

Math 132: Mathematical Models

Exam 1 (Midterm)

Section 1: Homework-like problems (20 pts.)

Solve all of the problems in this section. Like the homework problems, please show all your work. Detailed explanations are not necessary (but a little here and there will probably help). Answers provided without any work will receive at most half credit.

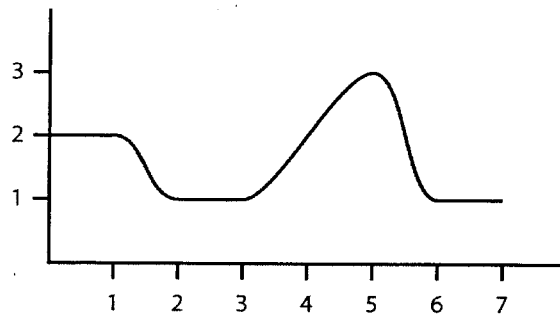
(2 pts.) 1) Donny was born three years before Rachel. Four years ago, Donny was twice as old as Rachel. How old is Rachel now? (Be sure to write and solve one or more functions for this problem.)

(2 pts.) 2) A currency exchange converts at a rate of .8 Euros to 1 U.S. Dollars, but charges a \$5 fee. How many Euros would you convert into Dollars if the number of each was the same?

(1 pt.) 3) Train A leaves from Cleveland going to Chicago. Train B leaves from Chicago going to Cleveland. Both trains leave at the same time. They are accidentally put on the same track and the trains nearly collide when Train A has traveled two-fifths of the way from Cleveland to Chicago. How much faster was Train B traveling than Train A?

(1 pt.) 4) A gardening manual recommends that, in pruning your juniper bushes, you allow them to grow (in height) by 20%, then cut them back by 20%, then let them grow by 20%, then cut them back by 20%, etc.... Why is this probably not good advice?

(5 pts., 1 per graph) 5) Here is the graph of the function $K(x)$:



Graph the following:

a) $3K(x)$

b) $K(x) - 2$

c) $3K(x) - 2$

d) $3(K(x) - 2)$

e) $K(x + 2)$

(3 pts. total) 6) A factory's assembly line can run at two different speeds. On the slower speed, the line assembles 1 widget every four minutes, with 15 widgets per day taken out for quality control. On the faster speed, the line assembles 1 widget every three minutes, but 45 widgets per day must be taken out for quality control. If the factory manager knows how long the machine will run on a given day, how can he decide which speed to run the machine to produce the most widgets?

First, solve the problem algebraically (using functions) (2 pts.). Then show where the solution would be on a graph. (1 pt.).

(2 pts. total) 7) Here is a chart of the amount of snowfall during a week in January in Buffalo, New York:

Day	Snowfall Amount
Monday	10"
Tuesday	6"
Wednesday	4"
Thursday	3"
Friday	2.5"

Imagine that these amounts were put on a graph. Describe the slope and concavity of the graph (1 pt.).

Now imagine that the cumulative total amounts were put on a graph. Describe the slope and concavity of the new graph (1 pt.).

(4 pts. total) 8) Chuck E. Cheese is now offering a bonus token plan when buying a birthday party package. For an additional \$30 plus \$2 per child, you get 50 tokens plus 10 tokens per child.

Write an equation for the average price per token (1 pt.), then draw a graph (1 pt). What would the price per token be for a birthday party with three children? Five children? (1 pt.) If you had many, many children attend a birthday party, what would be the average price per token? (1 pt.)

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Section 2: Write-up/Worksheet-like problems (10 pts.)

Please choose one of the following problems in this section to complete. Type a one to two page (double spaced) answer, following the rubric provided for the problem write-ups. It is not necessary to provide a summary of the problem at the beginning (just specify which problem you choose). Be sure to explain the solution, why it is the correct solution, and any generalizations.

1)

While working with square numbers, a student comes up with an algorithm for squaring two-digit numbers that end in five. Simply take the first digit, multiply it by one more than that number, and then append 25.

Does the student's algorithm work for all two digit numbers ending in five? Why or why not? If not, is there any way to fix the algorithm so that it does work? Does it work for numbers (ending in five) with more than two digits?

2)

After making a 10 by 10 times table, your class decides that it wants to make a 20 by 20 times table. One group of students working on the 11's column quickly notices a pattern. When you multiply a two digit number by 11, you'll get an answer with three digits. The answer has the same first and last digit as the number you're multiplying by 11. The middle digit of the answer is the sum of the first and last digit.

Does the group's algorithm work for all the numbers 11 through 20? Why or why not? If not, is there any way to fix the algorithm so that it does work? Does it work for two-digit numbers greater than 20? Does it work for numbers with more than two digits?

