Name: Key Period: __________

PC-4 Review. Show work. Mark Extraneous Solutions When Present.

1. Solve for x.

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

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

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

$$x+9 = 16x$$

$$-x \qquad -x$$

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

$x = 9/15$ $\quad x = \frac{3}{5}$

2. Solve for x.

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

$$\log_a(x(x-2)) = \log_a(x+4)$$

$$x^2 - 2x = x + 4$$

$$x^2 - 3x - 4 = 0$$

$$(x-4)(x+1) = 0$$

$x = 4$ $\quad x = -1$

Extraneous

3. Solve for x.

$$log_6(x+4) + log_6(x+3) = 1$$

$$\log_6((x+4)(x+3)) = 1$$

$$6^1 = x^2 + 7x + 12$$

$$0 = x^2 + 7x + 6$$

$$0 = (x+1)(x+6)$$

$x = -1$ $\quad x = -6$

Extraneous

4. Solve for x.

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

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

$$\log\left(\frac{2x+1}{x-2}\right) = 1$$

$$10^1 = \frac{2x+1}{x-2}$$

$$10(x-2) = 2x+1$$

$$10x - 20 = 2x + 1$$

$$\frac{8x}{8} = \frac{21}{8}$$

$$x = \frac{21}{8}$$

5. Solve for x.

$$4^{-4x+12} = 12^{x-2}$$

$$\log 4^{-4x+12} = \log 12^{x-2}$$

$$(-4x+12)\log 4 = (x-2)\log 12$$

$$-4x\log 4 + 12\log 4 = x\log 12 - 2\log 12$$

$$-4x\log 4 - x\log 12 = -2\log 12 - 12\log 4$$

$$x(-4\log 4 - \log 12) = -2\log 12 - 12\log 4$$

$$x = \frac{-2\log 12 - 12\log 4}{-4\log 4 - \log 12}$$

6. Find the domain of the function.

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

$$x + 7 > 0$$

$$x > -7$$

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

7. Find the domain of the function.

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

$$7x - 3 > 0$$

$$7x > 3$$

$x > \frac{3}{7}$ $\quad D: \{x \mid x > \frac{3}{7}\}$

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? Support your answer.
3.25% compounded monthly, or 3.20% compounded continuously?

$$1000\left(1 + \frac{0.0325}{12}\right)^{12(3)} \qquad 1000e^{.032(3)}$$

$= \$1102.27 \qquad \$1100.76$

The 3.25% compounded monthly is larger

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

$$2P = P\left(1 + \frac{0.0413}{4}\right)^{4t}$$

$$2 = (1.01033)^{4t}$$

$$\log_{1.01033} 2 = 4t$$

$$\frac{\log 2}{\log 1.01033} = 4t$$

$$67.4464 = 4t$$

$$t = 16.8616$$

About 16.8616 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.	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?
$\frac{20000}{15500} = \frac{15500\left(1+\frac{0.037}{4}\right)^{4t}}{15500}$ $1.290 = (1.00925)^{4t}$ $\log_{1.00925} 1.29 = 4t$ $t = 6.914$ $\frac{\log 1.29}{\log 1.00925} = 4t$ $27.656 = 4t$ In about 6.914 years	$\frac{15}{25} = \frac{25e^{K(10)}}{25}$ $0.6 = e^{K(10)}$ $\frac{\ln(0.6)}{10} = \frac{K(10)}{10}$ $K = -0.0511$ $25e^{-0.0511(24)}$ $= 7.334$ About 7.334 grams will remain
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?	14. The half-life of radium is 1690 years. If 10 grams are present now, how long until 3.5 grams remain?
$\frac{0.5A_0}{A_0} = \frac{A_0 e^{K(8)}}{A_0}$ $0.5 = e^{K(8)}$ $\frac{\ln(0.5)}{8} = \frac{K(8)}{8}$ $-0.0866 = K$ $\frac{0.10A_0}{A_0} = \frac{A_0 e^{-0.086t}}{A_0}$ $0.10 = e^{-0.086t}$ $\frac{\ln(0.10)}{-0.086} = \frac{-0.086t}{-0.086}$ $26.589 = t$ In about 26.589 years	$\frac{0.5A_0}{A_0} = \frac{A_0 e^{K(1690)}}{A_0}$ $0.5 = e^{K(1690)}$ $\ln(0.5) = K(1690)$ $-0.000410 = K$ $\frac{3.5}{10} = \frac{10e^{-0.000410t}}{10}$ $0.35 = e^{-0.000410t}$ $\frac{\ln(0.35)}{-0.000410} = \frac{-0.000410t}{-0.000410}$ $2560.542 = t$ In about 2560.542 years

15. What rate of interest compounded 1 time per year is required to double an investment in 6 years?

$2P = P\left(1+\frac{r}{1}\right)^{1(6)}$

$2 = (1+r)^6$

$\sqrt[6]{2} = \sqrt[6]{(1+r)^6}$

$1.122 = 1 + r$

$.122 = r$

A 12.2% intrest rate

16. A 50-mg sample of a radioactive substance decays to 34 mg after 30 days. How long will it take for there to be 2mg remaining?

$\frac{34}{50} = \frac{50e^{k(30)}}{50}$

$0.68 = e^{k(30)}$

$\frac{\ln(0.68)}{30} = \frac{k(30)}{30}$

$-0.0129 = k$

$\frac{2}{50} = \frac{50e^{-0.0129t}}{50}$

$.04 = e^{-0.0129t}$

$\frac{\ln(0.04)}{-0.0129} = \frac{-0.0129t}{-0.0129}$

249.5253

In about 249.5253 days

17. Fill in the table below, then answer the questions using the table.

x	-5	-3	0	1	7
$f(x)$	10	2	-5	7	-3
$g(x)$	1	12	-3	-2	8
$f^{-1}(x)$	0	7	undefined	undefined	1

18. Let $n(x) = \frac{4x-7}{8x+2}$ Algebraically determine $n^{-1}(x)$.

$x = \frac{4y-7}{8y+2}$

$x(8y+2) = 4y-7$

$8xy + 2x = 4y - 7$

$8xy - 4y = -7 - 2x$

$\frac{y(8x-4)}{\cancel{8x-4}} = \frac{-7-2x}{8x-4}$

$n^{-1}(x) = \frac{-7-2x}{8x-4}$

19. Verify the inverse of $n(x) = \frac{4x-7}{8x+2}$ by showing that $n(n^{-1}(x)) = x$. Showing work is a major portion of this problem.

$$\frac{4\left(\frac{-7-2x}{8x-4}\right) - 7}{8\left(\frac{-7-2x}{8x-4}\right) + 2} = \frac{\frac{-28-8x}{8x-4} - 7}{\frac{-56-16x}{8x-4} + 2} = \frac{\frac{-28-8x}{8x-4} - \frac{7(8x-4)}{8x-4}}{\frac{-56-16x}{8x-4} + \frac{2(8x-4)}{8x-4}}$$

$$= \frac{\frac{-28-8x}{8x-4} - \left(\frac{56x-28}{8x-4}\right)}{\frac{-56-16x}{8x-4} + \left(\frac{16x-8}{8x-4}\right)} = \frac{\frac{-28-8x-56x+28}{8x-4}}{\frac{-56-16x+16x-8}{8x-4}} = \frac{\frac{-64x}{8x-4}}{\frac{-64}{8x-4}}$$

$$= \frac{-64x}{8x-4} \cdot \frac{8x-4}{-64} = \frac{\cancel{-64}x}{\cancel{-64}} = x$$