

# Math 1483 - Functions and Modeling

## Exam 1

---

**Assigned:** 2020.09.15, 12:01 AM

**Due:** 2020.09.15 at 11:59 PM

**Instructions:** Work on this by yourself, if you feel you need to ask a question for clarification purposes, you may email the instructor. For each problem be sure to show all of your work and write every step down in a clear and concise manner. When finished, upload this front sheet and all of your work, as a pdf or jpg to Blackboard.

**Agreement:** Please read the following statement and then write it at the bottom of the page before the signature line:

*"I hereby swear that all the work that appears on this exam is completely my own, and I have not discussed any portion of this exam with any one else besides the instructor."*

**Printed Name:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

1. The ideal gas law is an equation which is a reasonable approximation to the behaviour of some gases under a range of conditions. It was first stated by Benoît Paul Émile Clapeyron in 1834 and is given by the equation:

$$PV = nRT$$

Here,  $P$  stands for pressure, which is measured in atmospheres (atm),  $V$  is volume (in L),  $n$  is the quantity of gas moles (mol),  $R$  is the gas constant, which is specific to each gas (units in L·atm/mol·K), and  $T$  is temperature using the Kelvin scale (units K). If we wish to know the pressure ( $P$ ) of the gas given all the other variables, we get the function:

$$P(n, R, T, V) = \frac{nRT}{V}$$

- (a) How many variables is  $P$  a function of?
- (b) What does  $P(0.7, 0.09, 270, 3.04)$  represent? State your answer in a complete sentence.
- (c) Evaluate  $P(0.7, 0.09, 270, 3.04)$  and explain what it means in a full sentence.
- (d) If the gas is quickly transferred to a container ten times as large as the original container from parts (b) and (c), what is the resulting pressure?

2. Figure 1 shows the elevation (in feet above sealevel) of Lake Texoma for the year 2015, the year of the floods. The blue graph is the actual elevation of the lake, the red is the desired elevation and the green graph you can is the level of the conservation pool. Use this figure to answer parts (a)–(f) below.

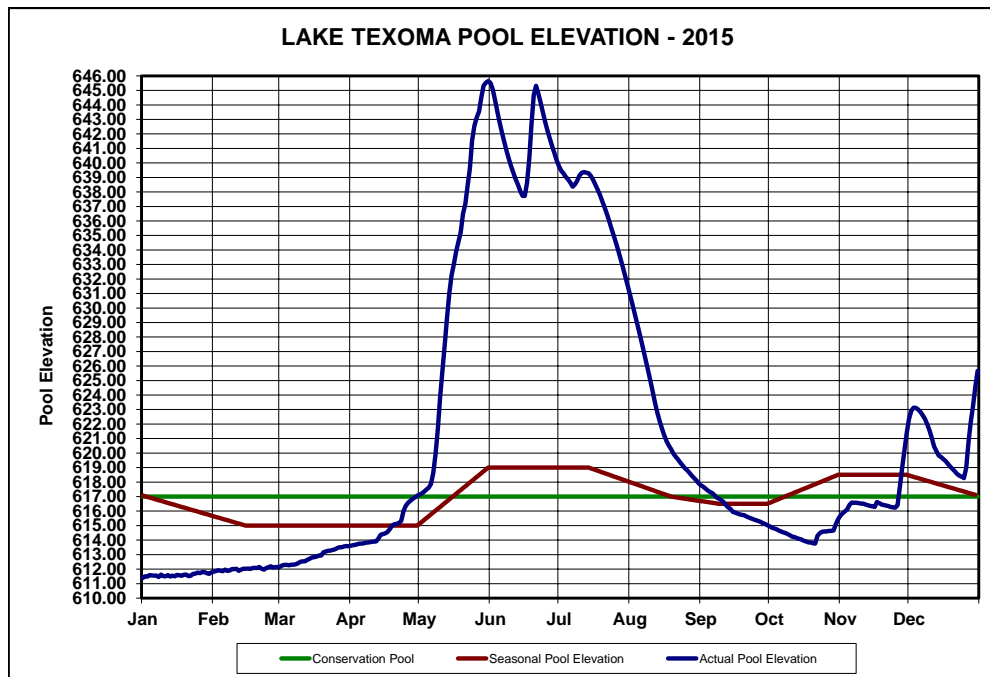


Figure 1: Lake Texoma pool elevation level for the year 2015.

- (a) Give a rough estimate on the days of the year over which the elevation on Lake Texoma was rising.
- (b) Give a rough estimate on the days of the year over which the elevation on Lake Texoma was decreasing.
- (c) When was Lake Texoma at its highest level?
- (d) When was Lake Texoma at its lowest level?
- (e) When was Lake Texoma below its seasonal pool elevation?
- (f) When was Lake Texoma rising in elevation the fastest?

3. The following is a table of the population of Durant from 1990 to 2015, given in 5 year increments:

year	population
1990	13,110
1995	13,050
2000	14,765
2005	15,316
2010	15,927
2015	17,214

- (a) For what range of 5 years did Durant have the greatest average rate of change?
- (b) What are the units on the average rates of change you calculated in part (a)?
- (c) Use the average rate of change to approximate the population of Durant in 2002.
- (d) Use the average rate of change from 2010 to 2015 to approximate the population of Durant in 2018.
- (e) The recorded population of Durant in 2018 was 18,175. Compare this value to the value from part (d). What does this tell you about the rate of growth of Durant?

4. In this problem, we will estimate the cost of a semester of living on campus at Southeastern. The cost per credit hour for an undergraduate face-to-face class is \$208.00 and for an online course is \$258.00. Every credit hour also incurs a \$107.00 in ‘mandatory’ fees of one kind or another. You have also decided to live by yourself in the North Halls, with your own private bathroom, which costs \$2155.00 per semester. For a meal plan, you chose Flex Choice 7 which runs you another \$1,650.00 per semester.

- (a) Write an expression which relates the total cost  $T$  to the number of face-to-face credit hours ( $f$ ) you wish to take and number of online credit hours ( $n$ ).
- (b) You have to take 3 face-to-face classes which are 3 credits, each, one face-to-face class which is 4 credits, and an online course with is 2 credits. Express this in function notation.
- (c) Evaluate your answer to part (b).
- (d) How much money would you save if you switched your online class to a face-to-face class?