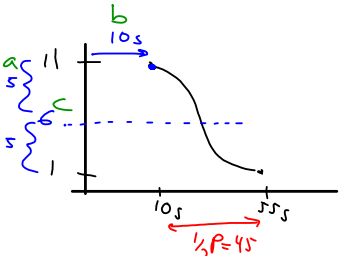
6.7 Solving Problems Using Sinusoidal Models

May 19

A group of students is tracking a friend, John, who is riding a Ferris wheel. They know that John reaches the maximum height of 11 m at 10 s and then reaches the minimum height of 1 m at 55 s. Determine his height after 78 seconds.



$P = 90s = \frac{360}{k}$

$k = \frac{360}{90} = 4$

$h(t) = 5\cos(4(t-10))^\circ + 6$

$h(78) = 5\cos(4(68))^\circ + 6 = 6.2$

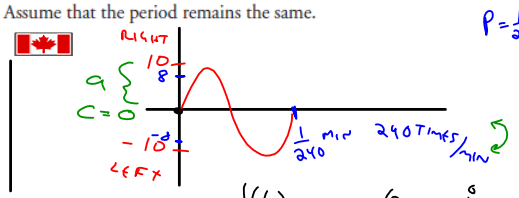
∴ HEIGHT AT 78 s IS 6.2 m.

The top of a flagpole sways back and forth in high winds. The top sways 10 cm to the right (+10 cm) and 10 cm to the left (−10 cm) of its resting position and moves back and forth 240 times every minute. At $t = 0$, the pole was momentarily at its resting position. Then it started moving to the right.

a) Determine the equation of a sinusoidal function that describes the distance the top of the pole is from its resting position in terms of time.

b) How does the situation affect the domain and range?

c) If the wind speed decreases slightly such that the sway of the top of the pole is reduced by 20%, what is the new equation of the sinusoidal function? Assume that the period remains the same.



$P = \frac{1}{240} = \frac{360}{k}$

$k = 360 \times 240$

$k = 86400$

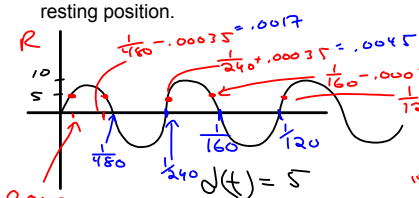
a) $d(t) = 10\sin(86400t)^\circ$

b) $D = \{t \in \mathbb{R} \mid t \geq 0\}$

$R = \{y \in \mathbb{R} \mid -10 \leq y \leq 10\}$

c) $d(t) = 8\sin(86400t)^\circ$

d) Find the first 5 times when the pole is 5 cm to the right of its resting position.



LEVEL 4

$\frac{1}{480} - .00035 = .0017$

$\frac{1}{240} + .00035 = .0045$

$\frac{1}{160} - .00035 = .0059$

$\frac{1}{120} + .00035 = .0087$

$d(t) = 5$

$10\sin(86400t) = 5$

$\sin(86400t) = 0.5$

$86400t = 30$

$t = \frac{30}{86400} = 0.00035$

$86400t = \{30, 150\} + 360n$

$t = \{.00035, .0017\} + .0042n$

$t = .00035, .0017, .0045, .0059, .0087.$

∴ THE FIRST 5 TIMES ARE .00035, .0017, .0045, .0059, .0087 MIN.

OR.

.02, .105, .27, .35, .52 s

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