6.2.4 Who killed Dr. Dedman?

An Application of Logarithms

Today you will put together everything that you have learned about logs and exponents to solve a murder mystery!

6-137. THE CASE OF THE COOLING CORPSE

The coroner's office is kept at a cool 17°C. Agent 008 kept pacing back and forth trying to keep warm as he waited for any new information about his latest case. For more than three hours now, Dr. Dedman had been performing an autopsy on the Sideroad Slasher's latest victim, and Agent 008 could see that the temperature of the room and the deafening silence were beginning to irritate even Dr. Dedman. The Slasher had been creating more work than Dr. Dedman cared to investigate.

"Dr. Dedman, don't you need to take a break?" Agent 008 queried. *" You've been examining this body for hours! Even if there were any clues, you probably wouldn't see them at this point."*

"I don't know," Dr. Dedman replied, *" I just have this feeling something is not quite right. Somehow the Slasher slipped up with this one and left a clue. We just have to find it."*

"Well, I have to check in with headquarters," 008 stated. *" Do you mind if I step out for a couple of hours?"*

"No, that's fine," Dr. Dedman responded. *" Maybe I'll have something by the time you return."*

"Sure," 008 thought to himself. *" Someone always wants to be the hero and solve everything himself. The doctor just does not realize how big this case really is. The Slasher has left a trail of dead bodies through five states!"* Agent 008 left, closing the door quietly. As he walked down the hall, he could hear the doctor's voice describing the victim's gruesome appearance into the tape recorder fade away.

The hallway from the coroner's office to the elevator was long and dark. This was the only way to Dr. Dedman's office. Didn't this frighten most people? Well, it didn't seem to bother old Ajax Boraxo who was busy mopping the floor, thought 008.

He stopped briefly to use the restroom and bumped into one of the deputy coroners, who asked, *" Dedman still at it?"*

"Sure is, Dr. Quincy. He's totally obsessed. He's certain there is a clue." As usual, when leaving the courthouse, 008 had to sign out.

"*How's it going down there, Agent 008*?" Sergeant Foust asked. Foust spent most of his shifts monitoring the front door, forcing all visitors to sign in while he recorded the time next to the signature. Agent 008 wondered if Foust longed for a more exciting aspect of law enforcement. He thought if he were doing Foust's job he would get a little stir-crazy sitting behind a desk most of the day. Why would someone become a cop to do this?

"*Dr. Dedman is convinced he will find something soon. We'll see!*" Agent 008 responded. He noticed the time: ten minutes before 2:00. Would he make it to headquarters before the chief left?

"*Well, good luck!*" Foust shouted as 008 headed out the door.

Some time later, Agent 008 sighed deeply as he returned to the coroner's office. Foust gave his usual greeting: "*Would the secret guest please sign in*?" he would say, handing a pen to 008 as he walked through the door. "*Sign in again,*" he thought to himself. "*Annoying!*" 5:05 PM. Agent 008 had not planned to be gone so long, but he had been caught up in what the staff at headquarters had discovered about that calculator he had found. For a moment he saw a positive point to having anyone who came in or out of the courthouse sign in: He knew by quickly scanning the list that Dr. Dedman had not left. In fact, the old guy must still be working on the case.

As he approached the coroner's office, he had a strange feeling that something was wrong. He could not hear or see Dr. Dedman. When he opened the door, the sight inside stopped him in his tracks. Evidently, Dr. Dedman was now the *newest* victim of the Slasher. But wait! The other body, the one the doctor had been working on, was gone! Immediately, the security desk with its annoying sign-in sheet came to mind. Yes, there were lots of names on that list, but if he could determine the time of Dr. Dedman's death, he might be able to scan the roster to find the murderer! Quickly, he grabbed the thermometer to measure the Doctor's body temperature. He turned around and hit the security buzzer. The bells were deafening. He knew the building would be sealed off instantly and security would be there within seconds.

"*Oh no!*" Foust cried as he rushed in, "*How could this happen? I spoke to the Doctor less than an hour ago!*"

As the security officers crowded into the room, Agent 008 explained what he knew, which was almost nothing. He had stopped long enough to check the doctor's body temperature: 27°C. That was 10°C below normal. Then he remembered: the tape recorder! Dr. Dedman had been taping his observations; that was standard procedure. They began looking everywhere.

The Slasher must have realized that the doctor had been taping and taken the tape recorder as well. Exactly an hour had passed during the search, and Agent 008 noticed that the thermometer still remained in Dr. Dedman's side. The thermometer clearly read 24°C. Agent 008 knew he could now determine the time of death.

