Studio College Algebra Mock Script

"Doubling Time -- Exponential Functions and the Water Experiment."

Characters:

Instructor (Rekha)

<u>Group A:</u>
Student 1A
Student 2A
GTA 1

<u>Group B:</u>
Student 1B
Student 2B
GTA 2

Undergraduate (Math major) Assistant

Setting: Computer Lab
Instructor starts off explaining what the lesson entails.

Instructor: Welcome back – before we begin our studio assignment today, I have a question for you. I have a 9.5 L bucket in my left hand. In my right hand, I have a pipette. 1 drop of water = 1/16 of a mL. Now, suppose I drop one droplet into this bucket, and 10 seconds later, I double this amount and put 2 drops into the bucket, wait 10 more seconds and put in 4 drops. . . .If, in 10 second intervals, if I keep doubling the previous amount of water, how long do you think it would take to fill this bucket? Once we get to 16 drops, that is roughly 1 mL, so continuing the doubling process will lead us to 2 mL then 4 mL, etc., etc. Get out a note card and write down your guess for how long it will take to fill the bucket.

Student 1A: (*Raises hand and waits briefly for instructor.)* How much water can that bucket hold again?

Instructor: 9.5 L

Students take about 1 minute and write their guesses on their cards. They'll have note cards to write on.

Instructor collects the note cards.

Instructor: Now that I have all your guesses, we're going to try this for ourselves and see how long it takes! Let's all go outside.

The students, GTAs, and undergraduate assistant all go outside, where the experiment is set up.

Instructor: Group A, I want you to stand behind this station. Group B, I'd like you to stand here. I need a few volunteers. Who has a watch with a minute hand?

Student 2A: (*Raises hand)* I do.

Instructor: Great. Please Come and stand here. I also need some volunteers who will be pouring the water into the buckets.

Student 1A, 1B, 2B all raise their hands. Instructor has them stand behind the 2 main buckets that are set up.

GTA 1 and GTA 2 will help each group with pouring water in a timely fashion.

Instructor: (*to the timekeeper)* You will need to say "GO" every 10 seconds. At that point, each of the groups will drop in each amount of water. *To the class:* Most everything is pre-measured, so you just have to dump it in when the timekeeper says 'GO'. Timekeeper - Make sure you keep track of when we start.

Remember, every time she says go, I'll instruct each of your groups on how much water to drop into the bucket.

Any questions?

(there are no questions.)

(*to the timekeeper)* -- Now, tell us when to begin.

Student 2A: Go!

At this point, the students are doing the activity. Writing up this part is unnecessary, as the instructor (Rekha) will make sure the students are putting in water at the right time intervals.

(about 3 minutes pass.)

Group A *pours their bucket into Group B's bucket; everything overflows.*

Instructor: (*to the timekeeper)* How long did that take?

Student 2A (timekeeper) : 3 minutes!

Instructor: Did any of you guess that? *No one raises their hand.* Well the answer is 3 minutes. Notice that for the first minute, even 2 minutes, the buckets were not filling up very rapidly. Once we hit 250 mL, things took off and you could see the effect of doubling. This type of growth is called exponential growth, and this is what we will investigate in studio today. We're going to look at this idea in context of money. Go ahead and head back inside; make sure you pick up a handout so you can get started with your spreadsheet. Both GTA's and our undergraduate assistant will be walking around the room to help answer questions.

The computers will already be set up with the spreadsheet. Students will just have to get back to their seats and ask the following questions.

(About 1 minute passes).

Student 1A: *(Raises hand. Undergraduate assistant walks over to the student.)* I'm not seeing the balance numbers down here in column C. I just see number signs. What is going wrong?

Undergraduate Assistant: If you stretch out the column, you can help solve that problem.

(*Pause of 30 seconds).*

Student 2B: *(Raises hand. GTA 1 walks over to the student.)* I'm trying to answer question # 1 -- How do I know which cell to choose? Both of these look close to 2000.

GTA 1: Well, you'll want to pick the one that is closest - subtract from 2000 and see which is smaller.

(Pause of 1 minute.)

Student 2B: Ok, I'll try that.

(Pause of 1 minute).

Student 1B: *(Raises hand. GTA 2 walks over to the student.)* We've filled in the chart on number 2, but I don't see any kind of pattern. All I can see is that as the interest rate goes up, the doubling time goes down.

GTA 2: Well, that's part of it. Try to look at pairs of number. For instance, 8x9 and 12x6 – what are those different products?

Student 1B: Wait, I need to get my calculator out.

GTA 2: You can use Excel like a calculator. Here, I'll show you. *(GTA 2 shows the student what to do).*

Student 1A: Oh, the product is 72. Well, 10*7 is 70, and that's close to 72.

GTA 2: Sure – have you heard of the Rule of 72?

Student 1B: I've heard that phrase in my accounting class.

GTA 2: Ok – so if you want to know how long an investment would take to double, you take 72 and divide by the interest rate – this would give you a reasonable estimate.

Student 1A: I see. Thanks.

(1 more minute).

Student 2A: *(Raises hand. GTA 1 walks over to the student.)* We're confused on # 2. We don't see any kind of pattern.

GTA 1: Hmm. I think this group over here seems to have something figured out for that problem. Why don't you see if they can explain it to you?

Student 2A and 2B *walk over to Group B.*

Student 2B: Could you help us figure out question 2?

Student 1A: Sure – try to multiply each pair of numbers. Like 10*7 or 36*2. Are the products close to some number?

Student 2B: Oh, okay. We'll try that out and see if we can figure out what's going on.

(*1 more minute passes by).*

Student 1B: *(Raises hand. Undergraduate assistant walks over to the student.)* I don't seem to understand this question. What is meant by a half-life?

Undergraduate Assistant: This is the length of time it takes for a given quantity to reduce to half its size. For instance – the length of time it takes for $1000 to reduce to $500, or the length of time it takes for $500 to reduce to $250. Using this idea, can you figure out the half life (in years) for this situation?

(1 more minute passes by).

Student 1A: (*Raises hand. Instructor walks over to the student.)* I'm having some trouble on question 4. What is this asking?

Instructor: I think many groups are getting stuck on this question. Let me bring everyone together and address this question at the front of the room.

(Instructor talks about problem 4, and the session is over.)

THE END.
