4. a) $P(t) = 10{,}000\, e^{.05t}$

b) $20{,}000 = 10{,}000\, e^{.05t}$

$$2 = e^{.05t} \rightarrow \ln(2) = \ln(e^{.05t}) = .05t$$

$$t = \frac{\ln(2)}{.05} \approx 13.86 \text{ years}$$

so in $1900 + 13.86$ or in 1913

c) $P'(t) = .05\, P(t)$

$P'(t) = .05(25{,}000) = 1250 \frac{\text{Armadillos}}{\text{yr}}$

5. Find decay constant.

$$\frac{1}{2} = e^{5.3 \cdot k} \rightarrow \ln(1/2) = \ln(e^{5.3k}) = 5.3k$$

$$k = \frac{\ln(1/2)}{5.3} \approx -.13078$$

decay constant is $.13078$

How long until 30% remains?

$$.3 = e^{-.13078t} \rightarrow \ln(.3) = \ln(e^{-.13078t}) = -.13078t$$

$$t = \frac{\ln(.3)}{-.13078} = 9.206 \text{ years}$$

6. Want \$10,000 at 4.5% in 5 years.

$$10{,}000 = Pe^{.045 \cdot 5} = Pe^{.225} = 1.2523P$$

$$P = \frac{10{,}000}{1.2523} \approx \$7{,}985.16$$

7. Want r first.

$$3 = 1 \cdot e^{r \cdot 10} \rightarrow \ln(3) = \ln(e^{10r}) = 10r$$

$$\text{so } r = \frac{\ln(3)}{10} = .10986$$

$$10 = 1 \cdot e^{.10986 \cdot t} \rightarrow \ln(10) = \ln(e^{.10986t}) = .10986t$$

$t = 20.959$ years. $\approx$ 2006