view Unit 3

1) $A(211) = 100e^{-.01885(211)} = 1.87335\text{ mg} \approx \boxed{1.87\text{ mg}}$

2) $f(x) = 20138(.811)^x$ Decay since $b = .811 < 1$.
$(1+r) = .811$
$r = -.189$ so constant percentage of rate of decay is $\boxed{-18.9\%}$

2.5) $f(x) = 7(1.048)^x$ growth since $b = 1.048 > 1$
$1 + r = 1.048$
$r = .048$ rate of growth $\boxed{4.8\%}$

3) $y = 63(1 - .0043)^x \rightarrow \boxed{y = 63(.9957)^x}$

4)

-2	33
-1	23.1
0	16.17 "a"
1	11 -
2	7.9 -

b? $\frac{16.17}{23.1} = .7$ $\frac{11.319}{16.17} = .7$ since $\frac{\text{term}}{\text{previous}}$ = same # that is "b"

$\frac{23.1}{33} = .7$ $\frac{7.9233}{11.319} = .69991$ $b = .7$

$\boxed{y = 16.17(.7)^x}$

5) Initial when $t = 0$ $P(0) = \frac{440}{1+39e^{-.3(0)}} = \frac{440}{1+39(1)} = \frac{440}{40} = 11$

6) max #, limit to growth, carrying capacity
as long as $\frac{L}{1+ab^x}$ then max is 1100

7) $e^{-x} = \frac{1}{18} \rightarrow \log_e\left(\frac{1}{18}\right) = -x \xrightarrow{\text{OR}}$ "Log both sides" $\ln e^{(-x)} = \ln\left(\frac{1}{18}\right)$

$\ln\left(\frac{1}{18}\right) = -x$ power rule

$\boxed{-\ln \frac{1}{18} = x}$ $-x \cdot \cancel{\ln e} = \ln\left(\frac{1}{18}\right)$

← same $-x = \ln\left(\frac{1}{18}\right)$

$\boxed{x = -\ln\frac{1}{18}}$

OR keep going...
power rule
$x = \ln\left(\frac{1}{18}\right)^{-1}$
$\boxed{x = \ln(18)}$

8) $\log_4\left(\frac{x^{1/2}}{y^6}\right) = \log_4 x^{1/2} - \log_4 y^6$ power

Quotient $\boxed{\frac{1}{2}\log_4 x - 6\log_4 y}$

9) Powers $4\log_m x - 7\log_m(x+5)$

$\log_m x^4 - \log_m(x+5)^7 \longrightarrow \log_m\left(\frac{x^4}{(x+5)^7}\right)$

$)\ y = Pe^{rt} \quad y = 200e^{.09(6)} = \boxed{\$343.20}$

11) $FV = R \cdot \frac{(1+\frac{r}{n})^{nt} - 1}{(\frac{r}{n})}$ $\quad FV = 300 \cdot \frac{(1+\frac{.05}{4})^{4(10)} - 1}{(\frac{.05}{4})} = \boxed{= \$15,446.86}$

12) $y = P(1+\frac{r}{n})^{nt}$

$\frac{2(1900)}{1900} = \frac{1900}{1900}(1+\frac{.09}{4})^{4t}$

$2 = (1+.09/4)^{4t} \longrightarrow \log_{(1+.09/4)}(2) = 4t$

$\frac{\frac{\log 2}{\log(1+\frac{.09}{4})}}{4} = \frac{4t}{4}$ $\quad \boxed{t = 7.7879 \text{ years}}$

13) $FV = 60 \cdot \frac{(1+\frac{.075}{12})^{12(30)} - 1}{\frac{.075}{12}}$ $\quad \boxed{= \$80,846.72}$

14) $FV = 50 \cdot \frac{(1+\frac{.08}{12})^{12(19)} - 1}{\frac{.08}{12}}$ $\quad \boxed{= \$26619.14}$

15) $PV = 232.11 \cdot \frac{1-(1+\frac{.075}{12})^{-12(3)}}{\frac{.075}{12}}$ $\quad \boxed{= \$7461.85}$

16) $y = 14000(1+\frac{.12}{2})^{2(3)} = \boxed{\$19,859.26}$

17) $\log_3(x-4) + \log_3(x-4) = 2$

$\log_3(x-4)^2 = 2 \longrightarrow 3^2 = (x-4)^2$

$\sqrt{9} = \sqrt{(x-4)^2}$

$\pm 3 = x - 4 \rightarrow x = 4 \pm 3 < \begin{smallmatrix}7\\1\end{smallmatrix}$ $\quad x = 7, \cancel{1}$

Double check original

$x = 7$ ✓ $\quad \log_3(7-4)^2 = 2$

$\log_3(3)^2 = 2$ ✓

$x = 1 \quad \log_3(1-4)^2 = 2$

↑ not possible $\therefore$ extraneous

18) $5^{(4x-2)} = 24$

$\ln 5^{(4x-2)} = \ln 24$

$\frac{(4x-2)\cancel{\ln 5}}{\cancel{\ln 5}} = \frac{\ln 24}{\ln 5}$

$4x - 2 = \frac{\ln 24}{\ln 5}$

$\frac{4x - \cancel{2}}{+2} = \frac{\frac{\ln 24}{\ln 5} + 2}{4}$

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

$\boxed{x = .9936}$

19) $3 - \log_2(x+6) = 2$

$-\log_2(x+6) = -1$

$\log_2(x+6) = 1$

$2^1 = x+6$ check $3 - \log_2(-4+6) = 2$ ✓

$\boxed{-4 = x}$

20) $4\log_5(4x+1) + 5\log_5(2x+6)$

$\log_5(4x+1)^4 + \log_5(2x+6)^5$

$\boxed{\log_5\left[(4x+1)^4(2x+6)^5\right]}$

21) Caffeine $\frac{1}{2}$ life problems.

22) Puppy problem: initial $(0, C) \to$ Plug in to find C

next $(t, y) \to$ Plug in to find k.

ex. Puppy (kitty, Bunny, etc) is born at 3 lbs. 8 months later puppy (kitty, bunny, etc) is 29 lbs. If animal's weight is proportional to (exponential function).

$y = Ce^{kt}$ $(0, 3)$ How much animal weigh after 10 months?

$(8, 29)$

$3 = Ce^{k(0)} \longrightarrow y = 3e^{kt}$

$3 = Ce^0$

$3 = C$

$\frac{29}{3} = \frac{3e^{k(8)}}{3}$

$\ln\frac{29}{3} = \ln e^{k8}$

$\frac{\ln\frac{29}{3}}{8} = \frac{k \cdot 8 \cdot \ln e}{8}$

$y = 3e^{\left(\frac{\ln\frac{29}{3}}{8}\right)t}$

$y = 3e^{(.2835...)t}$

$y = 3e^{(.2835...)(10)}$

$\boxed{y = 51.1348 \text{ lbs.}}$

(probably not a kitty or bunny 🙂)