

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 $\lim_{x \rightarrow 45,282^-} r(x)$ and $\lim_{x \rightarrow 45,282^+} r(x)$ 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 $\lim_{x \rightarrow 45,282^-} t(x)$ and $\lim_{x \rightarrow 45,282^+} t(x)$ 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.