Name: Key Period: __________

PC-3 Review. Show work. Mark Extraneous Solutions When Present.

1. Solve for x.

$$5^{x+9} = 625^{4x}$$

$5^{x+9} = (5^4)^{4x}$

$5^{x+9} = 5^{16x}$

$x + 9 = 16x$

$9 = 15x$

$\frac{9}{15} = x$

$x = 3/5$

2. Solve for x.

$$\log(2x) + \log(x+1) = \log(12)$$

$\log(2x(x+1)) = \log(12)$

$2x(x+1) = 12$

$2x^2 + 2x = 12$

$2x^2 + 2x - 12 = 0$

	$6x$	-12
3	$6x$	-12
x	$2x^2$	$-4x$
	$2x$	-4

$(2x-4)(x+3) = 0$

$x = 2$ $\quad$ $x = -3$ extraneous

3. Solve for x.

$$\log_3(x-2) + \log_3(x+15) = 2$$

$\log_3((x-2)(x+15)) = 2$

$3^2 = (x-2)(x+15)$

$9 = x^2 + 13x - 30$

$0 = x^2 + 13x - 39$

Use quadratic formula!

$x = 2.51$ $\quad$ $x = -15.51$ extraneous

4. Solve for x.

$$\log_5(x+3) = 1 - \log_5(x-1)$$

$+\log_5(x-1) \qquad +\log_5(x-1)$

$\log_5(x+3) + \log_5(x-1) = 1$

$\log_5((x+3)(x-1)) = 1$

$5^1 = (x+3)(x-1)$

$5 = x^2 + 2x - 3$

$-5 \qquad -5$

$0 = x^2 + 2x - 8$

$0 = (x+4)(x-2)$

$x = -4$ extraneous

$x = 2$

5. Solve for x.

$$4^{5x-3} = 9^x$$

$\log 4^{5x-3} = \log 9^x$

$(5x-3)\log 4 = x\log 9$

$5x\log 4 - 3\log 4 = x\log 9$

$5x\log 4 - x\log 9 = 3\log 4$

$x(5\log 4 - \log 9) = 3\log 4$

$\frac{x(5\log 4 - \log 9)}{5\log 4 - \log 9} = \frac{3\log 4}{5\log 4 - \log 9}$

$x = \frac{3\log 4}{5\log 4 - \log 9}$

6. Find the domain of the function.

$$f(x) = \log_4(x+7)$$

$x + 7 > 0$

$-7 \quad -7$

$x > -7$

$D: \{x \mid x > -7\}$

7. Find the domain of the function.

$$g(x) = \log(7x - 3)$$

$7x - 3 > 0$

$7x > 3$

$x > 3/7$

$D: \{x \mid x > 3/7\}$

8. Find the domain of the function.

$$y = 5^x$$

All real #'s

9. Which of the two rates would yield the larger amount in 3 years with an initial deposit of $1,000?

3.25% compounded monthly, or 3.20% compounded continuously?

$1000\left(1 + \frac{.0325}{12}\right)^{12(3)}$ $\qquad$ $1000e^{.032(3)}$

$= \$1102.266$ $\qquad$ $= \$1100.759$

This one.

10. How long would it take to double an investment given an annual interest rate of 4.13% compounded quarterly?

$2P = P\left(1 + \frac{.0413}{4}\right)^{4t}$

$2 = 1.010325^{4t}$

$\log_{1.010325} 2 = 4t$

$\frac{67.478}{4} = \frac{4t}{4}$

$16.87 = t$

16.87 years!

11. Zanaya deposits $15,500 into an account with a 3.7% interest rate compounded quarterly. When will she have $20,000? Solve algebraically first and then verify your answer using a graphing calculator.

$$\frac{20000}{15500} = \frac{15500\left(1+\frac{.037}{4}\right)^{4t}}{15500}$$

$$1.29 = 1.00925^{4t}$$

$$\log_{1.00925} 1.29 = 4t$$

$$\frac{27.656}{4} = \frac{4t}{4}$$

$$6.914 = t$$

In 6.914 years

12. Salt (NaCl) decomposes in water into sodium (Na^{+}) and chloride (Cl^{-}) ions according to the law of uninhibited decay. If the initial amount of salt is 25 kilograms and, after 10 hours, 15 kilograms of salt is left, how much salt is left after 1 day?

$$\frac{15}{25} = \frac{25e^{k(10)}}{25}$$

$$0.6 = e^{k(10)}$$

$$\frac{\ln 0.6}{10} = \frac{k(10)}{10}$$

$$-0.0511 = k$$

$$= 25e^{-0.0511(24)}$$

$$= 7.334$$

7.334 grams

13. After the release of radioactive material into the atmosphere from a nuclear power plant at Chernobyl (Ukraine) in 1996, the hay in Austria was contaminated by iodine-131 (half-life 8 years). If it is all right to feed the hay to cows when 10% of the iodine-131 remains, how long do the farmers need to wait to use this hay?

$$\frac{0.5N_0}{N_0} = \frac{N_0e^{k(8)}}{N_0}$$

$$0.5 = e^{k(8)}$$

$$\frac{\ln(0.5)}{8} = \frac{k(8)}{8}$$

$$-0.0866 = k$$

$$\frac{0.10N_0}{N_0} = \frac{N_0e^{-0.0866(t)}}{N_0}$$

$$0.10 = e^{-0.0866t}$$

$$\frac{\ln 0.10}{-0.0866} = \frac{-0.0866t}{-0.0866}$$

$$26.589 = t$$

In 26.589 years

14. The half-life of radium is 1690 years. If 10 grams are present now, how long until 3.5 grams remain?

$$\frac{0.5N_0}{N_0} = \frac{N_0e^{k(1690)}}{N_0}$$

$$0.5 = e^{k(1690)}$$

$$\frac{\ln 0.5}{1690} = \frac{k(1690)}{1690}$$

$$-0.000410 = k$$

$$\frac{3.5}{10} = \frac{10e^{-0.000410(t)}}{10}$$

$$0.35 = e^{-0.000410(t)}$$

$$\frac{\ln(0.35)}{-0.000410} = \frac{-0.000410t}{-0.000410}$$

$$2560.54 = t$$

In 2560.54 years

15. The logistic growth model $P(t) = \frac{500}{1+83.33e^{-0.162t}}$ represents the population of a bacteria after t hours.

a) What is the carrying capacity of the environment? 500

b) What was the initial amount of bacteria in the population? 5.92

c) When will the amount of bacteria be 300?

In 29.804 hours