The class before the exam there will be a chance to earn extra credit. Groups of two to three can present a solution to one of the problems below. Up to 4% can be earned:

- [1] Mastery of the problem: Do you understand the problem and all of the steps used to solve it? Would you be able to solve the problem if given a slightly different question?
- [1] Presentation of the problem: You are presenting material to your classmates that will be on their exam next week! Take care to explain your steps and why you take them but your group also needs to complete your presentation in under 10 minutes!
- [1] Presentation: Do you interact with the class? Do you make eye contact?
- [1] Fielding questions: Can you understand the questions and give a cohesive answer?

Word Problem Practice

1. Fibonacci posed the following problem: Suppose that rabbits live forever and that every month each pair produces a ew pair which becomes productive at age 2 months. If we start with one newborn pair, how many pairs of rabbits will we have in the nth month?

2. A doctor prescribes a 100mg antibiotic pill to be taken every eight hours. It is known that the body removes 75% of the antibiotic in eight hours.

   (a) How much of the antibiotics are in the body after the 2nd pill is taken? After the 3rd?

   (b) If Q_n is the quantity of the antibiotic in the body just after the nth tablet is taken, find an equation that expresses Q_{n+1} in terms of Q_n.

   (c) What quantity of the antibiotic remains in the body in the long run?

3. A certain ball has the property that each time it falls from height h onto a hard, level surface, it rebounds to a height $\frac{2}{3}h$. Suppose the ball is initially dropped from a height of 10 feet and that the ball continues to bounce indefinitely.

   Let b_n be the height the ball reaches on the n^{th} bounce. Let the initial height be recorded as b_0. Write out the first few terms of the sequence b_n. Find the total distance that the ball travels.

4. Use series to prove Euler's formula: $e^{ix} = \cos(x) + i\sin(x)$.

5. The number of people in line is taken every hour but only the last five readings are recorded. Below is a chart of the data N (number of people) at t o'clock. Use this data to estimated the first and second derivatives of N at $t = 11$.

t	9	10	11	12	13
$N(t)$	10	7	8	18	20

n	0	1	2	
$N^n(11) \approx$	8	?	?	

   Now use the approximate derivatives and data to build a quadratic function to approximate N. Use this this model to estimate for the number of people in line at time $t = 14$. Reflect on this model and how believable it is.

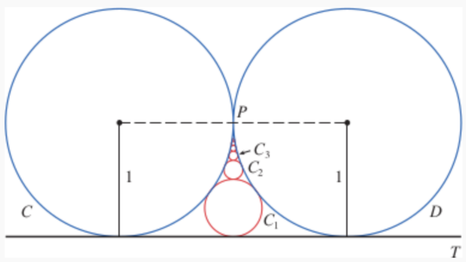
6. The temperature of a microprocessor is taken every second and only the last three readings are recorded. Below is a chart of the temperature C (in Celsius) and time t. Use this data to estimated the first and second derivatives of C at $t = 3$.

t	2	3	4
$C(t)$	46	48	52

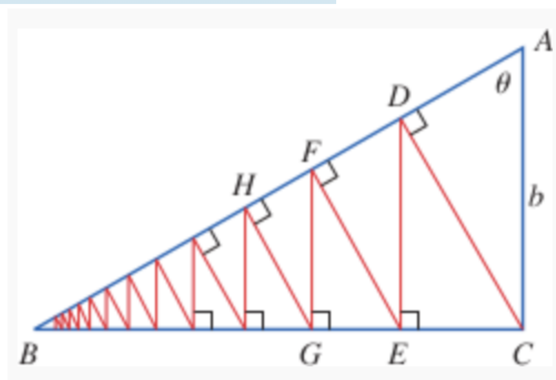
n	0	1	2
$C^n(3) \approx$	48	?	?

Now use the approximate derivatives and data to build a quadratic function to approximate C. Use this this model to estimate temperature at time $t = 5$. Reflect on this model and how believable it is.

7. . The figure shows two circles C and D of radius 1 that touch at P. The line T is a common tangent line; C_1 is the circle that touches C, D, and T; C_2 is the circle that touches C, D, and C_1; C_3 is the circle that touches C, D, and C_2. This procedure can be continued indefinitely and produces an infinite sequence of circles $\{C_n\}$. Find an expression for the diameter of C_n and thus provide another geometric demonstration of Example 2.



8. A right triangle ABC is given with $\angle A = \theta$ and $|AC| = b = 6$. CD is drawn perpendicular to AB, DE is drawn perpendicular to BC, $EF \perp AB$, and this process is continued indefinitely, as shown. Find the total lengths of all the perpendiculars, that is, find $|CD| + |DE| + |EF| + |FG| + ...$ in terms of θ.



9. What is wrong with the following calculation:

$$\begin{aligned} 0 &= 0 + 0 + 0 + ... \\ &= (1-1) + (1-1) + (1-1) + ... \\ &= 1 - 1 + 1 - 1 + 1 - 1 + ... \\ &= 1 + (-1+1) + (-1+1) + (-1+1) + ... \\ &= 1 + 0 + 0 + 0 + ... = 1 \end{aligned}$$