College Algebra
Chapter 4 Test

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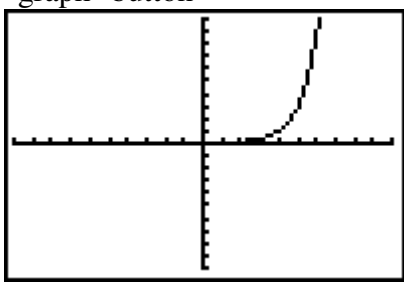
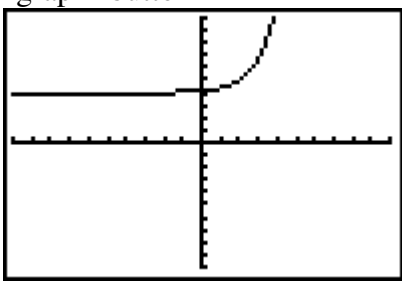
1. Graph

$f(x) = 3^{x-4}$ "y=" button "clear" button 3 "^" button "(" button "x-key" button "minus" button 4 ")" button "graph" button 	$f(x) = e^{x-2} + 4$ "y=" button "clear" button "2nd" button "ln" button "x-key" button "minus" button 2 ")" button "plus" button 4 "graph" button 

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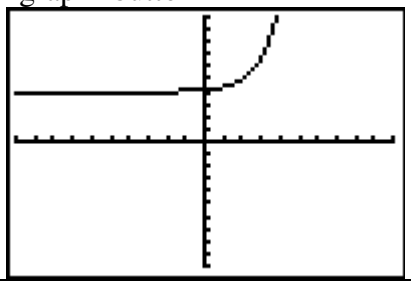
2. Use the Change of Base

Evaluate (4 decimal places if necessary):	Graph: $f(x) = \log_2(x-5)$
$\log_5 13$	(Have to show change of base setup for credit)
$\log_5 13$	$f(x) = \log_2(x-5)$
$= \dfrac{\log 13}{\log 5}$	$f(x) = \dfrac{\log(x-5)}{\log 2}$
$= 1.5937$	"y=" button "clear" button "log" button "x-key" button "minus" button 5 ")" button "divide" button "log" button 2 ")" button "graph" button 

3. Use the definition of a log

Write in logarithmic form: $5^{x-3} = 7$	Write in exponential form: $\log_7(x-1) = 2$
$\log_5 7 = x-3$	$7^2 = x-1$

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4. Use properties of logs

Write as separate logs: $\log\dfrac{x^3 y}{z^4\sqrt{w}}$ $\log\dfrac{x^3 y}{z^4\sqrt{w}}$ $\log(x^3 y)-\log\left(z^4\sqrt{w}\right)$ $\log x^3+\log y-\left[\log z^4+\log\sqrt{w}\right]$ $\log x^3+\log y-\log z^4-\log\sqrt{w}$ $3\log x+\log y-4\log z-\log w^{\frac{1}{2}}$ $3\log x+\log y-4\log z-\dfrac{1}{2}\log w$	Write as separate logs: $\log\sqrt[9]{\dfrac{x^2}{y^3}}$ $\log\sqrt[9]{\dfrac{x^2}{y^3}}$ $\log\left(\dfrac{x^2}{y^3}\right)^{\frac{1}{9}}$ $\dfrac{1}{9}\log\left(\dfrac{x^2}{y^3}\right)$ $\dfrac{1}{9}\log x^2-\dfrac{1}{9}\log y^3$ $\dfrac{2}{9}\log x-\dfrac{3}{9}\log y$ $\dfrac{2}{9}\log x-\dfrac{1}{3}\log y$
Condense into a single log: $5\log x-7\log y+3\log z$ $5\log x-7\log y+3\log z$ $\log x^5-\log y^7+\log z^3$ $\log\dfrac{x^5}{y^7}+\log z^3$ $\log\dfrac{x^5 z^3}{y^7}$	Condense into a single log: $3\log(x-1)+4\log x-7\log(x+2)$ $3\log(x-1)+4\log x-7\log(x+2)$ $\log(x-1)^3+\log x^4-\log(x+2)^7$ $\log\left[x^4(x-1)^3\right]-\log(x+2)^7$ $\log\dfrac{x^4(x-1)^3}{(x+2)^7}$

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5. Solve using equality of exponents

$4^{x-1} = 64$

$4^{x-1} = 64$

$4^{x-1} = 4^3$

$x - 1 = 3$

$x = 3 + 1$

$x = 4$

$9^{4x-1} = 27^{x+3}$

$9^{4x-1} = 27^{x+3}$

$3^{2(4x-1)} = 3^{3(x+3)}$

$2(4x-1) = 3(x+3)$

$8x - 2 = 3x + 9$

$8x - 3x = 9 + 2$

$5x = 11$

$\frac{5x}{5} = \frac{11}{5}$

$x = \frac{11}{5}$

$2^{x-3} = \sqrt[3]{2}$

$2^{x-3} = \sqrt[3]{2}$

$2^{x-3} = 2^{\frac{1}{3}}$

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

$3(x) + 3(-3) = 3\left(\frac{1}{3}\right)$

$3x - 9 = 1$

$3x = 1 + 9$

$3x = 10$

$\frac{3x}{3} = \frac{10}{3}$

$x = \frac{10}{3}$

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6. Solve a basic log equation

