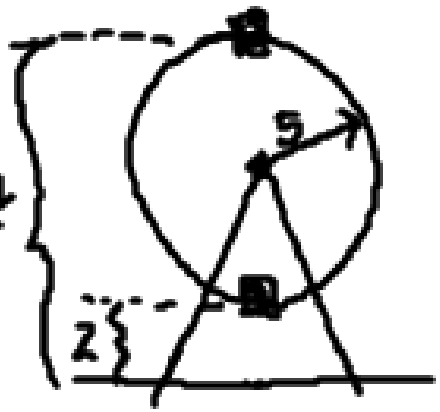
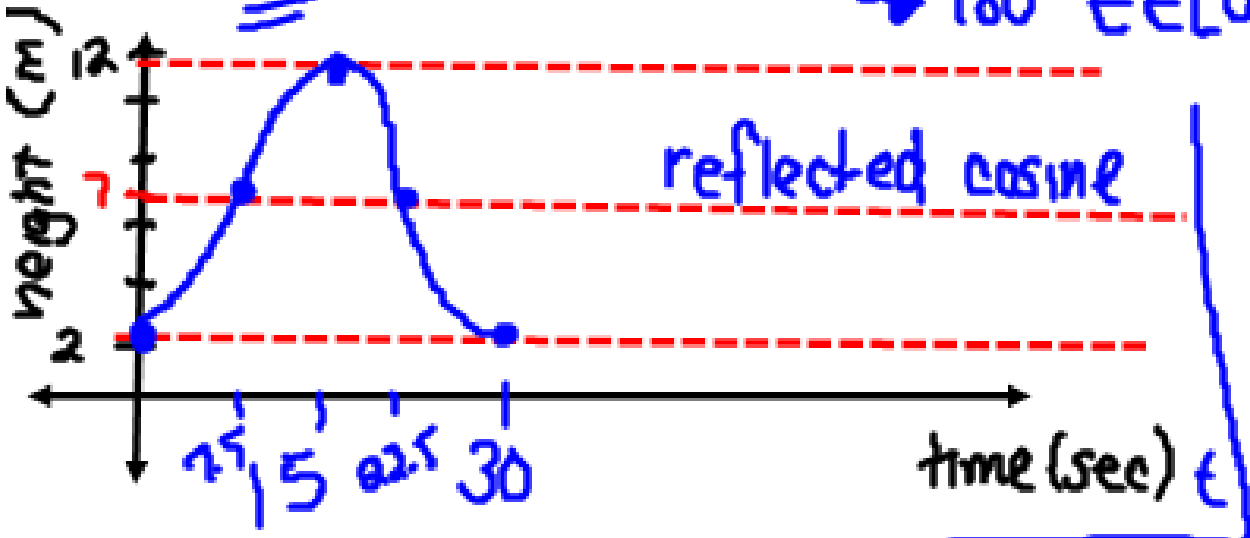
Applications of Trig Equations

1. The height of a specific car on a Ferris wheel varies sinusoidally with time. At 0 s, the car is at the lowest height, 2 m above the ground. The radius of the wheel is 5 m and it takes 30 s to complete one revolution.



Determine the times during the first 3 minutes when the car is at a height of 12 m.

↳ 180 $t \in [0, 180]$



VS 5 HT 0

VT 7 HS $= \frac{2\pi}{a\pi}$

R_x $= \frac{30}{2\pi} \cdot \frac{15}{\pi}$

$h = -5\cos\left(\frac{\pi}{15}t\right) + 7$

$2 = -5\cos\left(\frac{\pi}{15}t\right) + 7$

$5 = -5\cos\left(\frac{\pi}{15}t\right)$

$-1 = \cos\left(\frac{\pi}{15}t\right)$

$\frac{\pi}{15}t = \pi + 2\pi k, k \in I$

$\frac{\pi}{15}t\left(\frac{15}{\pi}\right) = \pi\left(\frac{15}{\pi}\right) + 2\pi k\left(\frac{15}{\pi}\right)$

$t = 15 + 30k, k \in I$

$t = 15, 45, 75, 105, 135$

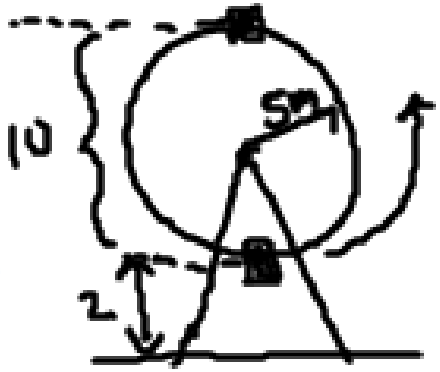
165 seconds.

