34. $\log_5(8-7x)=3$

$\log_a b=c \Leftrightarrow a^c=b$

$5^3=8-7x$

$125-8=-7x$

$117=-7x$

$\boxed{-\frac{117}{7}=x}$

$8-7\left(\frac{-117}{7}\right)$

$=8+117$

38. $\log(x+5)-\log(x-3)=\log 2$

$\log\frac{x+5}{x-3}=\log 2$

$\log_a M=\log_a N \Rightarrow M=N$

$\frac{x+5}{x-3}=2$

$x+5=2(x-3)$

$x+5=2x-6$

$\boxed{11=x}$

42. $\ln x - \ln(x-4) = \ln 3$

$\ln \frac{x}{x-4} = \ln 3$

$\frac{x}{x-4} = 3$

$x = 3(x-4)$

$x = 3x - 12$

$12 = 2x$

$\boxed{6 = x}$

46. $\log_5(x+4) + \log_5(x-4) = 2$

$\log_5\left[\underbrace{(x+4)(x-4)}_{x^2-16}\right] = 2$

$5^2 = x^2 - 16$

$25 + 16 = x^2$

$41 = x^2$

$\cancel{\pm}\sqrt{41} = x$

$\sqrt{36} < \sqrt{41} < \sqrt{49}$

$6 < \sqrt{41} < 7$

$\boxed{x = \sqrt{41}}$

48. $\log_3 x + \log_3(x+1) = \log_3 2 + \log_3(x+3)$

$\log_3[x(x+1)] = \log_3[2(x+3)]$

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

$x^2 + x = 2x + 6$

$x^2 - x - 6 = 0$

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

$\boxed{x=3}$, $\cancel{x=-2}$

4.6 Applications & Models

Population Growth

$P(t) = P_0 e^{kt}$, $k > 0$

$P(t)$ = population at time t

P_0 = initial population

k = exponential growth rate

Continuously Compounded Interest

$$P(t) = P_0 e^{kt}$$

$P(t)$ = amt of \$ @ time t

P_0 = initial investment

k = interest rate

How to find Growth Rate / Doubling Time

$$P(t) = P_0 e^{kt}$$

$$\log_a b^p = p \log_a b$$

$$\frac{P(t)}{P_0} = e^{kt}$$

$$\ln\left(\frac{P(t)}{P_0}\right) = kt$$

Doubling time T is the time it takes for the population to double

$$2P_0 = P_0 e^{kT} \qquad P(T) = 2P_0$$

$$2 = e^{kT}$$

$$\ln 2 = kT$$

$$\boxed{T = \frac{\ln 2}{k}}$$

2. exponential growth rate of rabbits is 11.7% per day $k=0.117$

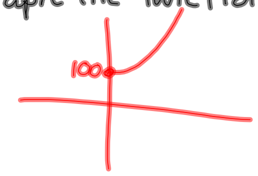
initial population of 100 rabbits P_0

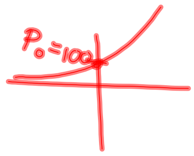
a. Find the exponential Growth Function

$P(t)=P_0e^{kt}$

$\boxed{P(t)=100e^{0.117t}}$

b. Graph the function





c. What will the population be after 7 days?

$P(7)=100e^{0.117(7)} \approx \boxed{227 \text{ rabbits}}$

d. Find the Doubling Time.

$2P_0=P_0e^{0.117T}$

$2=e^{0.117t}$

$\ln 2=0.117t$

$\frac{\ln 2}{0.117}=t$

$\boxed{T\approx 5.9 \text{ days}}$

8. Interest Compounded Continuously $\boxed{P(t)=P_0e^{kt}}$

	Initial Investment P_0	Interest Rate k	Doubling Time T	Amount after 5 years $P(5)$
a)	\$35,000	6.2%	$2P_0=P_0e^{0.062T}$ $2=e^{0.062T}$ $\ln 2=0.062T$ $T=\frac{\ln 2}{0.062}\approx 11.2\text{yr}$	$P(5)=35000e^{0.062(5)}$ $\approx \$47,719.88$
b)	\$5,000	$\frac{7130.90}{5000}=\frac{5000e^{k\cdot 5}}{5000}$ $\ln\left(\frac{7130.9}{5000}\right)=k\cdot 5$ $k=\frac{\ln\left(\frac{7130.9}{5000}\right)}{5}=7.1\%$	$T=\frac{\ln 2}{0.071}$ $\approx 9.8\text{ yr}$	\$7,130.90
c)	$11414.71=P_0e^{0.084(5)}$ $P_0=\frac{11414.71}{e^{0.084(5)}}$ $\approx \$7500$	8.4%	$T=\frac{\ln 2}{0.084}$ $\approx 8.3\text{yr}$	\$11,414.71
d)	$P_0=\frac{17539.32}{e^{0.063(5)}}$ $\approx \$12,800$	$T=\frac{\ln 2}{k}$ $k=\frac{\ln 2}{T}=\frac{\ln 2}{11}$ $\approx 6.3\%$	11yr	\$17,539.32

<u>4.5</u> # 27-47 odd

<u>4.6</u> # 5, 7