Calculus - Thankful For Story Problems

45 $p(t) = 9.865(1.025)^t$

$p'(t) = 9.865(\ln 1.025)(1.025^t)$

a) $p'(18) = .379921 \Rightarrow$ $\boxed{379{,}921 \text{ population increase per year}}$

b) $p'(26) = .462897 \Rightarrow$ $\boxed{462{,}897 \text{ pop. increase per year}}$

53 a) $M(200) = 3102e^{-e^{-.022(200-56)}} \approx \boxed{2974.15 \text{ grams}}$

b) $\lim_{t\to\infty} M(t) \approx \boxed{3102}$

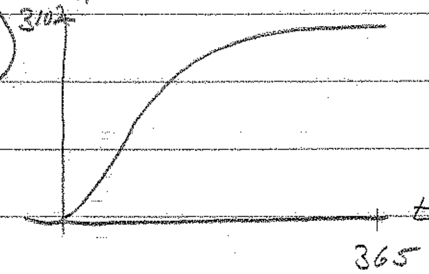
c) 80% of 3102 ≈ 2481.6 → graph $M(t)$ & estimate t when $M(t) \approx 2481.6$

$\boxed{t \approx 124 \text{ days}}$

d) $M'(t) = 3102e^{-e^{-.022(t-56)}}\left(-e^{-.022(t-56)}\right)(-.022)$

$\boxed{M'(200) = 2.754 \text{ grams/day}}$

e)



f)

Day	weight (g)	growth rate (g/day)
50	990.98	24.88
100	2121.7	17.73
150	2733.6	7.60
200	2974.2	2.75
250	3058.8	.943
300	3087.6	.317

(54) a) approaches Length of 589 mm

b) $559.55 = 589\left[1 - e^{-(.168(t+2.682))}\right]$

$.95 = 1 - e^{-.168(t+2.682)}$

$e^{-.168(t+2.682)} = .05$

$-.168(t+2.682) = \ln(.05)$

$-.168(t+2.682) \approx -2.9957$

$t + 2.682 \approx 17.8317$

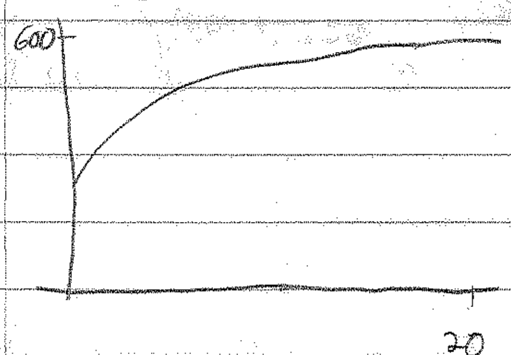
$\boxed{t \approx 15.149}$

c) $L'(t) = 589\left[0 - e^{-.168(t+2.682)}(-.168)\right]$

$L'(t) = (589)(.168)\left[e^{-.168(t+2.682)}\right]$

$L'(4) = 32.2$

growth of 32.2 mm/year @ 4 years old

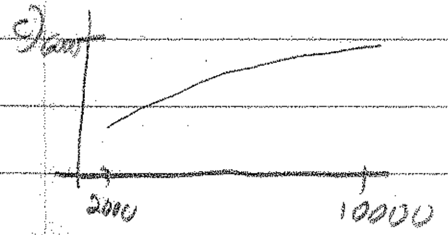
d) 

(58) $C'(x) = 5 \cdot \frac{1}{(\ln 2)x}$

a) $C'(10) = \frac{5}{(\ln 2)10} = \boxed{\frac{1}{2\ln 2}}$ b) $C'(20) = \frac{5}{(\ln 2)20} = \boxed{\frac{1}{(\ln 2)4}}$

(59) a) $A(4000) = 4.688\left(4000^{.8168 - .0154 \log 4000}\right) \approx \boxed{2590.2264}$

b) $A'(4000) \approx$ $\boxed{.457 \text{ increase in BSA/gram}}$

c) 

(62) a) $t(55) = 218 + 31(.933)^{55} \approx \boxed{218.684}$

b) $t'(n) = 31(\ln .933)(.933^{n})$

$t'(55) = 31(\ln .933)(.933^{55}) \approx$ $\boxed{-.0474}$ world record is decreasing by .0474 seconds/year.

c) $\lim_{n\to\infty} t(n) = 218$ sec

current W.R. is 3:43.13 = 223.13 sec

(65) a) $8.9 = \frac{2}{3} \log \frac{E}{.007}$

$13.35 = \log E/.007$

$10^{13.35} = E/.007$

$\boxed{E \approx 1.5671 \times 10^{11} \text{ kW-hr}}$

b) $247 \cdot 10 \text{ million} = 2{,}470{,}000{,}000$

$1.5671 \times 10^{11} \div 247 \times 10^{9}$

$\boxed{63.45 \text{ Months}}$

65c) $M' = \frac{2}{3}\frac{\frac{1}{10^{4.4}}}{(\ln 10)\left(\frac{E}{10^{4.4}}\right)} = \frac{2}{3}\left(\frac{1}{\ln 10}\right)\left(\frac{1}{\cancel{10^{4.4}}}\right)\left(\frac{\cancel{10^{4.4}}}{E}\right) = \frac{2}{3E(\ln 10)}$

c) $M' = \frac{2}{3(70000)\ln 10} \approx \boxed{4.136 \times 10^{-6}}$

d) It decreases.

66 a) $F(30) = 816.71$ cars/Hr
$F'(30) = -41.22$

b) $F(40) = 521.96$ cars/Hr
$F'(40) = -20.92$