$\log_3(4x-1)=2$	$\ln(x-8)=3$
$\log_3(4x-1)=2$	$\ln(x-8)=3$
$3^2=4x-1$	$e^3=x-8$
$9=4x-1$	$e^3+8=x$
$9+1=4x$	
$10=4x$	
$\frac{10}{4}=\frac{4x}{4}$	
$\frac{5}{2}=x$	

7. Solve a log equation by using properties of logs:

$\log_3(x)+\log_3(x-6)=3$	$\log(x+2)-\log(x+1)=1$
$\log_3(x)+\log_3(x-6)=3$	$\log(x+2)-\log(x+1)=1$
$\log_3 x(x-6)=3$	$\log\frac{x+2}{x+1}=1$
$3^3=x(x-6)$	$10^1=\frac{x+2}{x+1}$
$27=x^2-6x$	$10(x+1)=\frac{x+2}{x+1}(x+1)$
$0=x^2-6x-27$	$10x+10=x+2$
$0=(x-9)(x+3)$	$10x-x=2-10$
$x-9=0 \quad x+3=0$	$9x=-8$
$x=9 \qquad x=-3$	$\frac{9x}{9}=\frac{-8}{9}$
but x = -3 doesn't work so x = 9	$x=\frac{-8}{9}$

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8. Solve miscellaneous log problems:

Find the domain of: $f(x) = \log_2(7x-1)$ $7x-1>0$ $7x>1$ $\frac{7x}{7} > \frac{1}{7}$ $x > \frac{1}{7}$	Evaluate without using a calculator: $\log_3 9$ $\log_3 9$ $\log_3 3^2$ 2
Evaluate without using a calculator: $\log_2 \sqrt{8}$ $\log_2 \sqrt{8}$ $\log_2 8^{\frac{1}{2}}$ $\log_2 (2^3)^{1/2}$ $\log_2 2^{3/2}$ $\frac{3}{2}$	Evaluate without using a calculator: $5^{\log_5(4x-1)}$ $5^{\log_5(4x-1)}$ $4x-1$

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9. Solve an exponential equation

$9^{x-1} = 5$

$9^{x-1} = 5$

$\ln\left(9^{x-1}\right) = \ln 5$

$(x-1)\ln 9 = \ln 5$

$x\ln 9 - \ln 9 = \ln 5$

$x\ln 9 = \ln 5 + \ln 9$

$\dfrac{x\ln 9}{\ln 9} = \dfrac{\ln 5 + \ln 9}{\ln 9}$

$x = \dfrac{\ln 5 + \ln 9}{\ln 9}$

$4^{x+3} - 2 = 7$

$4^{x+3} - 2 = 7$

$4^{x+3} = 7 + 2$

$4^{x+3} = 9$

$\ln\left(4^{x+3}\right) = \ln 9$

$(x+3)\ln 4 = \ln 9$

$x\ln 4 + 3\ln 4 = \ln 9$

$x\ln 4 = \ln 9 - 3\ln 4$

$\dfrac{x\ln 4}{\ln 4} = \dfrac{\ln 9 - 3\ln 4}{\ln 4}$

$x = \dfrac{\ln 9 - 3\ln 4}{\ln 4}$

$4e^{2x-1} - 3 = 5$

$4e^{2x-1} - 3 = 5$

$4e^{2x-1} = 5 + 3$

$4e^{2x-1} = 8$

$\dfrac{4e^{2x-1}}{4} = \dfrac{8}{4}$

$e^{2x-1} = 2$

$\ln\left(e^{2x-1}\right) = \ln 2$

$2x - 1 = \ln 2$

$2x = 1 + \ln 2$

$\dfrac{2x}{2} = \dfrac{1 + \ln 2}{2}$

$x = \dfrac{1 + \ln 2}{2}$

10. Solve an exponential equation (compound interest problem)

Given interest is compounded continuously and principal is 3000, ending amount is 5000, rate is 2%, find time.	Given interest is compounded continuously and principal is 4000, ending amount is 4100, time is 3 years, find the rate.
$A = Pe^{rt}$	$A = Pe^{rt}$
$5000 = 3000e^{0.02t}$	$4100 = 4000e^{3r}$
$\frac{5000}{3000} = \frac{3000e^{0.02t}}{3000}$	$\frac{4100}{4000} = \frac{4000e^{3r}}{4000}$
$\frac{5000}{3000} = e^{0.02t}$	$\frac{4100}{4000} = e^{3r}$
$\ln\left(\frac{5000}{3000}\right) = \ln\left(e^{0.02t}\right)$	$\ln\left(\frac{4100}{4000}\right) = \ln\left(e^{3r}\right)$
$\ln\left(\frac{5000}{3000}\right) = 0.02t$	$\ln\left(\frac{4100}{4000}\right) = 3r$
$\frac{\ln\left(\frac{5000}{3000}\right)}{0.02} = t$	$\frac{\ln\left(\frac{4100}{4000}\right)}{3} = r$
$25.5 = t$	$0.0082 = r$
	$0.82\% = r$