MONT 104N – Modeling the Environment
Midterm Exam – November 1, 2019

Your Name: _____

I. In discussing amounts of water needed for irrigation of farmland, a common unit of volume is the acre-foot. One acre-foot of water is the amount of water necessary to cover a flat field one acre in area to a depth of one foot. Using the information below, answer questions A and B.

$$1 \text{ yard} = 3 \text{ feet}$$
$$1 \text{ acre} = 43560 \text{ square feet}$$
$$1 \text{ meter} \doteq 3.28 \text{ feet}$$

A. (10) How many cubic yards (yd^3) of water are in one acre-foot?

B. (10) How many cubic meters (m^3) of water are in one acre-foot?

II. The following table gives amounts (in tons) of materials of different types recycled in Washington State in two years, 1986 and 1998.

Category	1986	1998
Paper	391994	821994
Metal	9528	318710
Plastic	349	9871
Glass	48013	113338
Organics + Others	352	903466

A. (20) Construct a chart *for 1998* showing the percentages of that year's total accounted for by each of these types of materials. Any reasonable type of chart is OK.

B. (10) What percent of the total *for 1986* was accounted for by Paper and Plastic together?

III.

A. (10) In 2012, there were about 5.3×10^4 *alternative fuel vehicles* (powered by electricity, ethanol, natural gas, etc.) sold in the U.S. By 2016, that number had risen to 1.6×10^5. Construct a linear model for AFV = number of alternate fuel vehicles, as a function of t = years since 2012.

B. (5) What does your model predict about the number of AFV sold in 2017? The actual number was 1.95×10^5 vehicles. What is the percentage difference between the predicted number (the "comparison") and the actual number (the "reference")?

IV. Wind power has emerged as one of the faster-growing methods of electricity generation in recent years. In 2016, the generating power of wind turbines installed around the world was about 301 gigawatts and it was increasing at about 33.2% per year.

A. (10) Using this information, construct an exponential model for $WP =$ wind power generation as a function of $t =$ years after 2016.

B. (5) According to your model, how long will it take for the generating power of wind turbines to reach 3000 gigawatts?

Essay (30)

There is an ongoing movement at this point in history (i.e. 2019) that is especially strong in Sweden, where it known as *flygskam*. What does this Swedish word mean in English? What actions are proponents of *flygskam* urging other people not to continue doing, and what are their reasons for doing this? Part of the underlying reason for the existence of this movement is concern about how the actions are influencing greenhouse gas levels in the atmosphere. What proportion of current CO_2 emissions can be attributed to these actions and which people are contributing most to this? While the recommendations of proponents of *flygskam* might make a lot of sense from the environmental point of view, there are also certainly aspects of modern life that would be drastically changed if those recommendations were adopted by everyone. What would we be losing by following those recommendations? Are the environmental benefits great enough to justify the costs to individuals and society of adopting those recommendations?