Break-Ground:

Roxy and Yuri like food

Two young mathematicians discuss the eating habits of their cats.

Check out this dialogue between two calculus students (based on a true story):

Devyn: Yo Riley, I was watching my two cats *Roxy* and *Yuri* eat their dry cat food last night.

Riley: Cats love food! It's so weird that they swallow the pieces whole!

Devyn: I know! I noticed something else kinda funny though: Both Roxy and Yuri start and finish eating at the same times; and while I gave Roxy a little more food than Yuri, less food was left in Roxy's bowl when they stopped eating.

I wonder, is there is a point in time when Roxy and Yuri have the exact same amount of **dry cat food** in their bowls?

Riley: Hmmmmm. Do Roxy and Yuri both start and finish drinking their water at the same times? And does Roxy start with a little more water than Yuri, and finish with less water left than Yuri?

Devyn: Yes!

Riley: Interesting. I wonder, is there is a point in time when Roxy and Yuri have the exact same amount of **water** in their bowls?

Problem 1 *Is there a time when Roxy and Yuri have the same amount of dry cat food in their bowls assuming:*

- *They start and finish eating at the same times.*
- *Roxy starts with more food than Yuri, and leaves less food uneaten than Yuri.*

Hint: *You might want to try drawing a graph of this situation.*

Multiple Choice:

(a) *yes*

Learning outcomes: Understand the necessity of continuity for the Intermediate Value Theorem. Determine if the Intermediate Value Theorem applies.

(b) *no*

(c) *There is no way to tell.* ✓

Problem 2 *Is there a time when Roxy and Yuri have the same amount of water in their bowls assuming:*

- *They start and finish drinking at the same times.*
- *Roxy starts with more water than Yuri, and leaves less water left in her bowl than Yuri.*

Hint: *You might want to try drawing a graph of this situation.*

Multiple Choice:

(a) *yes* ✓

(b) *no*

(c) *There is no way to tell.*

Problem 3 *Within the context of the two problems above, what is the difference between "dry cat food" and "water?"*

Free Response: *If we write the amount of dry cat food as a function of time, this function is not continuous. The reason it isn't continuous is that the dry cat food is a collection of individual kibbles, which are eaten whole.*

On the other hand, if we write the amount of water as a function of time, this function is continuous.
