

## Ch 5 Review - part 1 of ch 5 test(2016)

Recall that **Newton law of cooling** states that the temperature  $T$  of a cooling substance at time  $t$  (in minutes) can be modeled by the equation  $T = (T_0 - T_R)e^{kt} + T_R$  where  $T_0$  is the initial temperature of the substance,  $T_R$  is the room temperature, and  $k$  is a constant that represents the cooling rate of the substance.

1. You have been simmering a stew. When you take it off the stove, its temperature is  $200^\circ\text{F}$ . The room temperature is  $68^\circ\text{F}$  and the cooling rate of the stew is  $k = -0.045$ . How long will it take to cool the stew to a serving temperature of  $90^\circ\text{F}$ ?

2. At 10am Cassandra shows up to ask a question and finds Tim standing over a dead body with a bloody knife in his hand. Tim professes his innocence because he was not home from 8-9:45am. He uses Newton's Law of Cooling to prove his innocence. The body temperature upon Cassandra's arrival was  $89^\circ\text{F}$  and the temperature in the room was set to  $72^\circ\text{F}$ . One hour later the body temperature has decreased to  $84^\circ\text{F}$ . Is Tim innocent?

3. A woman calls 911 to report that she has come home from grocery shopping and found her husband dead in the living room. When officers arrive to investigate, she tells them that she left for the grocery store between 10:30 and 11:00 and when she returned at noon, he was dead. The coroner shows up and at 1:00 records the temperature in the room as well as the current temperature of the body which are  $70^\circ\text{F}$  and  $80.4^\circ\text{F}$  respectively. They cordon off the apartment and close all doors and windows to ensure the room temperature remains constant. At 3:30 the coroner returns and again records the temperature of the room to be  $70^\circ\text{F}$  but the body's temperature has now cooled to  $75^\circ\text{F}$ . Using this information, approximate the time of death.

4. On the same set of axis  
Sketch the graph of  $y=e^x$  and  $y=\ln x$   
What is the domain and range of each-  
What are the asymptotes



Solve for  $x$ . No calculator. Leave answers exact.

1.  $\log x = 21$

2.  $\log |x| = 15$

3.  $\ln(x^2 - 1) = 3$

Write each log expression as a single log.

4.  $\log x - \log(y - 3) + 2\log z$

5.  $\ln x + \frac{1}{2} \ln y - 3\ln z$

Solve for  $x$  correct to 3 decimal places.

6.  $\log x = 1.6$

7.  $\log(x + 2) + \log 5 = 4$

8.  $15^{x+1} = 29$

9.  $8\ln(9 - x) = 5$

10.  $\log_7 58 = x$

11.  $\log_6(x + 3) + \log_6(x - 2) = 1$

Solve for x correct to 3 decimal places.

12.  $\frac{4^{x^2}}{4^{3x}} = 4^{18}$

13.  $3x^4 + 5 = 23$

14.  $22 - 5x^{1/6} = 13$

15.  $8 + e^{4x-1} = 14$

16.  $12(3^{7x}) = 60$

17.  $9 - \log_4(x + 3) = 1$

Simplify and evaluate each logarithmic expression. (No Calculator)

18.  $\log_4 7 - \log_4 28$

19.  $\log 4 + \log 25$

20.  $\log_3 12 + \log_3 9 - \log_3 4$

Simplify the expression - eliminate any negative and fractional exponents.

21.  $\left(\frac{-4x^{\frac{1}{3}}}{2x^{\frac{1}{2}}}\right)^3$

23.  $\frac{6x^{-1}y^{-3}}{3x^{-2}y^4}$

22.  $(x^4y^{-3}z^2)^{\frac{-2}{5}}$

24.  $3\sqrt[6]{x^1} (\sqrt[3]{x} - 4\sqrt[3]{x^{-2}})$

## Answer Key – Review Sheet for Chapter 5 Test Part 1

1. 39.817 mins.

2.  $k = -0.3483066943$

$t = -1.2854$  hours from 10AM

Time of death = 8:43 AM

Tim is innocent.

3.  $k = -0.2929471575$

$t = -3.453$  hours from 1:00 PM

Time of death = 9:33 AM

Not innocent.

