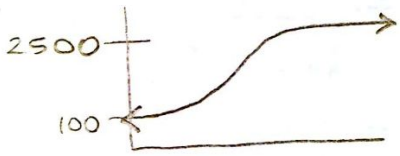
Logistic WS Key:

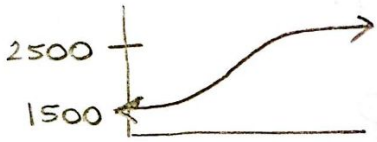
1) $\frac{dP}{dt} = 5P - .002P^2$

$\frac{dP}{dt} = 5P\left(1 - \frac{P}{2500}\right)$

a) $\lim_{t\to\infty} P(t) = 2500$



b) $\lim_{t\to\infty} P(t) = 2500$



c) omit or graph on calc

d) $\frac{1}{2}(2500) = 1250$ bears

2) E

$\frac{dP}{dt} = P\left(2 - \frac{P}{5000}\right)$

$\frac{dP}{dt} = 2P\left(1 - \frac{P}{10{,}000}\right)$

3) $\frac{dP}{dt} = 3P - .01P^2$

$\frac{dP}{dt} = 3P\left(1 - \frac{P}{300}\right)$

I. True

II. True

III. False

4) $\frac{dP}{dt} = .01P(100-P)$

$\frac{dP}{dt} = 1P\left(1-\frac{P}{100}\right)$

$K=1$

a) $P = \frac{M}{1+Ae^{-kt}}$

$20 = \frac{100}{1+Ae^{0}}$

$A = 4$

$P = \frac{100}{1+4e^{-t}}$

b) $P = \frac{100}{1+4e^{-3}} = 83$ animals

c) $80 = \frac{100}{1+4e^{-t}}$

$t = 2.773$ yrs.

5) $\frac{dP}{dt} = .003P(2000-P)$

$\frac{dP}{dt} = 6P\left(1-\frac{P}{2000}\right)$

a) 1000 students

b) $P(0) = 5$

$P = \frac{2000}{1+399e^{-6t}}$

c) $1000 = \frac{2000}{1+399e^{-6t}}$ $t = .998$ hrs

6) $\frac{dP}{dt} = .05P - .0005P^2$

$\frac{dP}{dt} = .05P(1-.01P)$

$\frac{dP}{dt} = .05P\left(1-\frac{P}{100}\right)$

$M = 100$

7) $\frac{dP}{dt} = P\left(3-\frac{P}{2000}\right)$

$\frac{dP}{dt} = 3P\left(1-\frac{P}{6000}\right)$

$M = 6000$

8) $\frac{dP}{dt} = .08P - .0002P^2$

$\frac{dP}{dt} = .08P(1-.0025P)$

$\frac{dP}{dt} = .08P\left(1-\frac{1}{400}P\right)$

a), b), c) } all 400

9) $\frac{dP}{dt} = .1P - .001P^2$

$\frac{dP}{dt} = .1P(1 - .01P)$

$\frac{dP}{dt} = .1P\left(1 - \frac{P}{100}\right)$

$K = .1$

a) $P = \frac{100}{1 + Ae^{-.1t}}$

$t = 0,\ P = 10$

$10 = \frac{100}{1 + Ae^{-.1(0)}}$

$A = 9$

$P = \frac{100}{1 + 9e^{-.1t}}$

b) $t = 3$

$P = \frac{100}{1 + 9e^{-.1(3)}} = 13$ bears

c) $50 = \frac{100}{1 + 9e^{-.1t}}$

$t = 21.972$ yrs

10) a) SF

b) $\frac{dy}{dx} = \frac{y}{\sqrt{1-x^2}}$ $\quad y(0) = 2$

$\int \frac{1}{y}\,dy = \int \frac{1}{\sqrt{1-x^2}}\,dx$

$\ln|y| = \arcsin x + C$

$y = e^{\arcsin x + C}$

$2 = Ce^{\arcsin(0)}$

$C = 2$

$y = 2e^{\arcsin x}$

c) $y\left(\frac{1}{2}\right) \approx 3.27$

d) $y = 2e^{\arcsin\left(\frac{1}{2}\right)}$

$y = 3.376$