THE UNIVERSITY OF BRITISH COLUMBIA
Math 414 Section 101

Homework 9
Due by 1pm on November 16, 2018

1. We call a bus overcrowded if there are more than 50% of the maximum allowable number of passengers inside. Children ride in several buses to a summer camp. Which is greater: the percentage of overcrowded buses or the percentage of children riding on overcrowded buses?

2. Amy and Bob play a game. They alternate turns, with Amy going first. At the start of the game, there are 20 cookies on a red plate and 14 on a blue plate. A legal move consists of eating two cookies taken from one plate, or moving one cookie from the red plate to the blue plate (but never from the blue plate to the red plate). The last player to make a legal move wins; in other words, if it is your turn and you cannot make a legal move, you lose, and the other player has won. Which player can guarantee that they win no matter what strategy their opponent chooses? Prove that your answer is correct.

3. Golden triangles problem

4. You want to buy a (widescreen) 52-inch LCD TV for your bedroom. You plan to put it in a cabinet that is 44 inches across and 41 inches tall. Answer the following questions and show all your work! Please take background information into account!
(a) Will the TV fit in the cabinet? (Assume the size of the frame on the TV is very small!)
(b) If the TV has 1 inch of plastic frame around the outside of the screen, will it fit?
(c) What is the biggest size of widescreen TV you could fit in the cabinet? (Assume the size of the frame is very small.)

Background Information: TV size refers to the diagonal length of the TV screen. For a widescreen TV, the ratio of length to width is 16 to 9 (so for every 16 inches of TV width, there is 9 inches of TV height)

5. Petals problem
3. **Golden Triangles**

Find the ratio of the sides of these equilateral triangles arranged inside a circle as shown.
5. **Petals**

Four congruent ellipses are arranged as shown. What is the radius of the circle?

Hint: First, show that if a line $y = mx + b$ is tangent to an ellipse $(x/a)^2 + (y/d)^2 = 1$, then it must satisfy $b^2 = c^2m^2 + d^2$. 