Coroner's Office – Please Sign In		
Name	Time In	Time Out
Lt. Borman	12:08	2:47
Alice Bingham	12:22	1:38
Chuck Miranda	12:30	2:45
Harold Ford	12:51	1:25
Ajax Boraxo	1:00	2:30
D.C. Quincy	1:10	2:45
Agent 008	1:30	1:50
Ronda Ripley	1:43	2:10
Jeff Dangerfield	2:08	2:48
Stacy Simmons	2:14	2:51
Brock Ortiz	2:20	2:43
Pierce Bronson	3:48	4:18
Max Sharp	3:52	5:00
Maren Ezaki	3:57	4:45
Caroline Cress	4:08	4:23
Milly Osborne	4:17	4:39
D.C. Quincy	4:26	4:50
Vinney Gumbatz	4:35	
Cory Delphene	4:48	4:57
Max Crutchfield	5:04	
Agent 008	5:05	
Security	5:12	

a. Make a sketch showing the relationship between body temperature and time. What type of function is it? Justify your answer.

b. Is there an asymptote for this relationship? If so, what does it represent? If not, explain why not.

c. Use your data and the general equation $y = km^x + b$ to find the equation that represents the temperature of the body at any certain time.

d. At approximately what time did Dr. Dedman die?

e. Who is the murderer?

⸺⸺⸺ Review & Preview ⸺⸺⸺

6-138. A rule-of-thumb used by car dealers is that the trade-in value of a car decreases by 20% of its value each year. Help (Html5)⇔Help (Java)

a. Explain how the phrase "decreases by 20% of its value each year" tells you that the trade-in value varies exponentially with time (i.e., can be represented by an exponential function).

b. Suppose the initial value of your car is $23,500. Write an equation expressing the trade-in value of your car as a function of the number of years from now.

c. How much will your car be worth in four years?

d. In how many years will the trade-in value of your car be $6000?

e. If your car is really 2.7 years old now, what was its trade-in value when it was new?

6-139. Solve for x without using a calculator. <u>Help (Html5)</u>⇔<u>Help (Java)</u>

a. $x = \log_{25}(5)$

b. $\log_x(1) = 0$

c. $23 = \log_{10}(x)$

6-140. Using your calculator, solve the equations below. Round answers to the nearest 0.001. <u>6-140 HW eTool</u> (Desmos). <u>Help (Html5)</u>⇔<u>Help (Java)</u>

a. $x^6 = 125$

b. $x^{3.8} = 240$

c. $x^{-4} = 100$

d. $(x + 2)^3 = 65$

e. $4(x - 2)^{12.5} = 2486$

6-141. If $f(x) = x^4$ and $g(x) = 3(x + 2)$, find the value of each expression below. <u>Help (Html5)</u>⇔<u>Help (Java)</u>

a. $f(2)$

b. $g(2)$

c. $f(g(2))$

d. $g(f(2))$

e. Are $f(x)$ and $g(x)$ inverses of each other? Justify your answer.

6-142. Kirsta was working with the function machine shown at right, but when she turned her back, her little brother Caleb dropped in a number. She didn't see what he dropped in, but she did see what fell out: 9. What operations must she perform on 9 to undo what her machine did? Use this to find out what Caleb dropped

in.

6-143. Write an equation for a machine that will undo Kirsta's machine. Call it $c(x)$.

6-144. What is the equation of the line of symmetry for the graph of $y = (x - 17)^2$? Justify your answer.

$$k(x) = \sqrt{x} + 5$$

6-145. This problem is a checkpoint for adding and subtracting rational expressions. It will be referred to as Checkpoint 6B.
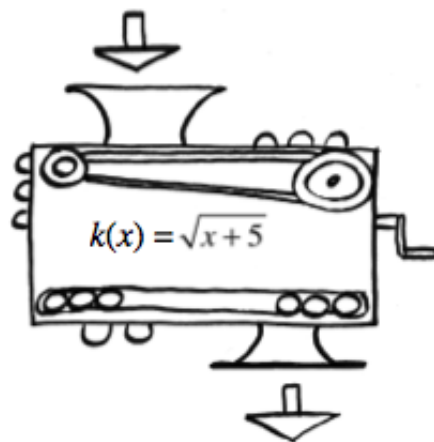
Add or subtract each pair of rational expressions. Simplify the result.

a. $\dfrac{4}{x^2+5x+6} + \dfrac{2x}{x+2}$

b. $\dfrac{3x^2+x}{(2x+1)^2} - \dfrac{3}{2x+1}$

Check your answers by referring to the Checkpoint 6B materials.

If you needed help solving these problems correctly, then you need more practice. Review the Checkpoint 6B materials and try the practice problems. Also, consider getting help outside of class time. From this point on, you will be expected to do problems like these quickly and easily.

6-146. Find $m\angle C$ in each triangle below.

a.

b.
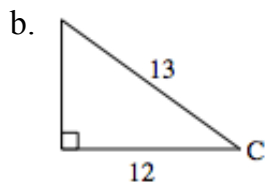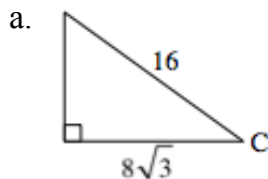
6-147. Write a system of inequalities that could be represented by the graph at right.