

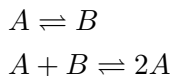
# MA211: Assignment #1

## Required Reading.

- §1.1-1.3, and 2.1.

**Quiz on Sept. 12th.** Any problems marked with \* require the use of maple. All other problems are to be done by hand. Any problems marked with # can be submitted for review by the grader.

1. Textbook §1.1: 2, 3, 12, 16#, 17, 19\*, 22, 30#, 43
2. Textbook §1.2: 3#, 9, 29c
3. Textbook §1.3: 6, 7, 8#, 9#, 18, 27
4. Textbook §2.1: 1\*, 8\*#, 21#, 28, 42ab
5. Molecules of two types are reacting. First, molecule  $A$  is transformed into molecule  $B$ . Then,  $A$  and  $B$  combine to form two molecules of  $A$ .



Let  $x(t)$  be the concentration of molecule  $A$  and  $y(t)$  be the concentration of molecule  $B$ .

- (a) Explain why the correct ODE model for this reaction system is of the form

$$\begin{aligned}x' &= -k_1^+ x + k_1^- y + (?)k_2^+ xy + (?)k_2^- x^2 \\y' &= k_1^+ x - k_1^- y + (?)k_2^+ xy + (?)k_2^- x^2 \quad .\end{aligned}$$

What integers should you replace the (?)'s with?

- (b) As we did in class, show that there is a conservation law. Prove it mathematically, but also explain why it makes sense from a chemistry point of view. Hint: as in class, it's easiest to deduce the conservation law by thinking about the chemistry.
- (c) Use this conservation law to write an ODE for  $x(t)$  only. It should not have  $y(t)$  in it.