Writing Assignments in Pre-Calculus

by Wendell Culp-Ressler and Annalisa Crannell

Paper 1: The Case of the Nice, Cold Beer
concept: creating and interpreting graphs

Paper 2: The Case of the Perfect Cans
concept: finding extreme values given a constraint

Writing Assignments in Calculus I

The latest, emerging saga. Rhoda Way flies Quinoa and Aioli to New Guinea. But will she crash and burn at the hands of Dee Seevers?

The first problem graphs a modified trigonometric function. Did Hugh S. Carryman's henchman arrive at the dock when the tide was low or high?	The first writing assignment is here.
The second problem optimizes the volume of a box folded from a giant sheet of cardboard.	The second writing assignment is here. An excellent solution is here.
The third question compares distance, velocity, and acceleration. Will the runway be long enough that Rhoda and Roger can fly away and escape the clutches of their captors?	The third writing assignment is here.

Tara Nova cleans salad jars and bags up spices. Will she find true love as well?

The first problem compares linear with exponential functions. Should Tara wash a jar twice with a lot of water each time, or many times with small amounts of water?	The first writing assignment is here. An excellent solution is here.
The second problem optimizes the volume of a small paper bag. It also introduces us to the oh-so-dreamy Justin Lumberpond (sigh).	The second writing assignment is here. An excellent solution is here.

Questions? See my website (https://sites.google.com/view/annalisacrannell/) for more information.

The third problem examines acceleration of a falling object. The ex-girlfriend is back and murder is afoot!	The third writing assignment is here . An excellent solution is here.

In this trio of assignments, Myron Sopher finds his beloved Philomena after years of separation. But will he get his girl, or will he lose her to his rival, Victor Dendron?

The first problem uses exponential functions; it requires technological help in the solution. How much money was put into the bank, and what was the interest rate, if we know how much money we made in the short and long run?	The first writing assignment is here. An excellent, to-the-point solution is here. Another excellent, more flowery solution is here.
The second problem optimizes the cost of a box that requires soldering. How should we build a storage box the most cheaply?	The second writing assignment is here. An excellent solution is here.
The third problem looks at acceleration due to gravity (and maybe air resistance?). Did Victor Dendron conspire to murder Gus Gusterson?	The third writing assignment is here. An excellent solution is here.
And just because many of my students wanted to know: Did Myron get his girl?	A good-bye letter from Myron is here.

In this trio of assignments, G. Olson Overby-Fitzpatrick, a railway owner, needs help with combating speeding tickets, packing problems, and murder charges. We discover he's not a very nice man.

The first problem uses one of my favorite problems contrasting average velocity with the average of several velocities. Does Overby-Fitzpatrick deserve a speeding ticket?	The first writing assignment is here. An excellent solution is here.

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The second problem optimizes the center of mass; surface area and volume of rectangular objects play an important role.

How high should Overby-Fitzpatrick pack papier-mache in his rail cars?

The second writing assignment is here. An excellent solution is here.

The third problem compares constant velocity with constant deceleration.

Did Overby-Fitzpatrick murder Peter Moss by stopping a train?

The third writing assignment is here. An excellent solution is here.

Writing Assignments in Calculus II

In this trio of assignments, Clay Moore (an accident-prone pottery worker) helps his boss figure out selling strategies for the enormous Enure Vase . . . and then suffers injuries involving aluminum ladders, roller skates, a bucket of tennis balls, not to mention a lead-glazed mug.

In the first paper, Clay wants to figure out when in the future he should sell his Vase.

This paper uses the Fundamental Theorem of Calculus, the product rule, and graph-reading skills.

The first paper is here. An excellent solution is here.

In this paper, Clay needs to determine both the height and the capacity of the Enure Vase.

This paper uses volume of solids of revolution and Riemann Sums.

The second paper is here. An excellent solution is here.

In this paper, Clay suffers from a bout of lead poisoning. Is Eve L. Vellen at it again?

This paper uses coupled linear differential equations.

The third paper is here.

In this trio of assignments, William Avering (a vacillating shoe manufacturer) tries to make good decisions about buying and selling rubber-storage containers . . . and then is diabolically trapped in

his own storage tank. This trio has some of the most unforgivable puns that I have yet used in paper assignments.

In the first paper, W. Avering wants to figure out when he should have sold his rubber making equipment to have maximized profit. This paper uses the Fundamental Theorem of Calculus, the product rule, and graph-reading skills.	The first paper is here. An excellent solution is here.
In this paper, Avering tries to determine the shape of the storage tank that Eve L. Vellen sold him. If he's wise, he'll calculate volumes using integration and solids of revolution.	The second paper is here. An excellent solution is here.
In this paper, W. Avering is trapped in an underground chamber using methods that are half Batman, half Rube Goldberg. Solving the problem requires both infinite series and understanding of the motion of falling objects.	The third paper is here. An excellent solution is here.

In this trio of assignments, Aloysius Ludwig Thumbs, a free-lance home repair technician, needs help with various home improvement projects. Poor Al is constantly beset by unfortunate accidents.

The first problem uses geometry and optimization to design a greenhouse.	The first writing assignment is here. An excellent solution is here.
The second problem uses first-order differential equations in the clean-up of a pollen spill.	The second writing assignment is here. An excellent solution is here.
The third problem calculates the average height of a weird trapezoidal object; it uses 3-d geometry and could involve integration.	The third writing assignment is here. The letter from Tasha is here. An excellent solution is here. The photos of the finished loft are here.

In this trio of assignments, Brent Trachte, the ethically dubious turkey farmer, needs help with his water tanks.

The first problem uses Riemann sums to find the volume of a (somewhat) cylindrical object.	The first writing assignment is here. An excellent solution is here.
The second problem has students determine the areas of slices of a circle, in order to find the volume of water in his cylindrical tank.	The second writing assignment is here. An excellent solution is here.
The third problem (which is almost calculus III material) uses 3-d geometry and arc length to solve a problem with the intersection of two cylinders of different diameters.	The third writing assignment is here. An excellent solution is here.
After all the work they did to help Brent, students get a follow-up letter from the law.	Here is advice to stay away from Brent!

In this trio of papers, Matilda Majestica has trouble at the "Search Us Circus".

The first problem deals with catenaries (is her high-wire made of titanium or aluminum?).	The first writing assignment is here. An excellent solution is here.
The second problem cools a large amount of jello (using Newton's Law of Cooling).	The second writing assignment is here. An excellent solution is here.
The third problem deals with attempted murder by rhinoceros (using damped oscillators and 2nd order differential equations).	The third writing assignment is here. An excellent solution is here.

Alas, I assigned the papers below so long ago that I do not have electronic versions of the solutions to these. But they're fun papers nonetheless.

The Case of the Jiggling Jello
concept: Newton's Law of Cooling

The Case of the Murky Well
concept: calculating volumes of solids of revolution [with thanks to Cohen, Gaughan, Knoebel, Kurtz, and Pengelly, *Student Research Projects in Calculus,* Washington DC: MAA (1991)].

The Case of the Crushed Clown
concept: projectile motion