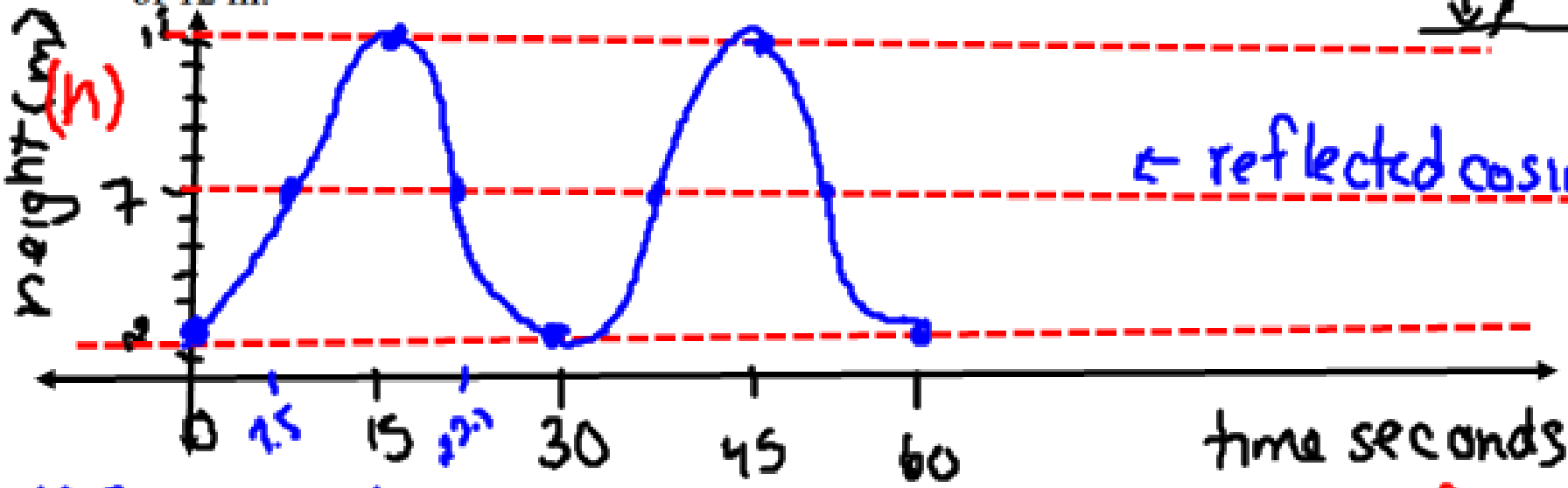
Applications of Trig Equations

1. The height of a specific car on a Ferris wheel varies sinusoidally with time. At 0 s, the car is at the lowest height, 2 m above the ground. The radius of the wheel is 5 m and it takes 30 s to complete one revolution.

$t \in [0, 180]$

Determine the times during the first 3 minutes when the car is at a height of 12 m.





