

**Assignment #1** – due Friday, January 17, 2020

1. Gobblecakes is a bakery that specializes in cupcakes. The annual fixed cost to make cupcakes is \$18,000. The variable cost including ingredients and labor to make a cupcake is \$0.90. The bakery sells cupcakes for \$3.20 apiece.
  - (a) If the bakery sells 12,000 cupcakes annually, determine the total cost, total revenue, and profit.
  - (b) How many cupcakes will the bakery need to sell in order to break even?
  - (c) If the maximum operating capacity of the Gobblecakes bakery is 12,000 cupcakes annually, determine the break-even volume as a percentage of that capacity.
2. Pastureland Dairy makes cheese, which it sells at local supermarkets. The fixed monthly cost of production is \$4,000, and the variable cost per pound of cheese is \$0.21. The cheese sells for \$0.75 per pound; however, the dairy is considering raising the price to \$0.95 per pound. The dairy currently produces and sells 9,000 pounds of cheese per month, but if it raises its price per pound, sales will decrease to 5,700 pounds per month. Should the dairy raise the price?
3. Hannah Byers and Kathleen Taylor are considering the possibility of teaching swimming to kids during the summer. A local swim club opens its pool at noon each day, so it is available to rent during the morning. The cost of renting the pool during the 10-week period for which Hannah and Kathleen would need it is \$1,700. The pool would also charge Hannah and Kathleen an admission, towel service, and life guarding fee of \$7 per pupil, and Hannah and Kathleen estimate an additional \$5 cost per student to hire several assistants. Hannah and Kathleen plan to charge \$75 per student for the 10-week swimming class.
  - (a) How many pupils do Hannah and Kathleen need to enroll in their class to break even?
  - (b) If Hannah and Kathleen want to make a profit of \$5,000 for the summer, how many pupils do they need to enroll?
  - (c) Hannah and Kathleen estimate that they might not be able to enroll more than 60 pupils. If they enroll this many pupils, how much would they need to charge per pupil in order to realize their profit goal of \$5,000?
4. Plot on the  $(x, y)$ -plane the feasible region for the following linear constraints:

$$4x + 5y \leq 20$$

$$12x - 5y \leq 30$$

$$-x + 3y \leq 6$$

$$x - y \leq 6$$

$$x, y \geq 0$$

How many *extreme points* (points where two or more lines intersect) does the feasible region have?

5. Plot on the  $(x, y)$ -plane the feasible region for the following linear constraints:

$$5x - y \geq 0$$

$$4x - 2y \leq 0$$

$$x + y \geq 0$$

What would happen to the feasible region if we change the third inequality to

$$x + y \leq 0?$$