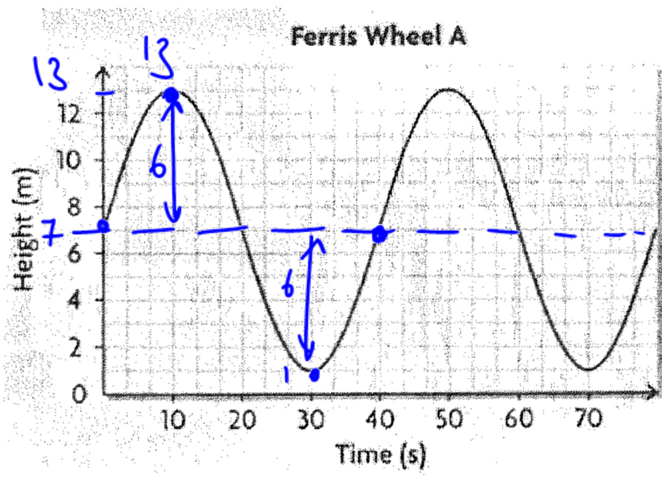
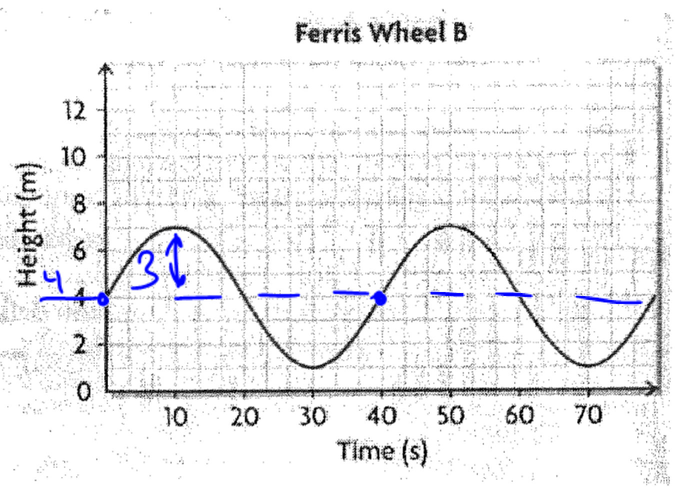
Application of Sinusoidal Functions

At an amusement park, Mr. B had different students ride two Ferris wheels. Jack rode on Ferris wheel A, and Julia rode on Ferris wheel B. Olivia collected data and produced two graphs.





What is the period of each function, and what does it represent?

Graph A

Period = 40 seconds

Graph B

40 seconds

Both ferris wheels take 40 seconds to complete one revolution

What is the equation of each axis of the curve, and what does it represent?

Graph A

$y = \frac{13+1}{2} = 7$

Graph B

$y = \frac{7+1}{2} = 4$

How high the center of the wheel above the ground. How high the axle is above the ground

What is the amplitude of each function, and what does it represent?

Graph A

$a = \frac{13-1}{2} = 6$

Amplitude gives the radius of the wheel.

Graph B

$a = \frac{7-1}{2} = 3$

State the equation that represents each function.

Graph A

$y = 6\sin(9x) + 7$

Graph B

$y = 3\sin(9x) + 4$

Who is travelling faster, Jack or Julia?

Comparing Speeds in Sinusoidal Functions

Recall!

$V = \dfrac{\Delta d}{\Delta t}$ $C = 2\pi r$ $\Delta d = C$

Graph A

$\Delta d = 2\pi r$
$= 2\pi 6$
$= 12\pi$
$\doteq 37.7$

$V = \dfrac{37.69\text{m}}{40\text{s}}$

$V = 0.94\text{m/s}$

Graph B

$\Delta d = 2\pi r$
$= 2\pi 3$
$= 6\pi$
$= 18.84\text{m}$

$V = \dfrac{18.84\text{m}}{40\text{s}}$

$V = 0.47\text{m/s}$

Reflecting

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

It changes the amplitude of the graph.

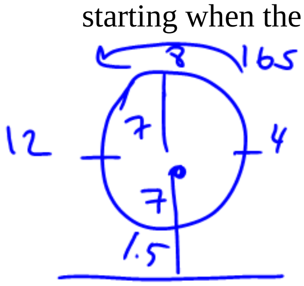
2. How does changing the height of the axle of the wheel affect the sinusoidal graph?

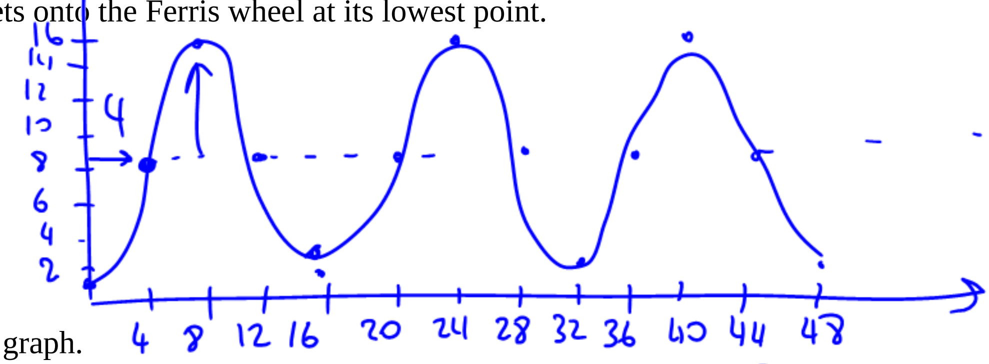
It affects the equation of the axis of the curve.

Try!

Example 1: A carnival Ferris wheel with a radius of 7m makes one complete revolution every 16s. The bottom of the wheel is 1.5m above the ground.

a) Draw a graph to show how a person's height above the ground varies with time for three revolutions, starting when the person gets onto the Ferris wheel at its lowest point.





b) Find an equation for the graph.

$c = 8.5$ $a = 7.$ $d = 4 \rightarrow$ for sin $16 = \dfrac{360}{k}$ $k = \dfrac{360}{16} = 22.5°/\text{s}$

$y = 7\sin[22.5(x-4)] + 8.5$

Example 2: In summer, the sun sets later than it does in winter. The time of the sunset can be important information for some people including parents, environmentalists, and film makers.
The latest sunsets occur around June 21(the 172nd day of the year), and the earliest ones occur around December 21 (the 355th day of the year).

Sunset times at Parry Sound on these dates in 2001 are given in the table:

Date	Day of the year (n)	Number of Hours of Sunlight (h) (y)
June 21	172	20.18 max
December 21	355	16.88 min

Determine an equation for the time of the sunset at Parry Sound on the *n*th day of the year.
Show this information on a rough sketch.

max = 20.18
min = 16.88

amplitude $= \frac{max - min}{2} = \frac{20.18 - 16.88}{2} = 1.65$

$d = 172$ for cos

axis of the curve $= \frac{max + min}{2} = \frac{20.18 + 16.88}{2} = 18.53$

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

$y = 1.65\cos[0.99(x - 172)] + 18.53$

$365 = \frac{360}{k}$

$k = \frac{360}{365} = 0.99^\circ/\text{day}$