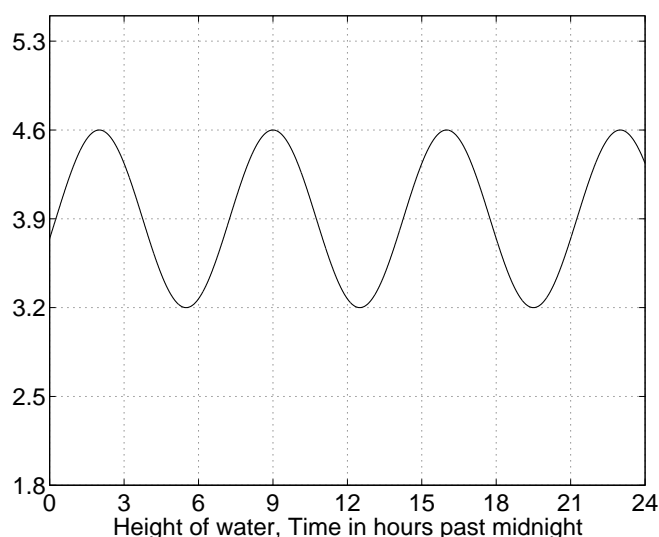


3. (9 points) (See Team homework problem 34, Chapter 1, Section 5.) The water level in an an underground tank varies periodically every 7 hours, oscillating between a maximum level of 4.6 feet and a minimum of 3.2 feet.

(a) If the water reaches a maximum height at 9am on a certain day, write a formula using the sine or cosine function, for the height  $h$  as a function of time  $t$ , where  $t$  is measured in hours past midnight of that day.

The amplitude  $|A|$  must be equal to  $(4.6 - 3.2)/2 = 1.4/2 = .7$  (feet) and the midline must be  $3.2 + .7 = 4.6 - .7 = 3.9$  (feet), and the period is 7 (hours), so the height in feet is given by

$$h(t) = .7 \cos\left(\frac{2\pi}{7}(t - 9)\right) + 3.9$$



(b) What are the period and amplitude of your function? (Use units, if appropriate.)

Period = .7 hours

Amplitude = .7 feet

(c) At what rate is the water rising or falling (indicate which) at 2pm on that day? (Be sure to use units in your answer.)

$$h'(t) = -.7 \sin\left(\frac{2\pi}{7}(t - 9)\right) \left(\frac{2\pi}{7}\right)$$

At 2pm,  $t = 14$ , so

$$h'(14) = -.2\pi \sin\left(\frac{2\pi}{7}(5)\right) \simeq .6126 \text{ ft./hour}$$

At 2pm, the water is rising at the rate of approximately .6126 feet per hour.