MA103: Mathematical Modeling & Intro to Calculus
Constraints and Feasible Regions 2

Lesson Objectives: Cadets will

1. Understand what it means for a solution to be feasible in the context of a linear programming problem
2. Identify whether a potential solution is feasible or not
3. Represent constraints algebraically
4. Visualize constraints for a linear programming problem as a feasible region (by hand)
5. Explore feasible regions and compare solutions within the feasible region
6. Explain the four model-driven assumptions that are necessary to use a linear programming model, and justify each for a real-world modeling scenario

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Corporate Advertising: A company produces cleaning supplies and wishes to focus advertising on three products: stain remover, liquid detergent, and powder detergent. The advertising campaign will focus on television and print media in order to increase sales. The chart below shows the estimated increase in sales for each unit of advertising in both television and print, the minimum required increase in sales by percentage, and the cost per unit of advertising. Formulate a linear program to minimize advertising cost.

Product	Television	Print Media	Minimum Required Increase
Stain Remover	0%	1%	3%
Liquid Detergent	3	2	18
Powder Detergent	-1	4	4
Unit Cost	\$1 million	\$2 million	

Algebraic Formulation:

Challenge Problem, Defense Transportation: A defense contractor produces military vehicles in Appleton and Greenville, WI for delivery to Ft. Liberty, NC and Ft. Cavazos, TX. Delivery from Appleton to Ft. Cavazos incurs a transportation cost of $500 per vehicle and delivery from Greenville to Ft. Cavazos incurs a transportation cost of $600 per vehicle. Transportation from Greenville to Ft. Liberty costs $900 per vehicle, while delivery from Appleton to Ft. Liberty costs $800 per vehicle. The Appleton factory can produce up to 20 vehicles per month and the Greenville factory can produce up to 25 vehicles per month. Ft. Liberty requires a monthly delivery of 10 vehicles and Ft. Cavazos requires 35 vehicles per month. How can the contractor optimize its delivery plan to minimize transportation cost?

Algebraic Formulation: