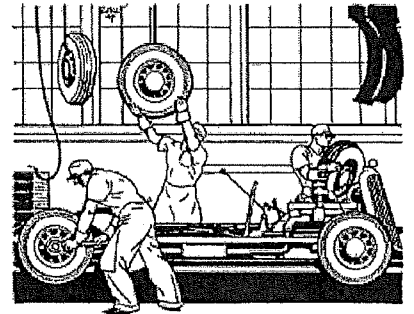


cw 7

# THE TOY FACTORY

Businesses and industries often use equations and inequalities to model their services and production. Creating a system of equations and inequalities allows them to mathematically optimize their operation and maximize profits. Today you will investigate this technique.

Otto Toyom builds toy cars and trucks. To make each car, he needs 4 wheels, 2 seats, and 1 gas tank. To make each truck, he needs 6 wheels, 1 seat, and 3 gas tanks. His storeroom has 36 wheels, 14 seats, and 15 gas tanks. He is trying to decide how many cars and trucks to build so he can make the largest possible amount of money when he sells them. Help Otto figure out what his options are:



First, organize the information.

Parts Needed to Build:					
Car			Truck		
Wheels	Seats	Gas Tank	Wheels	Seats	Gas Tank

Number of Parts Available		
Wheels	Seats	Gas Tank

Otto wants to make as much profit as possible. Find which combination of cars and trucks will make the most profit. To convince Otto that your recommendation is a good one, use algebra and graphs.

- a. Write three inequalities to represent the relationship between the number of cars ( $x$ ), the number of trucks ( $y$ ). Rewrite each inequality in graphing form by solving for  $y$ .

Let  $x$  = the number of cars built  
 Let  $y$  = the number of trucks built

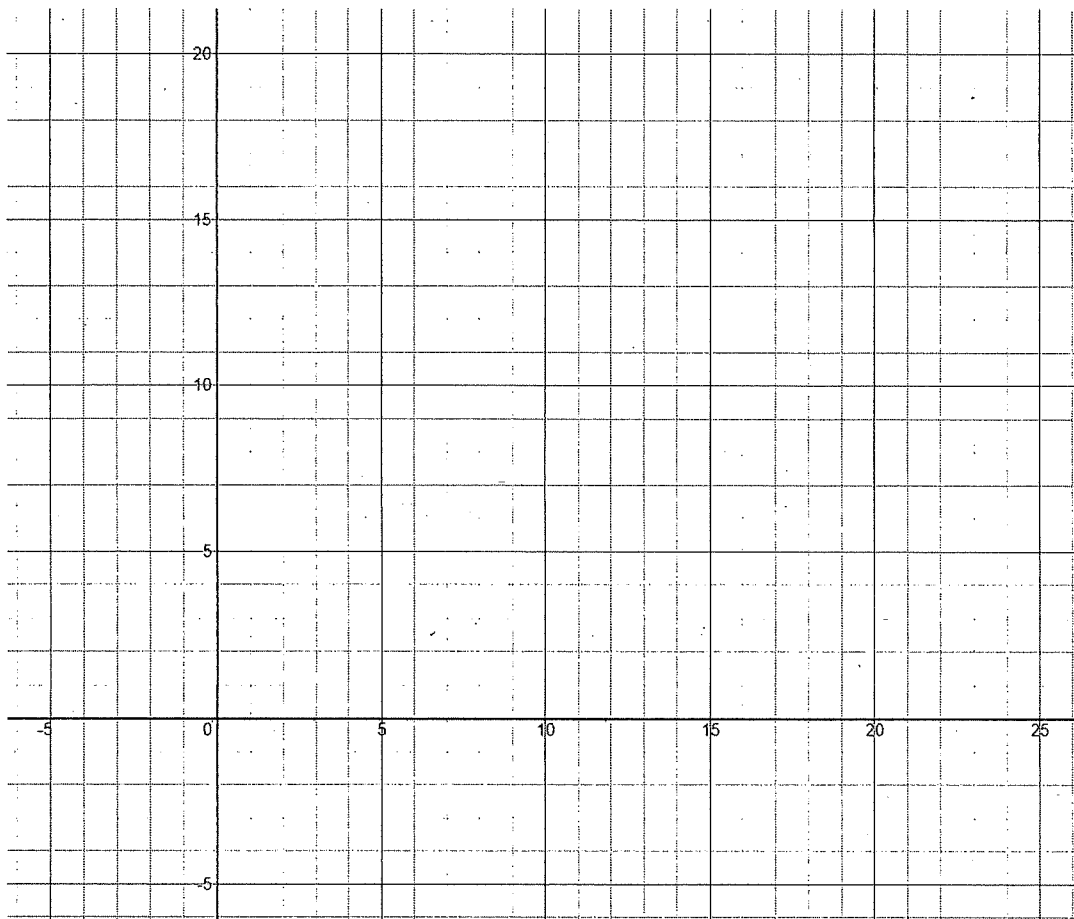
i. wheels

ii. seats

iii. gas tanks

- b. Why is it okay to assume that  $x \geq 0$  and  $y \geq 0$ ?

- b. Graph this system of inequalities on the same set of axes. Shade the solution region lightly. make sure to also graph  $x \geq 0$  and  $y \geq 0$ ?



- c. What are the vertices of the pentagon that outlines your region? Explain how you could find the exact coordinates of those points if you could not read them easily from the graph.
- d. Are there any points in the solution region that represent choices that seem more likely to give Otto the maximum profit? Where are they? Why do you think they show the best choices?
- e. Write an equation to represent Otto's total profit ( $P$ ) if he makes \$1 on each car and \$2 on each truck.
- f. Which points do you need to test in the profit equation to get the maximum profit? Is it necessary to try all of the points? Why or why not?
- g. What if Otto got greedy and wanted to make a profit of \$14? How could you use a profit line to show Otto that this would be impossible based on his current pricing?