VS 5 HS: $\frac{1}{12}$

VT 7 HT: 0

R_x

$AS = \frac{P}{360^\circ} = \frac{30}{360} = \frac{1}{12}$

$h = -5\cos(12t) + 7$

$12 = -5\cos(12t) + 7$

$5 = -5\cos(12t)$

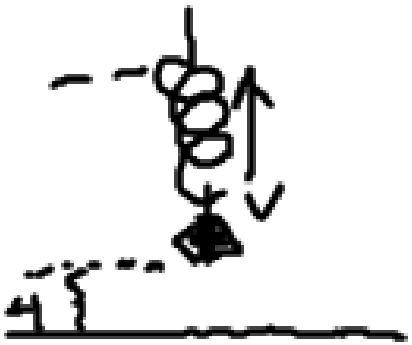
$-1 = \cos(12t)$

$\frac{12t}{12} = \frac{180^\circ}{12} + \frac{360^\circ}{12} k, k \in I$

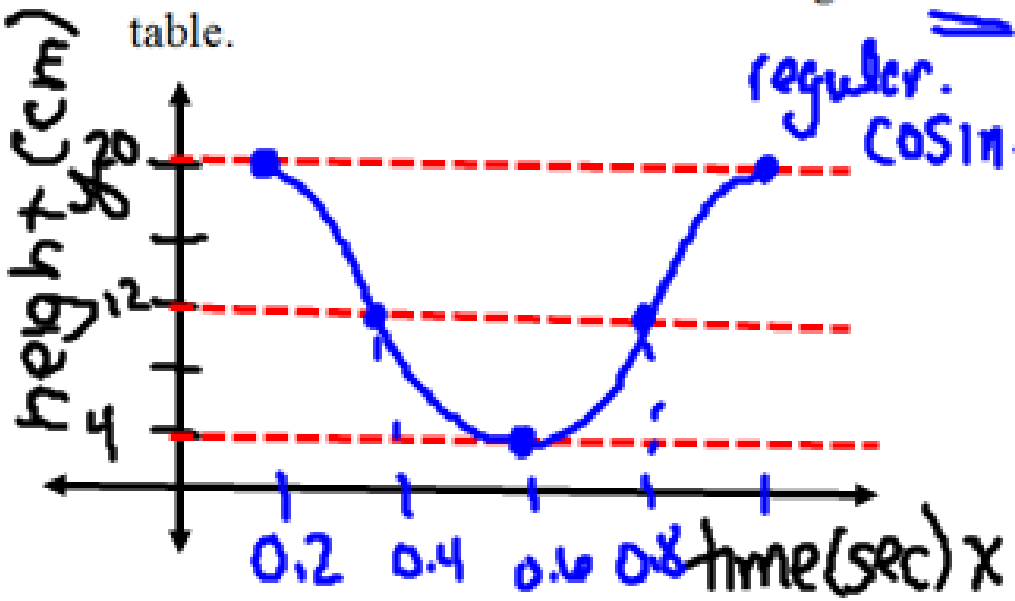
$t = 15 + 30k, k \in I$

$t = 15, 45, 75, 105, 135, 165,$ seconds.

2. Dean is holding on to the end of a spring attached to a weight. He moves his hand slightly up and down which causes the weight to oscillate. The weight repeatedly reaches a maximum height of 20 cm from the table and a minimum height of 4 cm. The first maximum height occurs at 0.2 s and the first minimum occurs at 0.6 s.



Determine ALL times when the weight is 12 cm from the top of the table.



regular cosine

$y = 8\cos[450(x - 0.2)] + 12$

$12 = 8\cos[450(x - 0.2)] + 12$

$0 = \cos[450(x - 0.2)]$

VS 8 HT .012

VT 12

Rx

$HS = \frac{P}{360} = \frac{08}{360}$

$HS = \frac{1}{450}$

$0 = \cos[450(x-0.2)]$

let $m = 450(x-0.2)$

$0 = \cos m$

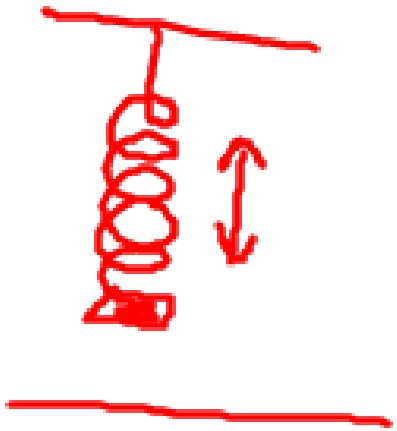
$m = \begin{cases} 90 \\ 270 \end{cases} + 360k, k \in I$

