30
30

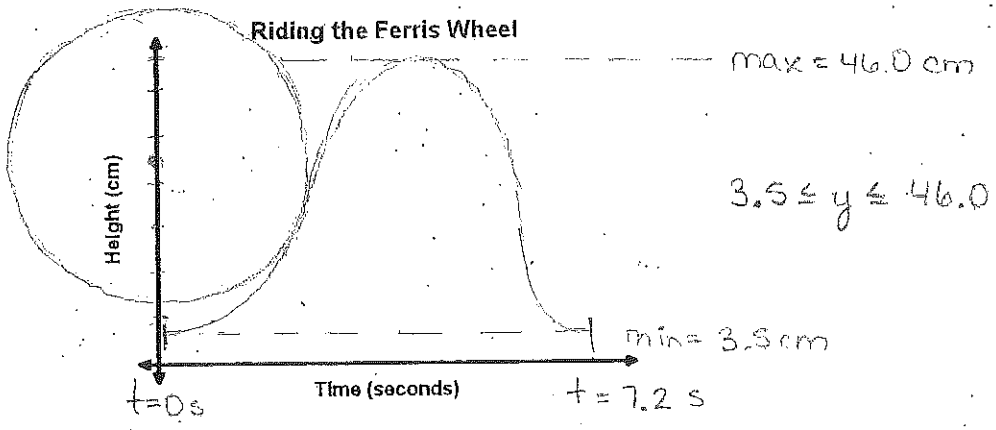
Calena Marchand

The Ferris Wheel

Sheet 1

Using K'nex

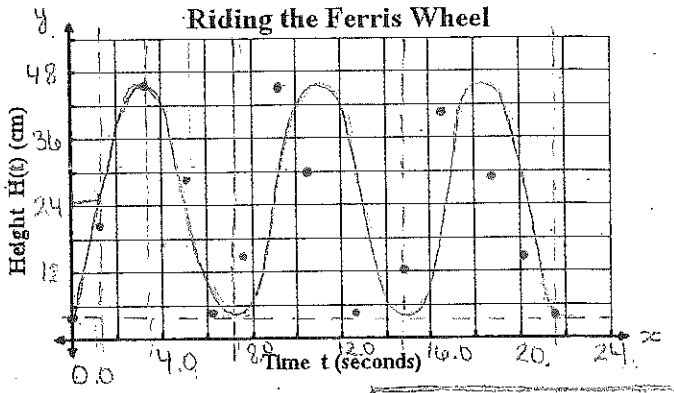
1. Place a small plastic figure or attach a pipe cleaner to a seat of the Ferris wheel at its lowest point. Turn th motor on and observe the motion of the wheel. Draw a sketch of the figure's height at any time t during two complete revolutions.



2. Use the Ferris wheel, metersticks, and a timer to gather data to complete the table below. Record at least 6 measurements for each rotation and use at least 2 complete revolutions. Collect a minimum of 12 data points.
3. Plot the data points from the table on the axes below.
4. Draw a "smooth" curve that is "close" to these data points.
5. What type of function would be most appropriate to choose to represent this curve? Why?

The sine curve because you are starting at the minimum point when t=0 (bottom of the ferris wheel)

Time (seconds)	Height of Seat (cm)
0.0	3.5 cm
1.66 s	21.2 cm
3.1 s	45.4 cm
4.54 s	29.0 cm
6.07 s	4.0 cm
7.60 s	15.4 cm
9.19 s	45.7 cm
10.73 s	30.3 cm
12.6 s	4.2 cm
14.49 s	12.3 cm
16.47	39.7 cm
18.91	29.5 cm
20.02	14.7 cm
21.66	3.5 cm



$h = \frac{85}{4} \sin 0.87(t-1.8) + \frac{99}{4}$

average $r = 21.25$ cm

$P = \frac{21.66}{3}$ $P = 7.22$ s

height of wheel above ground 3.5 cm

$d = \frac{\max + \min}{2}$ $d = 46 + 3.5/2$

$d = 24.75 \sim \frac{99}{4}$ (up)

$c = \frac{P}{4}$ around... $c = \frac{7.22}{4}$

$c = 1.8$ (right)

$b = \frac{2\pi}{P}$ $b = 0.87$

$b = \frac{2\pi}{7.22}$

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

$a = 46 - \frac{3.5}{2}$

$a = 21.25 \sim \frac{85}{4}$

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The Ferris Wheel

Using Technology

6. Plot the data points from the table on your calculator.

7. In paragraph form, describe below the following process to obtain a function that models the height of a particular seat on the Ferris wheel as it revolves.

   (*a*) Make an educated guess of a trigonometric function that best fits these data and explain why you have chosen this particular function. Describe how the numbers in the function relate to the diameter of the Ferris wheel and the period of the rotation.

   (*b*) Examine the graph of your function on your calculator. Describe how to modify one of the constants so that the function more accurately fits your data.

   (*c*) Test the modified constant by examining the graph of your function. Describe how to further modify one of the constants so that the function more accurately fits your data.

   (*d*) Repeat steps (*b*) and (*c*) until your conjecture looks "close." For each function, describe how the numbers in the formula relate to the diameter of the Ferris wheel and the period of the rotation.

7. a) The trigonometric function that best fits the data points is

$h = \frac{85}{4} \sin 0.87\left(t - 1.8\right) + \frac{99}{4}$ where: the amplitude is 21.25 $\left(\frac{\text{max} - \text{min}}{2} \rightarrow \frac{46 - 3.5}{2}\right)$

- the period of the rotation is 7.22 s: therefore $b = \frac{2\pi}{7.22}$ so "b" is 0.87.

The diameter of the Ferris wheel is equal to twice the amplitude (or the radius is equal to the amplitude) $r = 21.25$ cm

- "c" is a horizontal phase shift of 1.8 units right based off of the data points and the equation.

b) The graph of the function on my calculator ressembles the one that I drew. The only difference was that the one that was drown did not have a horizontal phase shift of 1.8 (In order to accomodate the periods the horizontal phase shift on my graph was about one unit right.)

In that case, I would keep the translation of 1.8: and modify my own graph to fit the data points