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