$450(x-0.2) = \begin{cases} 90 \\ 270 \end{cases} + 360k$

$x - 0.2 = \begin{cases} 0.2 \\ 0.6 \end{cases} + 0.8k$

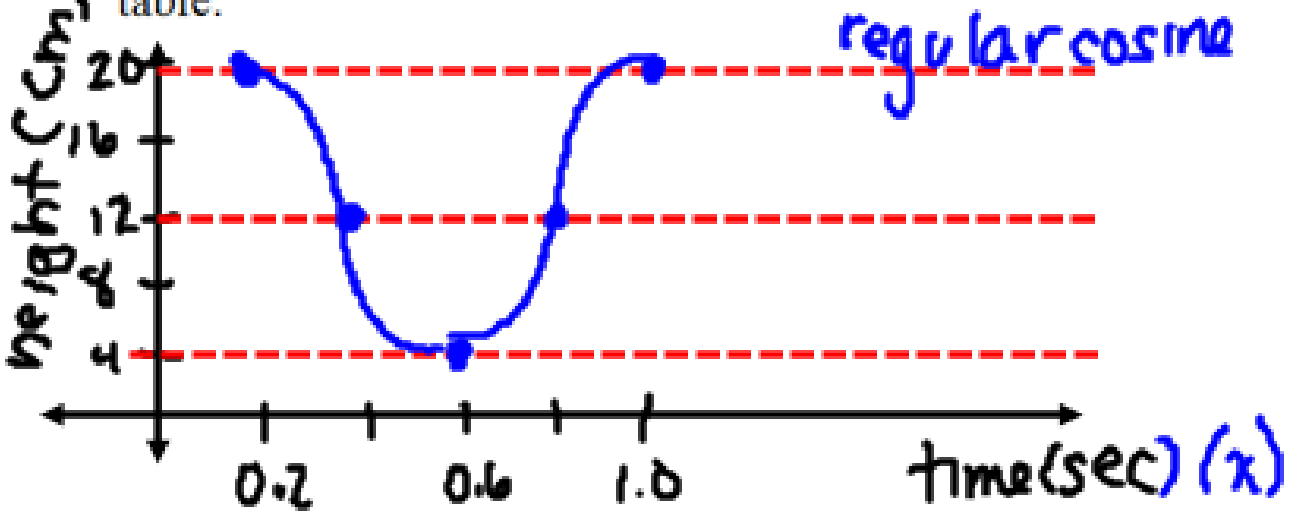
$\rightarrow x = \begin{cases} 0.4 \\ 0.8 \end{cases} + 0.8k, k \in I$

2. Dean is holding on to the end of a spring attached to a weight. He moves his hand slightly up and down which causes the weight to oscillate. The weight repeatedly reaches a maximum height of 20 cm from the table and a minimum height of 4 cm. The first maximum height occurs at 0.2 s and the first minimum occurs at 0.6 s.



(y)

Determine ALL times when the weight is 12 cm from the top of the table.



VS 8
VT 12
HT 0.2
$HS = \frac{P}{2\pi}$

$HS = \frac{0.8}{2\pi} = \frac{2}{5\pi}$

$y = 8\cos\left[\frac{5\pi}{2}(x - 0.2)\right] + 12$

$y = 8\cos\left[\frac{5\pi}{2}(x-0.2)\right]+12$

$12 = 8\cos\left[\frac{5\pi}{2}(x-0.2)\right]+12$

$0 = \cos\left[\frac{5\pi}{2}(x-0.2)\right]$

let $m = \frac{5\pi}{2}(x-0.2)$

$0 = \cos m$

$m = \begin{cases} \frac{\pi}{2} \\ \frac{3\pi}{2} \end{cases} + 2\pi k, k \in I$

$\frac{5\pi}{2}(x-0.2) = \begin{cases} \frac{\pi}{2} \\ \frac{3\pi}{2} \end{cases} + 2\pi k$

$\rightarrow x-0.2 = \begin{cases} \frac{\pi}{2}\left(\frac{2}{5\pi}\right) \\ \frac{3\pi}{2}\left(\frac{2}{5\pi}\right) \end{cases} + \left(\frac{2}{5\pi}\right)2\pi k$

$x-0.2 = \begin{cases} 0.2 \\ 0.6 \end{cases} + 0.8k$

$x = \begin{cases} 0.4 \\ 0.8 \end{cases} + 0.8k, k \in I$

3. A robot on Mars records the temperature every Mars day.

Number of Mars Days	0	100	200	300	400	500	600	700	800
Temp. (°C)	-43	-15	-5	-21	-59	-79	-68	-50	-27
Number of Mars Days	900	1000	1100	1200	1300				
Temp. (°C)	-5	-15	-70	-78	-68				

A) Find the maximum and minimum temperatures recorded by the robot.

max temp: -5°C min temp: -79°C

$\text{Amp} = \frac{\text{local max} - \text{local min}}{2}$

$= \frac{-5 - (-79)}{2}$

$= 37$

$\text{SA: } y = \frac{\text{local max} + \text{local min}}{2}$

$= \frac{-5 + (-79)}{2}$

$= -42$

Period = 900 − 200 = 700 days

B) Find a sine model for the temperature, T, in terms of the number of Martian days, n.

$y = 37\sin\left[\frac{18}{35}x\right] - 42$

$HS = \frac{P}{360} = \frac{700}{360} = \frac{35}{18}$

C) Use this information to estimate the length of a Martian year.

y = Period

#5-

HW: pg 276 #6-9, 17-21

This WILL be on the ICA