**WORKSHOP 1.5**

Handout

**Warm-up Question:**
A parking lot charges $3 for the first hour (or part of an hour) and $2 for each succeeding hour (or part), up to a daily maximum of $10. Sketch a graph of the cost of parking at this lot as a function of the time parked there.

**Problem Solving Method:**
1. Recall that in the first workshop you were introduced to four problem solving steps: (a) understand the problem, (b) come up with a plan, (c) carry out the plan, and (d) reflect on the answer.
2. Simply having steps is worthwhile. It helps organize your thoughts and gives you a way to start thinking about a problem – in short, it helps simplify a complicated process.
3. A number of questions may be helpful in achieving the first step of understanding the problem. Here are a few of them (we will look at other questions in the following weeks).
   (a) What are you asked to find or show?
   (b) Can you restate the problem in your own words?
   (c) Can you draw a picture?
   (d) Do you understand all the words used in the problem?
4. The plan for the rest of this workshop is for you to solve a problem using those four steps, paying particular attention to the first step.

**Main Problem:**
The federal tax rates for 2016 in Canada are:
- 15% on the first $45,282 of taxable income
- 22% on the next $45,281 of taxable income (on the portion of taxable income between $45,282 and $90,563)
- 26% on the next $49,825 of taxable income (on the portion between $90,563 and $140,388)
- 29% on the next $59,612 of taxable income (on the portion between $140,388 and $200,000)
- 33% on any income above $200,000.

1. Sketch a graph of a function \( r(x) \) representing the highest tax rate your income would be subject to if your taxable income is \( x \) (the tax rate of your highest taxed bracket). Explain what \( \lim_{x \to 45,282^-} r(x) \) and \( \lim_{x \to 45,282^+} r(x) \) mean and evaluate these limits.

2. Write down a piecewise function representing the amount of tax owed \( t(x) \) as a function of taxable income \( x \). Sketch the graph of the function \( t(x) \). Explain what \( \lim_{x \to 45,282^-} t(x) \) and \( \lim_{x \to 45,282^+} t(x) \) mean and evaluate these limits.

3. Canada’s income tax rates are called progressive because the rate increases as income increases. A flat tax has the same rate for everyone. Suppose income is taxable at a flat rate of 20%, for which income(s) would the flat tax be the same as the current progressive tax? Give a geometrical explanation.

4. (Bonus) Imagine a different tax code that uses the same brackets and rates, but applies the top rate on all the income (for example a person earning $100,000 would be taxed at 26% of $100,000). Roughly sketch what would the tax owed graph look like under that different tax code. Argue in a few sentences about the pros and cons of the different tax codes.