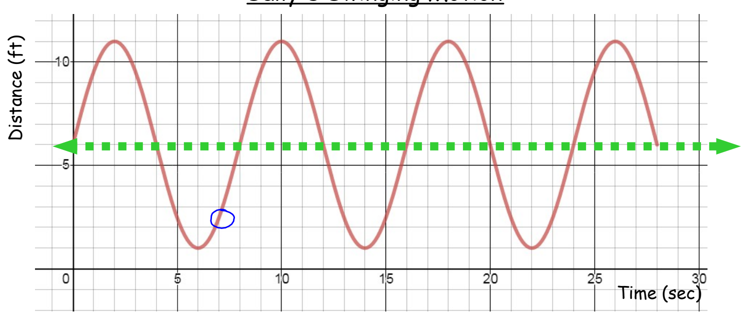
5.6 - Applications of Trig Functions

Ex 1 Sally was swinging back and forth in front of a motion detector. Her distance from the detector was modeled by the following graph:

Sally's Swinging Motion



- What is the equation of the axis? 6 Counting

Algebraically: $\frac{max+min}{2} \Rightarrow \frac{11+1}{2} = 6$

- What is the amplitude? 5 Counting

Algebraically: $\frac{max-min}{2} \Rightarrow \frac{11-1}{2} = 5$

- What is the period of the function 8s
- For how long was Sally swinging? 28s
- Describe the position of the swing when she stops:

middle / bottom of swing

- How close did Sally get to the motion detector? 1 ft
- At t=7 sec would it be safe to run between Sally and the motion detector? Explain why or why not.

Visually, she is 2.5 ft away and swinging away.
∴ Likely yes, it is safe

Algebraically

$a = 5$

$c = 6$

$d = 0$ (for sin function)

$k = \frac{360}{8}$

$= 45$

$f(t) = 5\sin(45t) + 6$

$f(7) = 5\sin(45 \cdot 7) + 6$

$\doteq 2.46$

∴ It will be a tight squeeze but likely safe because she is moving away.

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Ex 2. The rodent population in a region varies approximately according to the equation $r(t) = 1200 + 300\sin 90t$, where t is the number of years since 1970 and r is the number of rodents.

$r(t) = 300\sin(90t) + 1200$

a) Find the maximum and minimum number of rodents.

$max = 1200 + 300$
$= 1500$

$min = 1200 - 300$
$= 900$

b) What is the period of the function?

$period = \frac{360}{90}$
$= 4$ years

c) How many rodents could be expected in 2018?

$t = 2018 - 1970$
$= 48$

$r(t) = 300\sin(90t) + 1200$

$r(48) = 300\sin(90 \cdot 48) + 1200$
$= 1200$

$\therefore$ The population is expected to be 1200 in 2018.

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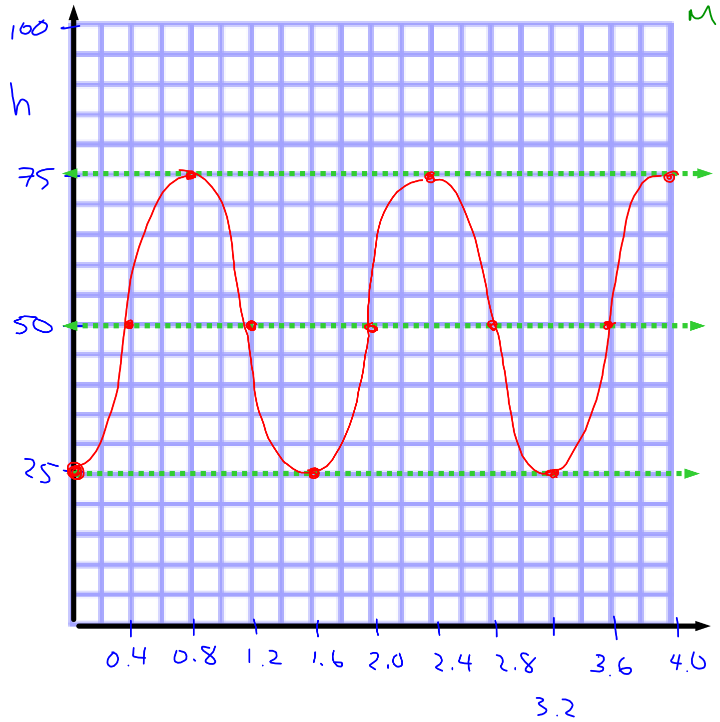
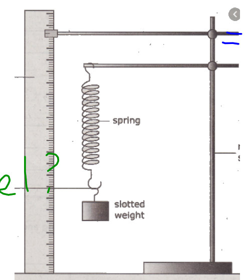
Ex 3. A weight is supported by a spring. The weight rests 50 cm above a tabletop. The weight is pulled down 25 cm and released at time t=0. This creates a periodic up-and-down motion. It takes 1.6 s for the weight to return to the low position each time. Determine an equation for the sinusoidal function.

