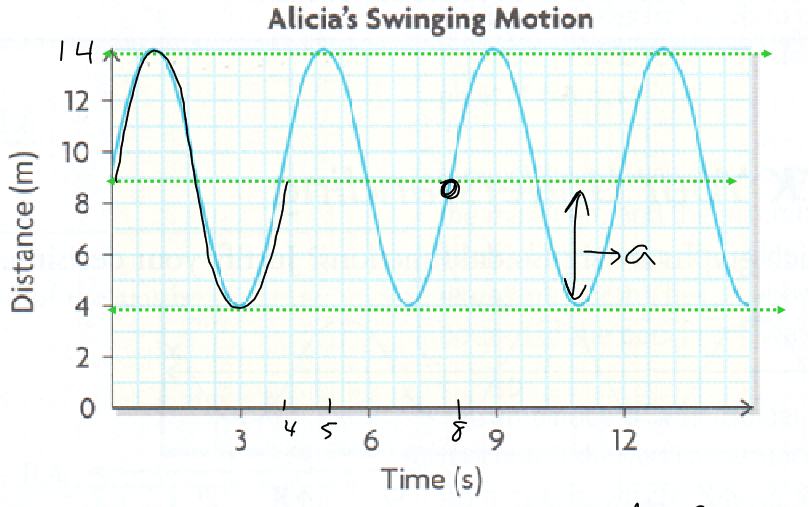
5.3 Graphs of Sinusoidal Functions

Ex 1:

Alicia 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? $d = 9$ Counting

Algebraically: $d = \frac{14+4}{2} = 9$

- What is the amplitude? 5 Counting

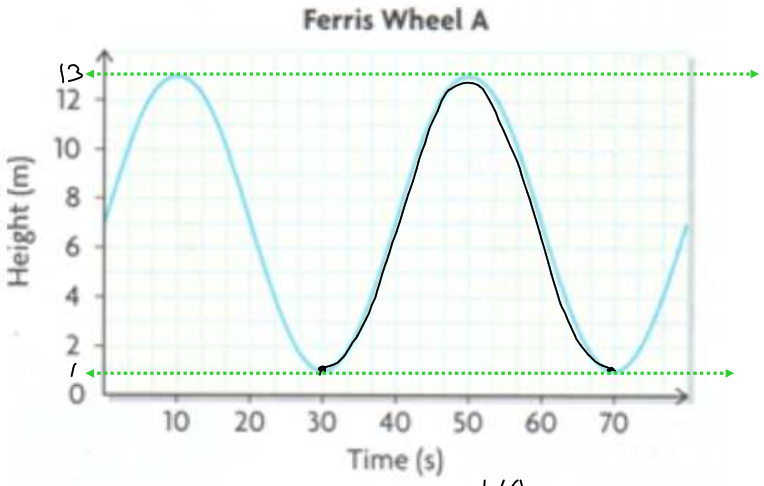
Algebraically: $a = \frac{14-4}{2} = 5$

- What is the period of the function approx 4s
- How close did Alicia get to the motion detector? 4m
- At t=8 sec would it be safe to run between Alicia and the motion detector?

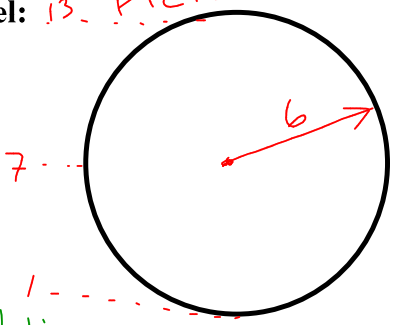
Yes, she is approx 10m away and moving further away

NOTE: It is always safe, as the closest she ever gets is 4m

Ex 2:



- **What is the period of the function** 40s
- **Maximum** 13 **Minimum** 1
- **What is the equation of the axis?** h=7
- **What is the amplitude?** 6m
- **Determine the circumference of the Ferris Wheel:** 13. Picture it



Recall $C = 2\pi r$ (but not as here in your amplitude)

$C = 2\pi(6)$
$\approx 37.7m$

- **Determine the speed of the Ferris Wheel:**

Recall speed = distance / time

$Speed = \frac{37.7\,m}{40\,s}$ → Dist. of 1 one revolution; → Time of one revolution

$\approx 0.94\,m/s$

Ex 3: Comparing Functions

a) A Ferris Wheel at Carp Fair has a radius of 12 m and rotates once every 60 sec. At its lowest point, a rider is 2 m above the ground.

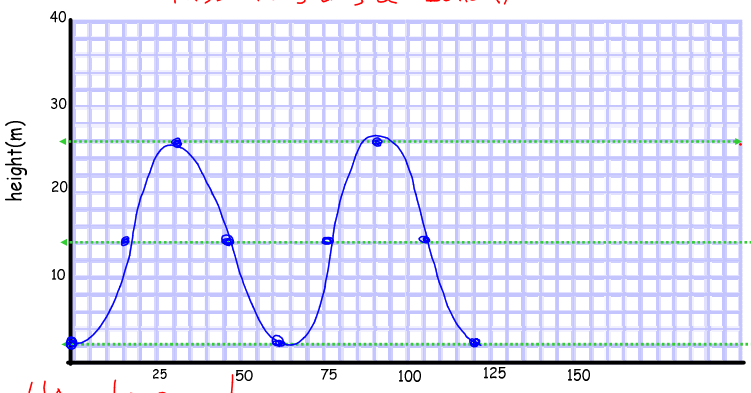
Amplitude

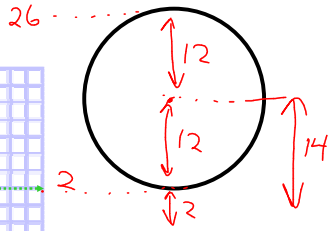
period

MIN

Sketch the height of a passenger above the ground for two complete revolutions of the Ferris Wheel

