

**REVIEW UNIT 5 DAY 1 CALCULATOR FOR ALL QUESTIONS**  
**FREE RESPONSE QUESTION**

Video game nerds can estimate the age of a Luigi based on the length of Luigi's footprint using the function

$$L(t) = 15 - 5.3e^{-0.07t},$$

where  $L(t)$  represents the length of the footprint in centimeters and  $t$  represents Luigi's age in years.

The age of Luigi can also be based on the diameter of a pile of Luigi's pooh using the function

$$D(t) = 15.022(1 - e^{-0.121t-0.555}),$$

where  $D(t)$  represents the diameter of the pile of pooh in centimeters and  $t$  represents Luigi's age in years.

- a. Find the value of  $L(0)$  and  $L(2)$ . Using correct units of measure, explain what this value represents in the context of this problem.

•  $L(0) = 9.7 \text{ cm}$  +1

+1 When Luigi is born, his footprint is 9.7 cm long

•  $L(2) = 10.392 \text{ cm}$  +1

+1 When Luigi is 2 years old, his footprint is 10.392 cm long

- b. Find the value  $D(15)$ . Using correct units of measure, explain what this value represents in the context of this problem.

$D(15) = 13.618 \text{ cm}$  +1

+1 When Luigi is 15 years old, his pooh is 13.618 cm in diameter.

## FREE RESPONSE continued

- c. During the first 20 years of Luigi's life, will the diameter of his pile of pooh ever be the same as the length of his footprint? If so, at what age? Explain how you arrived at your answer by investigating the graphs of  $L(t)$  and  $D(t)$ .

$$L(t) = D(t)$$

+1 The graph of  $L(t)$  and  $D(t)$  intersect at  $t = 9.389$

+1 when Luigi is 9.389 years old, the length of his footprint will be equal to the diameter of his pooh

- d. Solve the equation  $L(t) = 10$  to the nearest whole number. Using correct units of measure, explain what the solution to this equation represents in the context of this problem. Show your algebraic work.

$$10 = 15 - 5.3e^{-0.07t}$$

$$-5 = -5.3e^{-0.07t}$$

$$+1 \quad \frac{5}{5.3} = e^{-0.07t}$$

$$\ln\left(\frac{5}{5.3}\right) = -0.07t$$

$$-\frac{100}{7} \ln\left(\frac{5}{5.3}\right) = t$$

$$+1 \quad 0.832 \approx t \quad (\text{says to round to whole number})$$

+1 when Luigi is 1 year old, he will have a footprint length of 10cm.

**MULTIPLE CHOICE**

1. Find the value of  $2 \log_5 2 - \ln 5$ .

- A. -1.179
- B. -0.748**
- C. -0.268
- D. 3.034
- E. Operation cannot be performed

2. The function  $B(t) = 250e^{0.0693t}$  gives the number of bacteria in a culture dish  $t$  hours after the initial population is placed in the dish. After how many hours has the initial population doubled?

- A. 15.853 hours
- B. 10.002 hours**
- C. 1.585 hours
- D. 1.000 hours
- E. 12.182 hours

$$500 = 250 e^{0.0693t}$$

$$2 = e^{0.0693t}$$

$$\ln 2 = 0.0693t$$

$$\frac{\ln 2}{0.0693} = t$$

3. Order the expressions  $\log_{10} 2$ ,  $2 \ln(e^3)$ , and  $e^{2 \ln 4}$  from least to greatest.

- A.  $\log_{10} 2$      $e^{2 \ln 4}$      $2 \ln(e^3)$
- B.  $2 \ln(e^3)$      $e^{2 \ln 4}$      $\log_{10} 2$
- C.  $\log_{10} 2$      $2 \ln(e^3)$      $e^{2 \ln 4}$**
- D.  $2 \ln(e^3)$      $\log_{10} 2$      $e^{2 \ln 4}$
- E.  $e^{2 \ln 4}$      $2 \ln(e^3)$      $\log_{10} 2$

