Name: _____

Date: _____

1. A thief is filling her backpack with two types of valuable substances. She can carry up to 35 kg, and her backpack can fit up to 15 liters.

   Each bag of X has a weight of 3 kg, volume of 0.7 L, and value of 500 thousand USD.

   Each bag of Y has a weight of 0.06 kg, volume of 0.08 L, and value of 40 thousand USD.

   There is no requirement to take full bags, so the thief can opt for a fraction of a bag.

   How many bags of each should the thief take to maximize her profit?

1. The thief should take 9.6 bags of X and 103.54 bags of Y. We can use linear programming to see this.

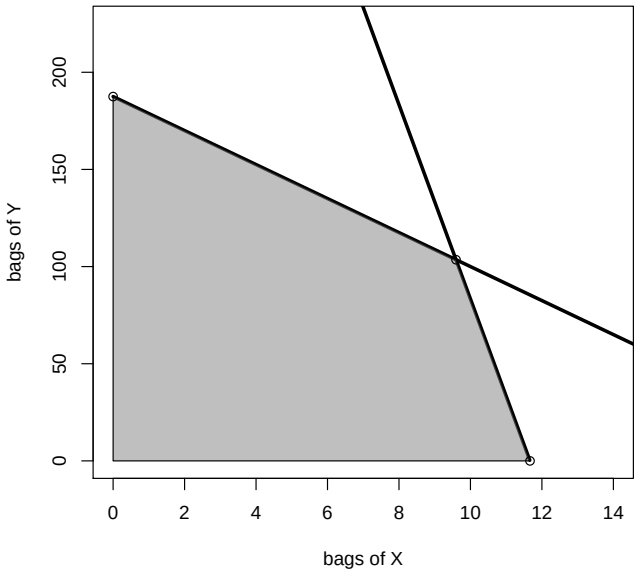
   We write a weight inequality.

   $$3x + 0.06y \leq 35$$

   We write a volume inequality.

   $$0.7x + 0.08y \leq 15$$

   We graph the two inequalities, shading the feasible region.



   There are three vertices of interest.

   $$(0, 187.5)$$

   $$(9.6, 103.54)$$

   $$(11.67, 0)$$

   We write a profit function (the objective function).

   $$P(x, y) = 500x + 40y$$

   We determine the profits.

   $$P(0, 187.5) = 7500$$

   $$P(9.6, 103.54) = 8939.39$$

   $$P(11.67, 0) = 5833.33$$

   Thus, the thief should take 9.6 bags of X and 103.54 bags of Y.