Admin Notes / Agenda

- Warm Up - task 2 from yesterday L48 - plot
- Zero Point Quiz
- Excel Work

1 Linear Programming Assumptions

Linear programming models rely on several fundamental assumptions that ensure the relationships between variables remain linear and mathematically tractable:

1. **Additivity:** The total effect of all decision variables is the sum of their individual contributions. There are no interactions or combined effects among variables.

   $$Z = 5x_1 + 3x_2$$

   Here, the total profit Z is simply the sum of the profits from x_1 and x_2; there is no term like x_1x_2, which would violate additivity.

2. **Proportionality:** Each variable's contribution to the objective function and constraints is directly proportional to its value. Doubling a variable doubles its impact on cost, profit, or resource use.

   $$\text{If } x_1 = 2 \text{ and } a_1x_1 = 10, \text{ then doubling } x_1 \text{ to 4 makes } a_1x_1 = 20.$$

   This linear relationship holds because a_1x_1 scales directly with x_1.

3. **Continuity:** Decision variables can take on any fractional (continuous) value within the feasible region. This means the model assumes quantities are divisible rather than restricted to whole numbers.

   $$x_1 = 2.5 \text{ units is allowed, as long as it satisfies all constraints.}$$

   For example, $2x_1 + 3x_2 \leq 20$ remains valid even if $x_1 = 2.5$ and $x_2 = 4.3$.