7.8 Skills

1. Fishing

$\frac{1}{2} = e^{0.084t}$

$\ln\frac{1}{2} = \ln e^{0.084t}$

$\ln\frac{1}{2} = 0.084t \ln e$

$\ln\frac{1}{2} = 0.084t$

$t = \frac{\ln\frac{1}{2}}{0.084}$ $t = -8.252\text{yrs}$

$\boxed{\text{about } 8.25 \overset{\text{decreasing}}{\text{years}}}$

2. Population

$P = ae^{rt}$

$P = 3.5e^{30(0.015)}$

$P = \boxed{5.489 \text{ million}}$

3. Population

$P = 80e^{0.015t}$

$120{,}000 = 80e^{0.015t}$

$\frac{120{,}000}{80{,}000} = e^{0.015t}$

$1.500 = e^{0.015t}$

$\ln 1500 = \ln e^{0.015t}$

$\ln 1.500 = 0.015t \ln e$

$\ln 1500 = 0.015t\ (1)$

$t = \frac{\ln 1500}{0.015}$

$\boxed{t \approx 27 \text{ years}}$

#4. Bacteria:

$y = ae^{rt}$

$50{,}000 = 2000e^{0.657d}$

$\frac{50{,}000}{2000} = e^{0.657d}$

$25 = e^{0.657d}$

$\ln 25 = \ln e^{0.657d}$

$\ln 25 = 0.657d \ln e$

$d = \frac{\ln(25)}{0.657}$

$d = 4.8993$ $\boxed{\approx 4.9 \text{ days}}$

$\boxed{\text{or} \approx 5 \text{ days}}$

#5. Nuclear Power ([illegible])

$\frac{1}{2}$ life of Plutonium 239

$y = ae^{kt}$ ← half life | $y = a(\frac{1}{2})^{\frac{t}{24360}}$

$\frac{1}{2} = e^{kt}$

$\frac{1}{2} = e^{k(24,360)}$

$\ln(\frac{1}{2}) = 24360k$

$k = (\ln \frac{1}{2})/24360$

$\boxed{k = .0000285}$

#6. DEPRECIATION

$y = ae^{rt}$

$8600 = 12500e^{0.062t}$

$\ln\left(\frac{8600}{12500}\right) = 0.062t$

$t = \ln\left(\frac{8600}{12500}\right)/0.062$

$t = -6.03$

$\approx \boxed{6 \text{ years}}$

#7. LOGISTIC GROWTH

$p(t) = \frac{105,000}{1 + 2.7e^{-0.0981t}}$

a. Max. population

105,000 (from top of formula)

b. When does population reach 100,000?

$100,000 = \frac{105,000}{1 + 2.7e^{-0.0981t}}$

$\frac{(1 + 2.7e^{-0.0981t})(100000)}{100000} = \frac{105000}{100,000}$

$2.7e^{-0.0981t} = 1.05 - 1$

$e^{-0.0981t} = .05/2.7$

$-0.0981t = \ln\left(\frac{.05}{2.7}\right) / -0.0981$

$t = 40.6624 \approx \boxed{40.66 \text{ years}}$