(1) Solve $4.3(1.7)^t = 19.4$ for $t$.

\[ t = \frac{\ln(19.4/4.3)}{\ln(1.7)} \]

\[ t = 2.83938 \]

(2) If you need $50,000 in 25 years, then how much should you invest now at 9% interest compounded annually.

\[ P(t) = P_0 (1.09)^t \]

We want to find $P_0$.

\[ P(25) = P_0 (1.09)^{25} = 50,000 \]

\[ P_0 = \frac{50,000}{(1.09)^{25}} \]

Amount to invest is $\$5798.39$

(3) A population of roaches in a dorm starts with 5. If the size of the population grows exponentially, and after 3 weeks has size 40, then find a formula for the size, $R(t)$, of the roach population after $t$ weeks.

**Method 1**

\[ P(t) = 5a^t \]

\[ P(3) = 5a^3 = 40 \]

\[ a^3 = \frac{40}{5} \]

\[ a = \sqrt[3]{8} = 2 \]

so \[ R(t) = 5(2)^t \]

**OR** \[ R(t) = 5e^{0.69315t} \]

Both are correct.

**Method 2**

\[ R(t) = 5e^{kt} \]

\[ R(3) = 5e^{3k} = 40 \]

\[ e^{3k} = \frac{40}{5} \]

\[ k = \frac{\ln(8)}{3} = 0.69315 \]

so \[ P(3) = 5e^{0.69315(3)} \]