(1) a) $\log_3 5x = \boxed{\log_3 5 + \log_3 x}$

b) $\boxed{\log \frac{y}{17}} = \log y - \log 17$

c) $\ln 2^{-5} = \boxed{-5 \cdot \ln 2}$

d) $\boxed{\log_4 (3x)} = \frac{\log (3x)}{\log 4}$

(2) a) True
b) False
c) True
d) False
e) False
f) False
g) True
h) True

(3) a) $e^{2x} = 75$

$\ln e^{2x} = \ln 75$

$2x = \ln 75$

$\boxed{x = \frac{\ln 75}{2}}$

≈ 2.16

b) $3^{x-3} = 5$

$\ln 3^{x-3} = \ln 5$

$(x-3) \cdot \ln 3 = \ln 5$

$x - 3 = \frac{\ln 5}{\ln 3}$

$\boxed{x = \frac{\ln 5}{\ln 3} + 3}$

≈ 4.46

c) $\frac{50}{4+e^{2x}} = 11$

$4 + e^{2x} = \frac{50}{11}$

$e^{2x} = \frac{6}{11}$

$2x = \ln \frac{6}{11}$

$\boxed{x = \frac{\ln \frac{6}{11}}{2}}$

$\approx -.303$

d) $e^{2x} + 5e^x - 6 = 0$

$(e^x + 6)(e^x - 1) = 0$

$e^x + 6 = 0 \quad e^x - 1 = 0$

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

~~$x = \ln -6$~~ $x = \ln(1)$

$\boxed{x = 0}$

(4) $\boxed{1.39}$

(5) a) $\ln x = 5.4$

$\boxed{e^{5.4} = x}$

b) $\log(x+2) + \log(x-1) = 4$

$\log((x+2)(x-1)) = 4$

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

$10^4 = x^2 + x - 2$

$x^2 + x - 10002 = 0$

$x = \frac{-1 \pm \sqrt{1 - 4(1)(-10002)}}{2(1)}$

$(x = 99.5)$ OR ~~$x = -100.5$~~

c) $\log_3(x-2) + \log_3(x+5) = 2\log_3 3$

$\log_3((x-2)(x+5)) = \log_3 3^2$

$x^2 + 3x - 10 = 9$

$x^2 + 3x - 19 = 0$

$x = \frac{-3 \pm \sqrt{9 - 4(1)(-19)}}{2(1)}$

d) $17 - 4\log x = 25$

$-4\log x = 8$

$\log x = -2$

$10^{-2} = x$

$\boxed{x = \frac{1}{100} = .01}$

(6) $\log \sqrt[5]{\frac{3y}{x}}$

$= \log\left(\frac{3y}{x}\right)^{1/5}$

$= \frac{1}{5}\log\left(\frac{3y}{x}\right)$

$\boxed{= \frac{1}{5}\log 3 + \frac{1}{5}\log y - \frac{1}{5}\log x}$

(7) $4\log x - 4\log z + \log x$

$= \log x^4 - \log z^4 + \log x$

$= \log\left(\frac{x^4 \cdot x}{z^4}\right) = \log\left(\frac{x^5}{z^4}\right)$ (A)

(8) $3^{a+1} = 4b$

$\log_3 4b = a+1$ (D)

(9) a) $\log_3 81 = \boxed{4}$ b) $\log_2 32 = \boxed{5}$ c) $\log \sqrt[3]{10} = \boxed{\frac{1}{3}}$

(10) a) $8 = 4e^{k(1)}$

$2 = e^k$

$\ln(2) = k$

STO...

After 4 days...

$A = 4e^{\ln(2)(4)}$

$\boxed{A = 64 \text{ guppies}}$

After 1 week (7 days)

$A = 4e^{\ln(2)\cdot 7}$

$\boxed{A = 512 \text{ guppies}}$

b) $2000 = 4e^{\ln(2)t}$

$500 = e^{\ln(2)t}$

$\ln 500 = \ln(2)t$

$t = \frac{\ln 500}{\ln(2)} = \boxed{8.97 \text{ days}}$

(11) a) $P(0) = \frac{1200}{1+99e^{-.4(0)}} = \boxed{12 \text{ deer}}$

b) $1000 = \frac{1200}{1+99e^{-.4t}}$

$1+99e^{-.4t} = 1.2$

$99e^{-.4t} = .2$

$e^{-.4t} = \frac{1}{495}$

$-.4t = \ln\left(\frac{1}{495}\right)$

$t = \frac{\ln\left(\frac{1}{495}\right)}{-.4}$

c) $\boxed{1200 \text{ deer}}$

(12) MODEL DEPENDS ON DATA ENTRY