

## Homework 6

**Practice Exercises from the Textbook**

- §3.8 : 3, 4, 5, 7, 10, 11, 12, 13, 15, 16, 17
- §3.9 : 5, 7, 13, 15, 18, 22, 23, 25, 27, 29, 35, 37, 40, 41, 45

**Exercises Due Thursday 27th October at the beginning of class :**

- §3.9 : 14, 16, 28, 30, 38, 40, 42

**Exercise 1** (2009). A bacteria culture grows with relative growth rate. After 2 days there are 40'000 bacteria and after 7 days the count is 4 billion =  $4 \cdot 10^9$ .

- Write a differential equation satisfied by the bacteria population at any time  $t$ .
- Find the initial population, expressed as an integer.
- Find the population after  $t$  days.

**Exercise 2** (2007). When a cold drink is taken from a refrigerator, its temperature is 5C. After 25 minutes in a room that has fixed temperature 20 C, its temperature has increased to 10 C. What is the temperature of the drink after another 25 minutes, i.e. 50 minutes after the drink is taken from the refrigerator? Assume that the temperature of the drink satisfies Newton's Law of Cooling. To receive full marks, write your answer in completely simplified form, with no "ln"'s appearing.

**Exercise 3** (2006). Two cities, Growth and Decay, have populations that are respectively increasing and decreasing, at (different) rates that are proportional to the respective current population. Growth's population is now 3 million and was 2 million 10 years ago, and Decays population is now 5 million and was 7 million 10 years ago.

- How many years from now will Growth's population equal 4 million?
- How many years from now will Growth and Decay have the same population?

**Exercise 4** (2005). Wallapak stores her malt beverages outside her house, on her back porch. On a very hot day, she takes one such beverage and places it in her refrigerator, which is constantly kept at 4C. After 15 minutes, the beverage cooled down to 26 C, and, after another 15 minutes, it was at 15C. How hot was the beverage when it was placed in the refrigerator? Assume the temperature of the beverage obeys Newton's Law of Cooling.

**Exercise 5** (2010). When an apple is taken from a refrigerator, its temperature is 3C. After 30 minutes in a 19C room, its temperature is 11C.

- Assuming that the temperature of the apple satisfies Newton's Law of Cooling, write the differential equation satisfied by the temperature  $T(t)$  of the apple at time  $t$ .

- b) Find the temperature of the apple 90 minutes after it is taken from the refrigerator, expressed as an integer number of degrees Celsius.
- c) Determine when the temperature of the apple is 16C.

**Directions concerning the page setup for assignments :**

- On the top of the first page write clearly and in this order your  
Last Name :      First Name :      Student Number :
- The title (“Homework 6”)
- The title of every exercise and clearly separate the exercises
- Staple the sheets together

Remember that there are marks for presentation and explanations, just a bunch of numbers or equations won't give you full mark.