## MAT1575 Module 2 - An algorithm for computing the (signed) area under a linear function.

Objectives: Construct an algorithm for computing $\int_{a}^{b} f(x) d x$ for any linear function $f(x)=$ $m x+y_{0}$. Implement the algorithm in python using trinket.io.

1. Explain what $\int_{a}^{b} f(x) d x$ means geometrically.
2. If $m=0$, compute the (signed) area between the horizontal line and the $x$-axis in terms of $a, b$, and $y_{0}$. (Hint: Sketch an example and show that the area is given by the area of a nice geometrical shape.)
3. If $m \neq 0$, find the solution to the equation $m x+y_{0}=0$. What does this $x$-value represent?
4. If $a<-\frac{y_{0}}{m}<b$, compute the (signed) area between the line and the $x$-axis in terms of $a, b$, $m$, and $y_{0}$. (Hint: Sketch an example and show that the area is the sum of the signed areas of two right triangles.)
5. If it is not true that $a<-\frac{y_{0}}{m}<b$, compute the (signed) area between the line and the $x$-axis in terms of $a, b, m$, and $y_{0}$. (Hint: In this case, the line is either entirely above the $x$-axis or below it. Use the same strategy as in question 4 but with different shapes.)
6. Construct an algorithm for computing $\int_{a}^{b} f(x) d x$ for any linear function $f(x)=m x+y_{0}$ using your answers to questions 2-5.
7. Implement your algorithm in python using trinket.io. A basic skeleton of the algorithm appears here: https://trinket.io/python/8b2e762948
8. Test your algorithm against the following examples:
(a) Compute the area under $f(x)=3$ from $x=2$ to $x=7$.
(b) Compute the area under $f(x)=4 x$ from $x=-1$ to $x=3$.
(c) Compute the area under $f(x)=\frac{2}{5} x+1$ from $x=-2$ to $x=-1$.
(d) Compute the area under $f(x)=-2 x+4$ from $x=0$ to $x=8$.