Max = 75 c = 50 per. = 1.6

Min = 25 a = 25 Scale = $\frac{1.6}{4}$ = 0.4





Which model?

sin / cos

-sin / -cos

d = 0

$k = \frac{360}{1.6}$

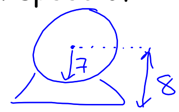
$= 225$

$\therefore h(t) = -25\cos(225t) + 50$

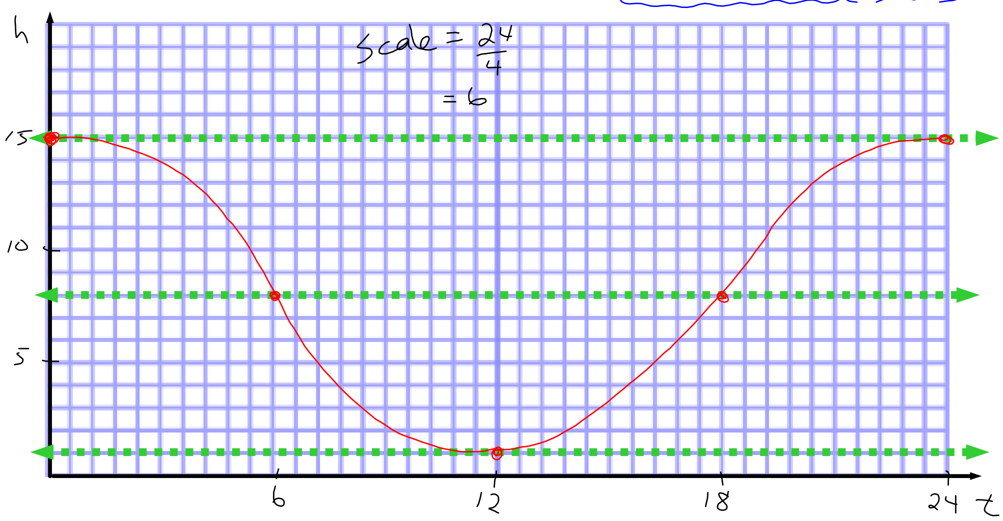
OR

Ex4. A ferris wheel has a radius of 7 m. The centre of the wheel is 8 m above the ground. The Ferris wheel rotates at a constant speed of $15^0/s$. There is only one red seat on the Ferris wheel.

max = 8 + 7 = 15 min = 8 − 7 = 1 a = 7 c = 8 k = 15 period = $\frac{360}{15}$ = 24



a) Graph one rotation of the wheel, as a function of height over time in seconds, if the red seat starts at the maximum height. ⇒ cos



b) Determine an equation of a cosine function which describes the height of the red seat, where h is the height in metres and t is the time in seconds.

a = 7 k = 15
c = 8 d = 0

$h(t) = 7\cos(15t) + 8$

c) Determine an equation of a sine function which describes the height of the red seat where h is the height in metres and t is the time in seconds.

$h(t) = 7\sin[15(t+6)] + 8$

OR

$h(t) = -7\sin[15(t-6)] + 8$

Homework:
5.6 Handout

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