(assume starts at bottom)





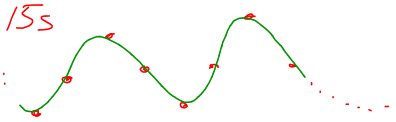
Max: 26
Min: 2
Axis: h = 14
Period = 60s

How to graph
- Determine scale
- Determine pattern
- Draw pattern
- Draw curve

Scale = $\frac{\text{period}}{4}$

= 15s

Pattern:



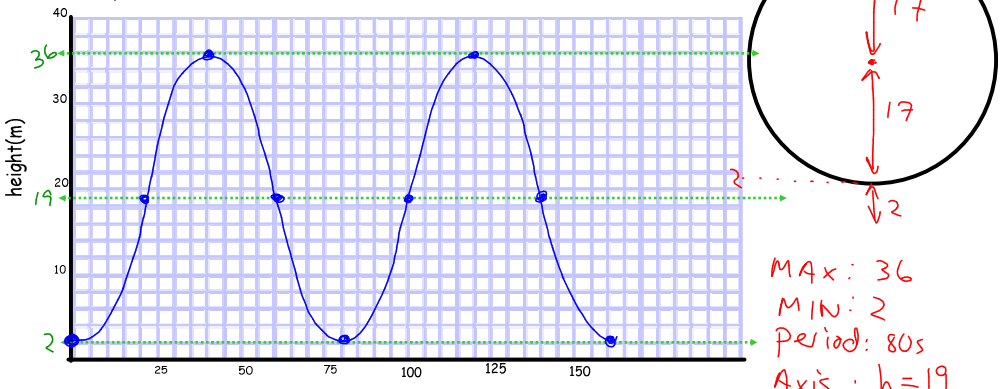
b) The Carp agricultural society is bringing in a new Ferris Wheel that has a radius of 17 m and rotates every 80 sec. On this ride, the highest point a passenger reaches is 36 m.

amplitude

period

MAX

Sketch the height of a passenger above the ground for two complete revolutions of the Ferris Wheel

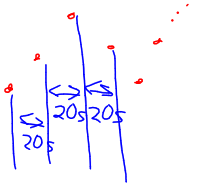


MAX: 36
MIN: 2
Period: 80s
Axis: h = 19

Scale = $\frac{80}{4}$

= 20s

Same pattern:



b) Compare the curves:

Property	12m wheel	17m wheel
Period	60s	80s
Amplitide	Given $a = 12m$	Given $a = 17m$
Equation of the axis	$h = \frac{26+2}{2}$ $h = 14$	$h = \frac{36+2}{2}$ $h = 19$
Range	$\{2 \leq h \leq 26, h \in \mathbb{R}\}$	$\{2 \leq h \leq 36, h \in \mathbb{R}\}$
Speed of the wheel	$\text{Speed} = \frac{2\pi r}{\text{period}}$ $= \frac{2\pi(12)}{60}$ $\doteq 1.3 m/s$	$\text{Speed} = \frac{2\pi(17)}{80}$ $\doteq 1.3 m/s$

Communication:

1. How does changing the radius of the wheel affect the sinusoidal graph?

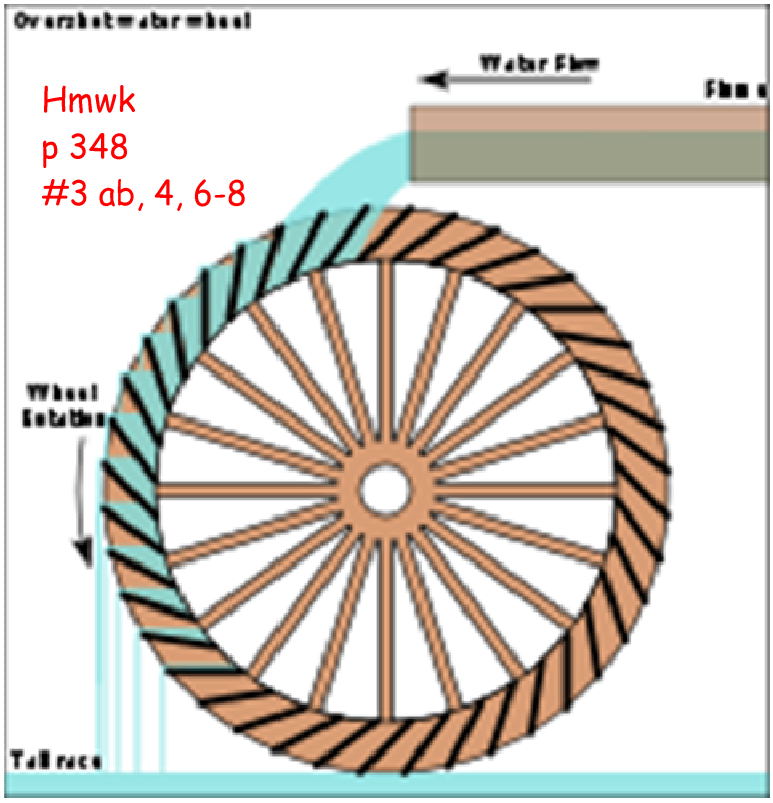
Change the amplitude

2. How does changing the height of the axle of the wheel affect the sinusoidal graph?

Changes the equation of the axis

3. How does changing the speed of the wheel affect the sinusoidal graph?

Changes the period



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