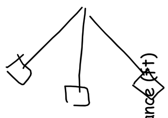
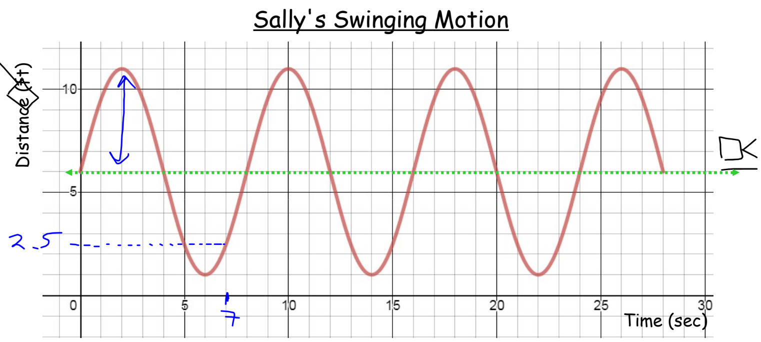
5.6 - Applications of Trig Functions

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:





- What is the equation of the axis? 6 Counting

Algebraically: $c = \frac{max+min}{2}$

$= \frac{11+1}{2}$ $\boxed{c=6}$

- What is the amplitude? 5 Counting

Algebraically: $a = \frac{max-min}{2}$

$= \frac{11-1}{2}$ $\boxed{a=5}$

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

Middle / Bottom of her 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

Approx 2.5 ft

Algebraically

From eqn

$a = 5$

$c = 6$

$d = 0$

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

$= 45$

$d = 5\sin[45(t)] + 6$

Sub $t = 7$

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

$d \doteq 2.46$

∴ It will be a close-call, but safer since she is moving away.

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.

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

$a = 300$
$c = 1200$

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?

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

$\therefore$ The period is 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 will be 1200 in 2018

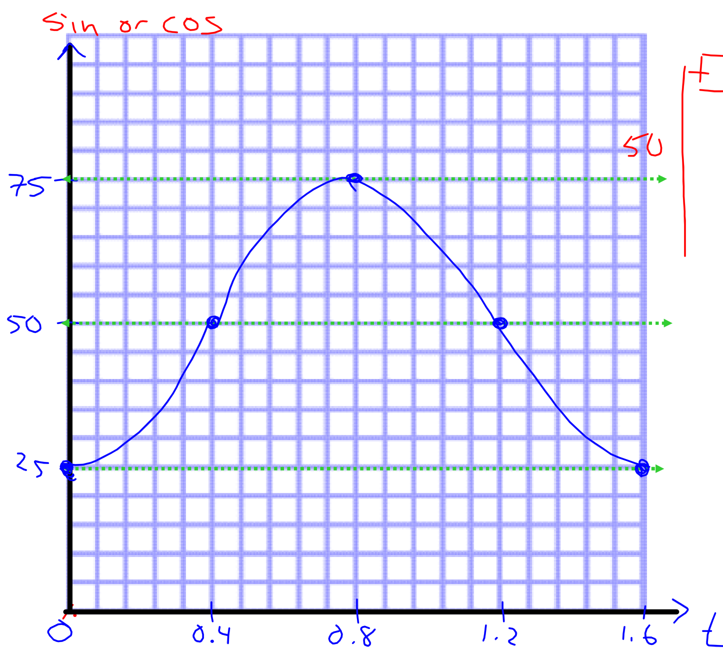
<u>Ex 3</u>. A weight is supported by a spring. The weight rests 50 cm above a tabletop. The weight is pulled down 25 cm and released at time t=0. This creates a periodic up-and-down motion. It takes 1.6 s for the weight to return to the low position each time. Determine an equation for the <u>sinusoidal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

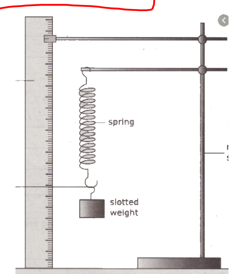
$\boxed{a = 25}$ $\boxed{\text{period} = 1.6\text{ s}}$

$\boxed{c = 50}$

25

+ 25





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

$\boxed{k = 225}$

$y = -25\cos 225t + 50$

OR

$y = 25\sin\left[225(t - 0.4)\right] + 50$

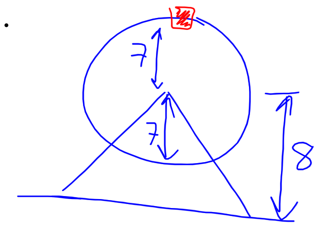
Ex4. A ferris wheel has a radius of 7 m. The centre of the wheel is 8 m above the ground. The Ferris wheel rotates at a constant speed of 15^0/s. There is only one red seat on the Ferris wheel.

$\text{period} = \frac{360}{15}$

$= 24 \text{ sec.}$

$\boxed{a = 7}$

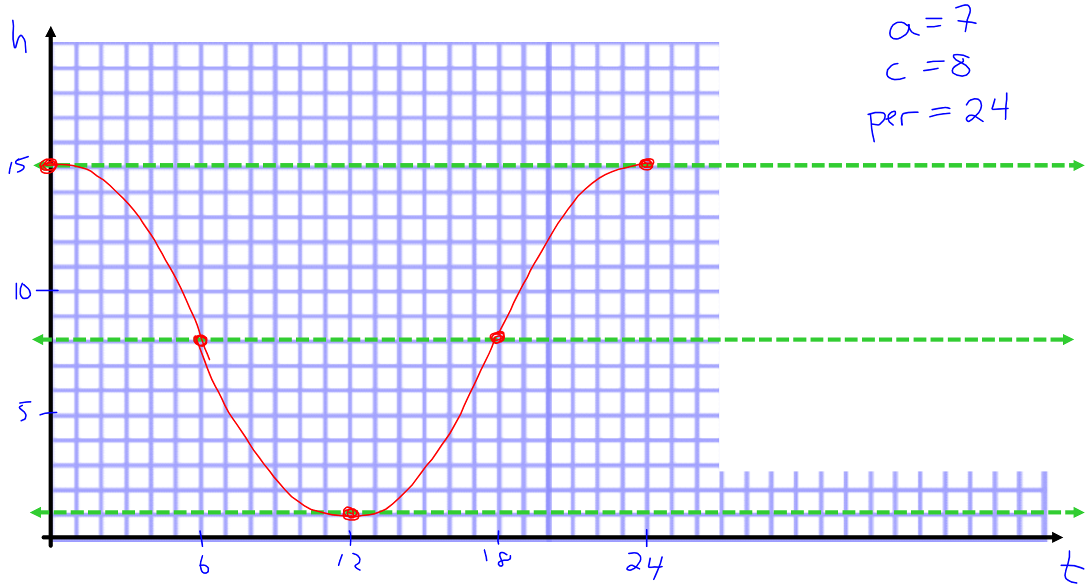
$\boxed{c = 8}$



$\boxed{k = 15}$

Max = 15
Min = 1

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.



$a = 7$
$c = 8$
$per = 24$

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.

$h = 7\cos 15t + 8$

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.

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

OR

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

Homework:
p 321 # 16
5.6 Handout