1. [10 points] The population of squirrels in Ann Arbor oscillates sinusoidally between a low of 4.1 thousand on January 1 and a high of 5.4 thousand on July 1. Let $P(t)$ be the population, in thousands, of squirrels in Ann Arbor t months since January 1.

    a. [5 points] On the axes below, graph the function P, showing at least one full period. Remember to label your axes and make sure important features of the graph are clear.
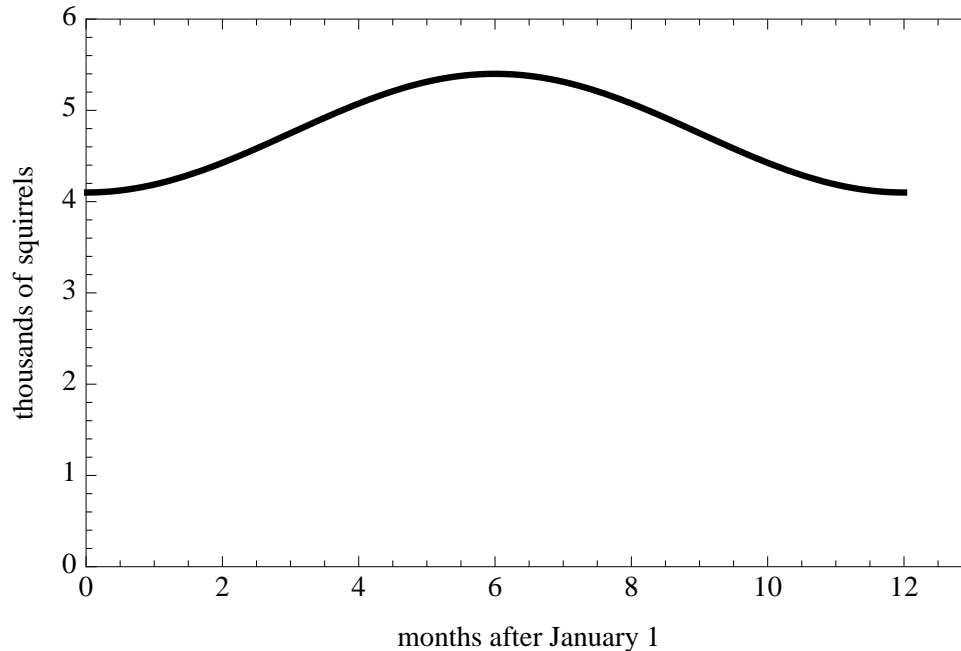
    b. [5 points] Use your graph to find a formula for $P(t)$.

> *Solution:* From the problem, we know that P is at its minimum when $t = 0$, so $-\cos$ is the natural choice of function to use. We need the appropriate values of A, B and C in $P(t) = -A\cos(Bt) + C$. We are given that the period is 12 months, so $B = 2\pi/12 = \pi/6$. A is the amplitude, which is half the distance between the maximum and minimum values, i.e. $A = (5.4 - 4.1)/2 = 0.65$. The value for C is the vertical shift, which is the average of the maximum and minimum. That is, $C = (5.4 + 4.1)/2 = 4.75$.

$$P(t) = \underline{\hspace{2em} -0.65\cos\left(\frac{\pi t}{6}\right) + 4.75 \hspace{2em}}$$