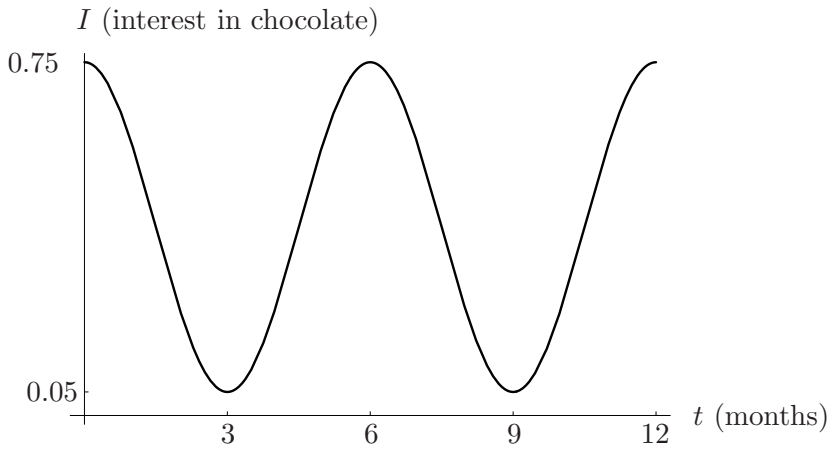
7. (14 points) Kevin's interest in chocolate fluctuates during the year. His girlfriend works at a chocolate factory, and sometimes he gets a chocolate overload. Even at the best of times, he wouldn't gauge his level of "chocolate interest" as more than, say, a 75% interest. Assume that Kevin's interest in chocolate is given by the graph of $I(t)$ shown below, where t is in months and $t = 0$ is January 1st, 2004.



(a) Assuming I is a trigonometric function, find a formula for I in terms of t.

midline: $I = 0.4$
amplitude: $A = 0.35$
period $= 6 \Rightarrow B = \frac{2\pi}{6} = \frac{\pi}{3}$
So, one possible equation for I is

$$I(t) = 0.35\cos(\frac{\pi}{3}t) + 0.4.$$

(b) List all months of 2004 in which Kevin's interest in chocolate was increasing.

Notice that the function is increasing between $t = 3$ and $t = 6$ as well as between $t = 9$ and $t = 12$. We're told in the problem that $t = 0$ corresponds to January 1, 2004. So, the function is increasing during the following months:

April, May, June and October, November, December.

(c) For what value(s) of t during 2004 was Kevin's interest in chocolate increasing the fastest?

$t = 4.5$ and $t = 10.5$