4

$$y = e^x$$

Important point (0,1) - Growth

Domain:  $(-\infty, \infty)$

Range:  $(0, \infty)$

Asymptote:  $y = 0$  (Horizontal)

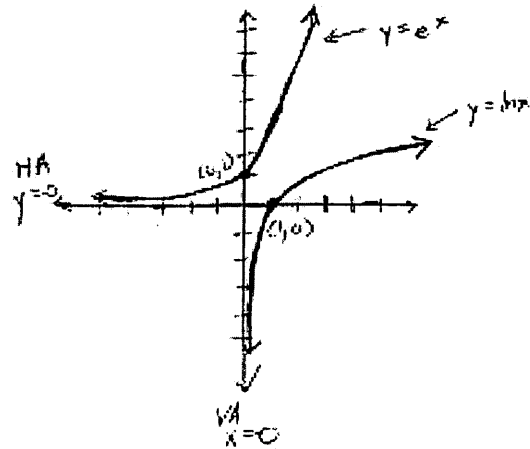
$$y = \ln x$$

Important point (1,0)

Domain:  $(0, \infty)$

Range:  $(-\infty, \infty)$

Asymptote:  $x = 0$  (Vertical)



5.  $A = \$32,210.20$

6.  $r = 18.35\%$  decrease

7.  $t = 10.245$  years

8.  $k = -0.0922061939$

$t = -4.9985$  hours from noon

Time of death = 7:00 A

9.  $y = 3^x$  Important point (0,1) - Growth

Other points (-2, 1/9) (-1, 1/3) (0,1) (1,3) (2,9)

Domain:  $(-\infty, \infty)$

Range:  $(0, \infty)$

Asymptote:  $y = 0$  (Horizontal)

$y = \log_3 x$

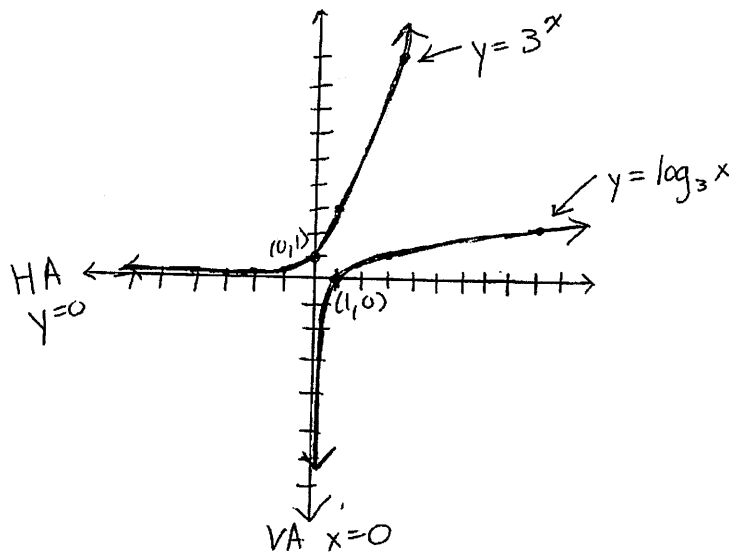
Important points (1,0)

Other points (1/9, -2) (1/3, -1) (1,0) (3,1) (9,2)

Domain:  $(0, \infty)$

Range:  $(-\infty, \infty)$

Asymptote:  $x = 0$  (Vertical)



$x$	$3^x$
-2	1/9
-1	1/3
0	1
1	3
2	9

$y = \log_3 x \iff 3^y = x$

$x$	$\log_3 x$
1/9	-2
1/3	-1
1	0
3	1
9	2

## Answers to Chapter 5 Test Part 2 Review

1.  $x = 10^{21}$

2.  $x = \pm 10^{15}$

3.  $x = \pm \sqrt{e^3 + 1}$

4.  $\log\left(\frac{xz^2}{y-3}\right)$

5.  $\log\left(\frac{x\sqrt{y}}{z^3}\right)$

6.  $x = 10^{1.6} \approx 39.811$

7.  $x = 1998$

8.  $x = 0.243$

9.  $x = 7.132$

10.  $x = 2.087$

11.  $x = 3$

12.  $x = 6, x = -3$

13.  $x = \pm 1.565$

14.  $x = 34.012$

15.  $x = 0.698$

16.  $x = 0.209$

17.  $x = 65533$

18.  $\log_4(1/4) = -1$

19.  $\log 100 = 2$

20.  $\log_3 27 = 3$

21.  $\frac{-8}{\sqrt{x}}$

22.  $\frac{\sqrt[5]{y^6}}{\sqrt[5]{x^8} \sqrt[5]{z^4}}$

23.  $\frac{2x}{y^7}$