The Tissue Box Problem

In this project, you will design a tissue box based on a chosen theme. The content displayed on each side of your tissue box as well as your overall design must relate to your theme. Start by finding or creating a calculus problem (related to your theme) that requires the use of integration.

- On one side of the box, define your problem. Find a way to incorporate your name into the problem.
- On another side, explain why this problem is personally interesting to you.
- On another side, solve the problem.
- On the final side, illustrate your problem.

Be creative! You will be graded on the complexity and creativity of your problem, the thoughtfulness of your personal reflection, the accuracy of your solution, and the visual appeal of your overall design as it relates to your theme. This project is worth 50 points.

> ***Example*:** The rate of change of the number of ducks $N(t)$ living in a large pond in Mrs. Krummel's back yard is directly proportional to $450 - N(t)$, where t is the time in years. When $t = 0$, the duck population is 120. Mrs. Krummel, whose favorite childhood fairy tale was *The Ugly Duckling*, spends many evenings by the pond, feeding bread crumbs to the ducks. As a result, when $t = 2$, the population has increased to 180. If her duck feeding habits continue, what will the duck population be when $t = 3$?

The Tissue Box Problem: Student Samples

Problem:
Myles visited Australia. A kangaroo decides to visit Myles at his hotel. The kangaroo mistakes Myles for its Joey and puts him in its pouch. The kangaroo then hops away. The kangaroo's velocity is given by the equation $y = 2000\sin\ x+3\ \cos\ x+3$ meters per second. After 5 minutes, the kangaroo notices that Myles is not its Joey and throws him out. How far must Myles walk to get back to his hotel?

Motivation:
This problem interests me because I have never been outside of the country, with the exception of Canada. I chose a place far off that would be exciting. Also, riding around in a pouch sounds like it would be fun.

Problem:
Jackie just won the lottery!!! With the money, she decides to buy a farm. Her favorite animal on the farm is her cow. Every morning she milks her cow at a rate of $\frac{1}{9}\sec\ 3x\ \tan\ 3x\ +5$ gallons per hour. If Jackie milks her cow for 30 minutes each morning, how much milk will she have after a week?

Motivation:
Cows are my favorite animals so to make this problem interesting to me I decided to make it about cows. Also, I've never created my own integration problem so I thought it was interesting to find different ways to make sure that the problem would work.

The Tissue Box Problem: Student Samples

Problem:
Firefighter Elizabeth and the rest of Engine 9 are called to a fire and race to the scene. They soon realize that they only have 20 gallons of gas left. If gas consumption of the truck is defined as $f(x) = \frac{x^2+1}{x^2+9}$ miles per gallon and the fire is 10 miles away, will they make it all the way there?

Motivation:
This problem is interesting to me because it uses two types of integration, which exemplifies how we can put together what we've learned in different lessons to solve one problem. I loved creating a realistic problem because it reinforces that the math I'm learning can be applied to a real life situation. It let me be creative and think outside the (tissue) box – something very new for me in a math class!

Problem:
The number of spots on a giraffe changes at a rate of $60\sin\left(\frac{\pi x}{60}\right)\cos\left(\frac{\pi x}{60}\right)$ spots per year. If Blessing's giraffe, Sam, had 40 spots when he was born, how many spots does he have now that he is 5 years old?

Motivation:
This problem is interesting to me because I like giraffes. They are cool. I want a giraffe! I like animals a lot, and I like trig functions.

The Tissue Box Problem: Student Samples

Problem:
Eric's ram is currently resting in the Kimbylicious Fields. Eric's ram is usually hungry and can eat blades of grass at a rate of $f \quad x \quad = 3x^2 \quad 5e^x$ blades per minute, where x is the time in minutes since he begins eating. Find out how many blades of grass Eric's ram can eat in the first 2 minutes.

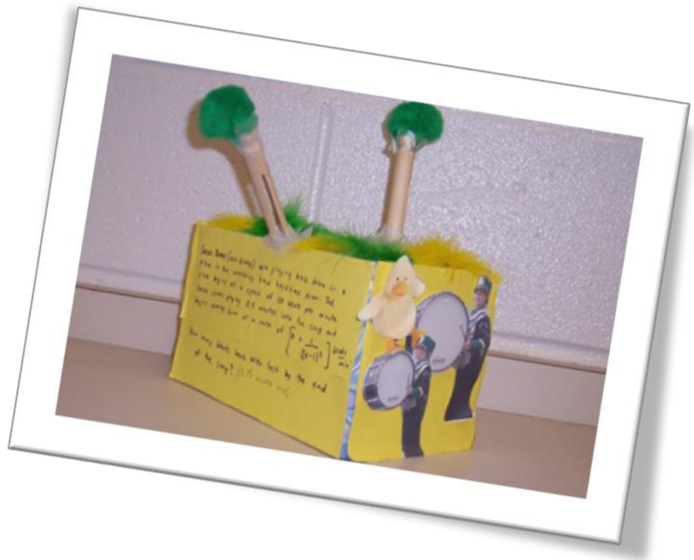
Motivation:
This problem is personally interesting because the ram is an important animal to me. I am Chinese and according to the Chinese zodiac, I was born in the year of the ram (sometimes referred to as the sheep). Also, I was born on March 27th and the zodiac sign for that date is Aries, which also happens to be a ram.

Problem:
Marie is sight-reading a new piece and runs into a double stop. OHNOES!!! The first time she plays the double stop she has a 40% chance of getting it in tune. She practices for a week and improves her chance to hit the notes at a rate of $20e^{-(1/2)x}$ percent per day. She then stops practicing and the chance goes down at a rate of $-\frac{80}{x-4 \quad ^2}$ percent per day. What is her chance to hit the double stop at the end of her first week? If she never practices the piece again, what will her chance of hitting the double stop end up as?

Motivation:
This problem is of personal interest to me because I play violin, and I would be a heck of a lot happier if this were how my practicing actually worked! I could calculate exactly how long I would need to practice for ever piece I was playing, as well as how much trouble I would be in after taking a week off of practice....

The Tissue Box Problem: Student Samples

Problem:
Sarah and Kimby are playing bass drum in a piece in the marching band halftime show. The piece begins at a speed of 110 beats per minute. Sarah starts playing 0.5 minutes into the song and begins slowing down at a rate of $x+\frac{1}{3x-1^{3}}$ beats per minute. How many beats have been lost by the end of the song?



Motivation:
This problem applies to my life because I am in marching band and this problem actually occurs in real life. Kimby and I are both members of the bass drum "chicks with sticks." As bass drums, we are very important to maintaining the beat and tempo of the band. It is interesting to actually calculate how slowing down at a certain rate adds up to make such a difference in speed over a short period of time. So, this problem puts numbers to a common situation in my life that I wouldn't otherwise apply math to.