1. A skydiver jumps out of a plane at time $t = -10$ s and free-falls for the first 10 s with a constant acceleration due to gravity, $g = 10$ m/s$^2$. At $t = 0$ s, she deploys her parachute, and thereafter falls with an acceleration, $a(t) = -90e^{-t}$ m/s$^2$.

(a) What is her speed 20 s after the jump (i.e. at $t = 10$ s)?
(b) What is her terminal velocity?

2. Alice and Bob live in the same house at a distance of 2.1 km from UBC. They are both enrolled in Math-103 with lectures at 1:00 PM. Alice leaves the house at 12:40 PM (let’s call this time $t = -5$ min) on her bike, accelerates for 5 minutes, during which time her velocity is given by $f(t) = 30(t + 5)$ m/min. After this time, she maintains a constant speed. Bob wakes up late, and leaves the house at 12:45 PM ($t = 0$ min) on his bike, and for the first 3 minutes his acceleration is given by $a(t) = \frac{200}{3} \cdot t$ m/min$^2$. After this time, he maintains a constant speed.

(a) What is Alice’s acceleration during the first 5 minutes of her ride?
(b) What is Bob’s acceleration at 12:50 PM?
(c) Does Alice make it to the Math-103 lecture on time? Does Bob?
(d) Does Bob catch up with Alice on his way?

3. Problem 4.16

4. Problem 4.18

5. Determine a positive value of $L$ for which the average value of the function $f(x) = x^3 - 3x$ over the interval $[0, L]$ is 0.

6. Problem 4.29