Calculus II
Homework Six
Due Friday 17 February, 2017

Link to Webwork: `https://courses1.webwork.maa.org/webwork2/COA-ESL024`

You should feel free to use WolframAlpha to help you evaluate integrals .

Chapter 8.1:

- WeBWorK Assignment: None
- Textbook Problems:

  1. 2
  2. 4
  3. 12
  4. 24
  5. 25 (Optional)

Chapter 8.2:

- WeBWorK Assignment: None
- Textbook Problems:

  1. 2
  2. 10
  3. 11
  4. 12
  5. 29

Chapter 8.6:

- WeBWorK Assignment: None
- Textbook Problems:

  1. 9
  2. In Moore, Michael R. "Native American water rights: Efficiency and fairness." *Nat. Resources J.* 29 (1989): 763, the author discusses attempts to quantify the present value of the water rights that Native American tribes were denied access to. For example, suppose that yearly value of an acre-foot of water is \$5. (This

value arises because the water can be used to increase agricultural productivity.) Suppose a tribe had been denied access to this water for the past 100 years. What is the value of this water today? I.e., what is the total value of the foregone profits over the last 100 years?

(a) Using a discount rate of 3% write an integral that gives an expression for the present value of 100 years of foregone profits. Briefly explain how you arrived at this integral.

(b) Evaluate the expression you arrived at and compare the answer to that obtained in footnote 38 on page 774 of Moore's paper. A pdf can be found at: `lawschool.unm.edu/nrj/volumes/29/3/07_moore_native.pdf`.

(c) What would be the value of the water if one had not applied discounting?

3. You decide to start a kombucha business. Doing to will require a purchase of \$100,000 in kombucha equipment. You expect to sell 40,000 bottles of kombucha each year, making a profit of fifty cents on each bottle sold. The kombucha equipment will last for ten years; after that it will become so gross that it will need to be replaced.

(a) What is the present value of the ten-year income stream of profits from your kombucha sales? Assume a discount rate of $r = 0.05$.

(b) What is the present value of the income stream if you use a discount rate of $r.0.1$.

(c) (**Optional, but recommended, especially for those interested in business and/or sustainable energy.**) Note that as the discount rate increases, the present value decreases. How large a discount rate would you have to apply so that the value of the income stream was equal to \$100,000? To figure this out, keep r as variable and evaluate the integral. Then set it equal to \$100,000 and solve for r. You'll need WolframAlpha for this last step, as the equation you'll get is one that can't be solved algebraically. (The quantity you just calculated is known as the *internal rate of return* (IRR). The IRR is the discount rate that makes the present value of an income stream equal to the cost of that income stream—in this case the cost of your kombucha equipment. The IRR is a very useful and commonly used metric for evaluating investments.