5. (12 points) In Ann Arbor the earliest sunset is at 4 p.m. and the latest at 8 p.m. (ignoring daylight savings time).

(a) Determine a trigonometric function, f, as a function of t in days, where $f(t)$ gives the number of hours past midnight when sunset occurs. Assume that $t = 0$ represents the winter solstice (December 21) and ignore leap years. [Recall that winter solstice is the shortest day of each year.]

(b) Give a practical interpretation of $f(90)$ in the context of this problem.

(c) Interpret $f'(120) = 0.03$ in the context of this problem.

(d) Suppose $g(x) = cf(x + h) - k$ for positive constants c, h and k. Give the following for $g(x)$ (your answers may involve c, h and k):

(i) Amplitude

(ii) Midline

(iii) Period