le \frac{2}{3}x - 2000$, $y \ge -\frac{1}{5}x$; The search-and-rescue teams should search near the island of Samoa.]**

Basic facts of the case:

The balloon departed from the airport at the very northern tip of the Philippines. The flight was supposed to follow a straight path *directly* to an airport in French Polynesia.

The balloon's last known location was at (–1000, 1000) near the Solomon Islands.

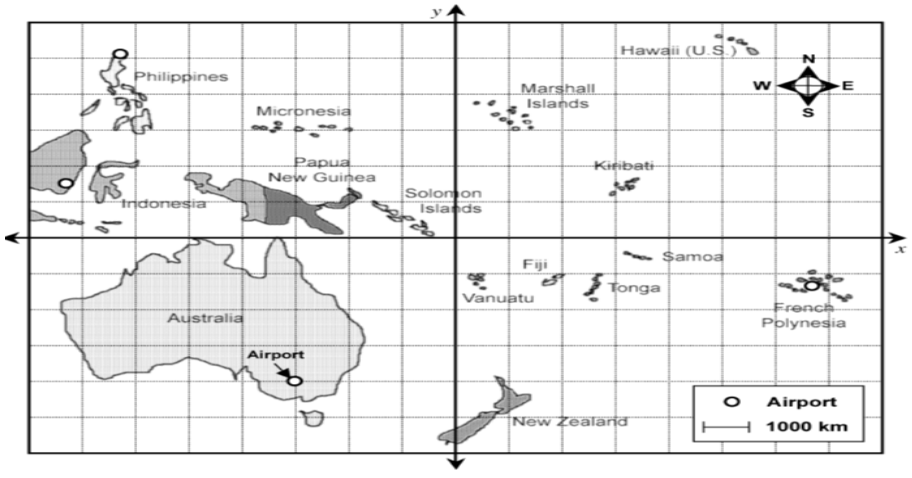
Pilot's report from a nearby airplane:

"We were on our way from Australia, when we saw a hot-air balloon sinking rapidly. I am certain that it crashed south of our flight path. When we left Australia, we traveled 2000 km north for every 3000 km east that we flew."

Phone call received today:

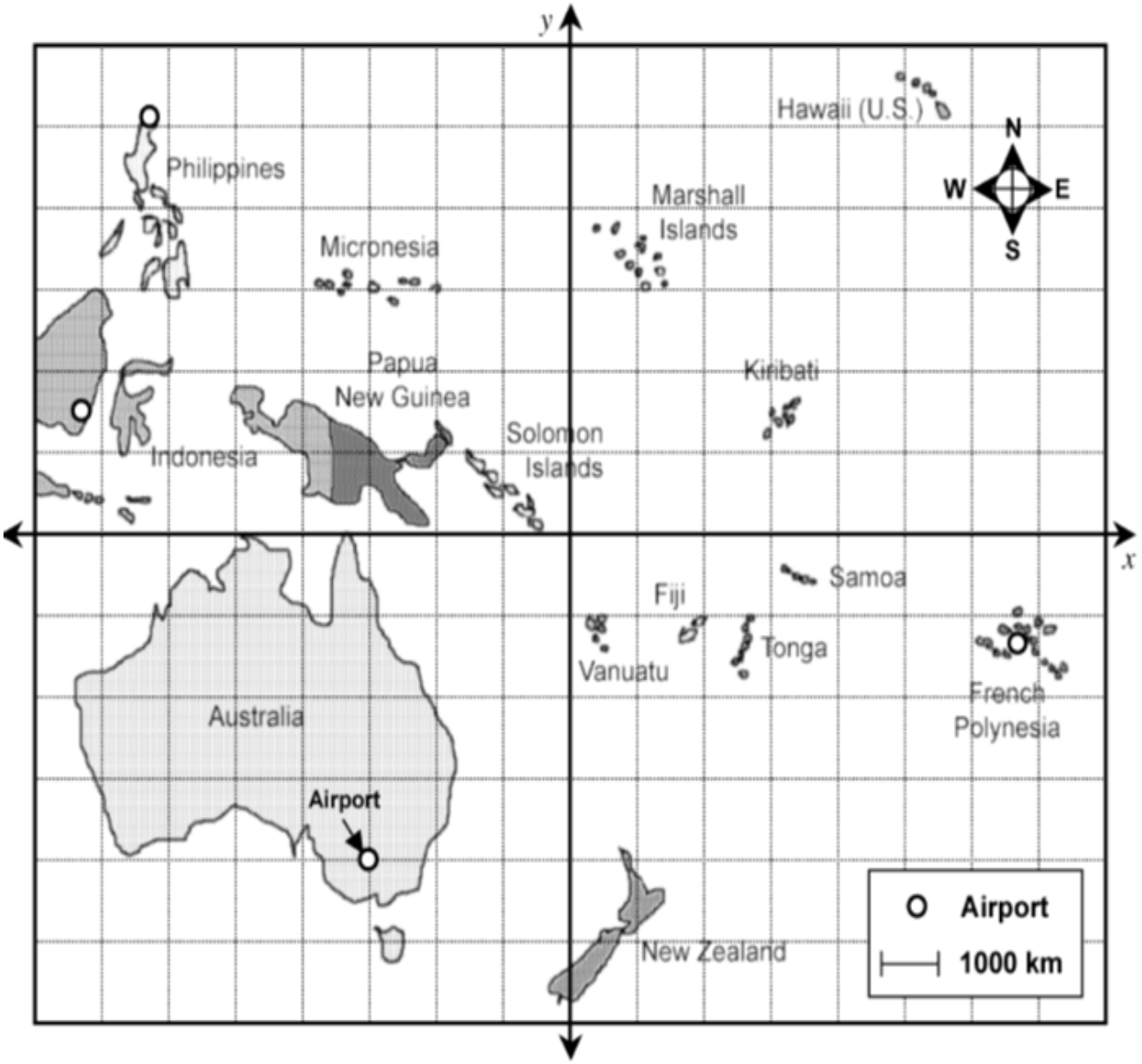
"I was a passenger on a flight that flew directly from French Polynesia to Indonesia. I was looking out my window when I saw the balloon going down to the north of where we were flying."

Search and Rescue



GROUP GRAPH

Search and Rescue



Laboratory Activity Rubric

Name _____
Date _____

Chapter Number _____ Lab Title _____

Directions
Check one box in each row to indicate the level of performance. Give each check mark the assigned number of points. Add the points in each column. Then, add across the bottom row to find the total score.

POINTS	10	9	8	7	6	
Performance Level	**Excellent**	**Good**	**Average**	**Fair**	**Poor**	
Lab Activity: Worked on Problem Individually						
Participated as a Goup Member						
Participated as a Presenter						
Listened Intently to other Group Presentations						
Lab Report: Correctly shaded target area of inequalities						
Produced the correct equations to pass on to "Central Command"						
Made appropriate conclusions						
Applied critical thinking skills						
POINTS	+	+	+	+	=	

Total Score