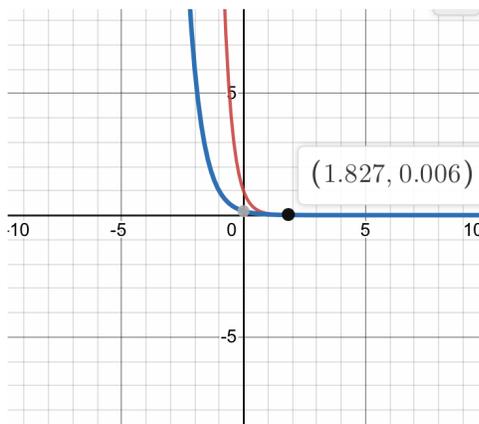
$$\log 2 = 0.301$$

$$2 \ln e^3 = 6$$

$$e^{2 \ln 4} = 16$$

4. The solution to the equation  $4^{-2x} = 6^{-x-1}$  lies on which of the following intervals?

- A.  $-2 < x < -1$
- B.  $-1 < x < 0$
- C.  $0 < x < 1$
- D.  $1 < x < 2$**
- E.  $2 < x < 3$



5. Solve for x:  $\log(3 - x) - \log(2x + 1) = 1$

$3 - x > 0$   
 $3 > x$

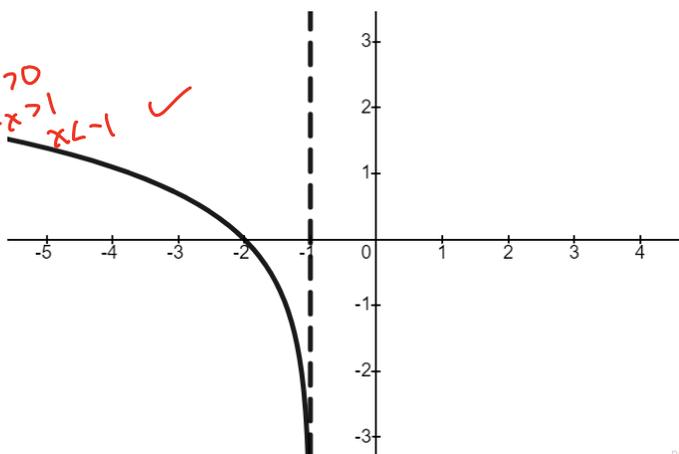
$x < 3$        $x > -\frac{1}{2}$   
 $\log \frac{3-x}{2x+1} = 1$   
 $10^1 = \frac{3-x}{2x+1}$

$20x + 10 = 3 - x$   
 $21x = -7$   
 $x = -\frac{7}{21}$

$x = -\frac{1}{3}$

6. Which of the functions below could be the function whose graph appears to the right?

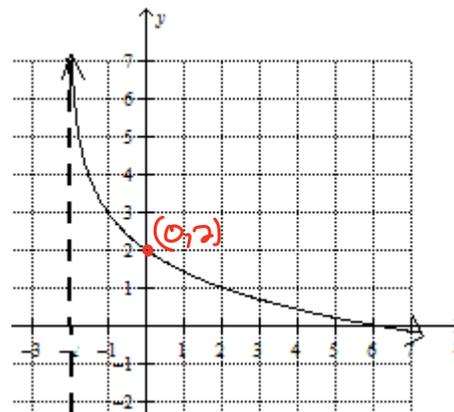
- I. ~~X~~  $f(x) = \log_b(x - 1)$  →  $x > 1$
- II.  $\checkmark$   $g(x) = \log_b(-x - 1)$  →  $-x - 1 > 0$  →  $x < -1$  ✓
- III. ~~X~~  $h(x) = \log_b(2 - x)$  →  $2 - x > 0$  →  $2 > x$



- A. I only
- B. I and III only
- C. II only**
- D. III only
- E. II and III only

7. Pictured to the right is the graph of a logarithmic function,  $h(x)$ . Use the graph to determine which statements below are true.

- I. The graph of  $h^{-1}(x)$  has an x - intercept of (2, 0). ✓
- II. The argument of the function  $h(x)$  could be  $(x + 2)$ . ✓
- III. The graph of  $h^{-1}(x)$  lies below its horizontal asymptote. ~~X~~



- A. I only
- B. II only
- C. III only
- D. I and II only**
- E. I and III only

$x + 2 > 0$   
 $x > -2$