Part 1 – The First Constraint

In this problem, you will build a model of a real-life situation by writing linear inequalities to represent the constraints on the situation. You will see how the set of solutions changes as each constraint is added.

The owner of a clock business can build one clock in 90 minutes. He can work at most 40 hours a week building clocks. Write an inequality to represent the number of clocks, *x*, that he can make in one week.

You can view the solutions to this inequality on your handheld in two different ways.

One way is to use a spreadsheet, as shown on page 1.5. Another way is to graph the inequality, shown on page 1.6. All of the points in the shaded region are solutions to the inequality.

On page 1.5, type your inequality in cell **b1**, using “a1” for *x*. Type an **=** before the inequality. Type *x*-values in **a1**.

1. Can the owner make 10 clocks in a week? 20? 30?

Part 2 – Another Constraint

The owner decides to hire an expert to help make clocks. The expert can make a clock in 75 minutes. However, the owner can only afford to pay the expert to work at most 20 hours a week. Write a linear inequality that gives the number of clocks, *y*, which the expert can make in one week.

On page 1.8, type your inequality in cell **d1**, using “c1” for *y*. Type an **=** before the inequality. Test *y*-values in **c1**.

2. Can the expert make 10 clocks in a week? 15? 20?

Test different values for *x* and *y* on page 1.8 until both inequalities are true. For example, if $x = 10$ and $y = 10$, then both the first and second inequalities are true, and the ordered pair (10, 10) is a solution to the system $\begin{cases} 1.5x \le 40 \\ 1.25y \le 20 \end{cases}$.

Any combination of an *x*-value that is a solution to the first inequality and a *y*-value that is a solution to the second inequality is a solution to this system.

3. What does the solution (10, 15) represent in this situation?

4. List as many solutions to the system as you can.

Next view the solutions to this system by graphing it on page 1.12. Solve your inequality for *y*. In the function bar for **f1**, delete the = and replace it with the appropriate inequality sign. Then type your inequality. All the points in the darkest area, where the two shaded rectangles overlap, are solutions to the system of inequalities.

A point and its coordinates have been placed on the graph for you. Drag this point into the intersection of the two graphs.

5. List several points that are within this area.

6. Compare your answer to Question 5 with your answer to Question 4.

Part 3 – A Final Constraint

A store wants to buy at least 50 clocks a week from the owner. If the owner and the expert work together, can they fill the order? Write an inequality using *x* and *y* to show the number of clocks they need to build to fill the order.

On page 1.15, enter your inequality in cell **e1**, using "a1" for *x* and "c1" for *y*. Type an = before the inequality. Test values for *x* and *y* in cells **a1** and **c1**.

7. List several solutions to this inequality.

Any points (x, y) that make all three inequalities true are solutions to the system

$$\begin{cases} 1.5x \le 40 \\ 1.25y \le 20 \\ x + y \ge 50 \end{cases}.$$

8. Is there an ordered pair (x, y) that makes all three inequalities true? List as many solutions to the system as you can.

9. What does your answer to Question 8 mean in this situation?

Solve the third inequality for *y* and graph it on page 1.19.

10. Is there an area where all three shaded areas overlap?

11. What does this mean about the solutions to this system?

Challenge: Use the **Graph Trace** feature on page 1.19 to find the maximum number of clocks that the owner and expert can make in one week.