PreCalculus- Trigonometric Functions Name _____

Ferris Wheel Tycoon

Congratulations

You have just landed a job for Calcu-Now's Amusement Park as their newest Civil Engineer. With your stellar math skills and problem solving ability they put you on the job right away. Perhaps not the most thrilling ride, but possibly the most important, you are assigned to the improvement of the Ferris wheel. The Ferris wheel is old and has not been serviced for many years. The park manager acknowledges that people will not be interested in the ride unless some improvements are made. You immediately decide increasing the speed and adding some features will do the trick.

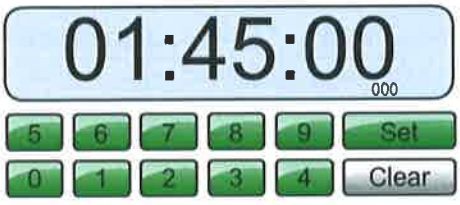
Current Conditions

Size and Speed

You fire up the old Ferris wheel and time a cart making the revolution around the wheel. It takes a minute and 45 seconds for the cart to reach its starting position just like the control panel predicts. The technicians helping you on the job mention that it was built to match the size of the original Ferris Wheel in Chicago. This should give you the information you need to find its current speed.

Regulations

The IAAPA (Amusement Ride Safety Regulations and Standards Organization) states that Ferris wheel riders should not reach a speed of more than 12 mph or there is a danger that they will be thrown from the cart. The control panel makes the speed an easy adjustment. Its current setting of 1:45 just needs reset.



Added Features

Tracking Position

The park manager insists that a system is put in place to track the height of each cart at any moment. You assure the manager that this will be a breeze since the cart oscillates up and down for four oscillations.

Camera Feature

You also decide to mount a camera 20 feet off the ground to capture the joy of the riders. You will have a camera on both sides of the wheel to catch the riders 20 feet on the way up and 20 feet on the way down. After the Ferris Wheel speed has been increased, you need to time the cameras to fire when the cart reaches 20 feet on both sides.

Water Ride

As a final thrill feature, you decide to spray the riders with water. One technicians suggests that you time this 15 seconds into the ride. Sounds like a good idea but you are worried it will conflict with the camera shot. You don't want water getting on the camera.

Time to Propose an Improvement

This could make or break your career as a civil engineer. Or worse, cause serious harm to a rider f you don't design this ride correctly. A lot rests in your hands. Use the information to develop a report that the technicians can use to improve the ride. Include the adjustments needed and use mathematical reasoning to defend your proposal.

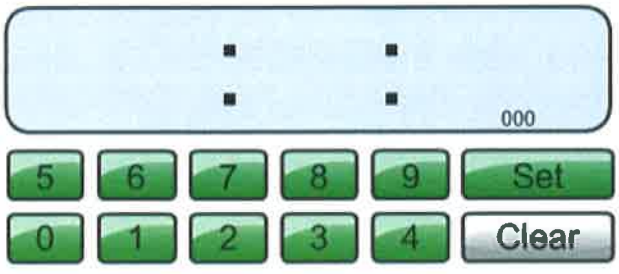
Adjusting Speed

The cart's current speed is _____ mph.

←Mathematical proof

The cart speed should be increased to make a revolution in _____.

←Mathematical proof



← Reset the control panel

CHECKING ADDED FEATURES

The height of a cart starting from the ground at time t is model by _____.

←Mathematical proof
graph 1 complete *ride*

The camera should be programmed to take a picture after _____ sec.

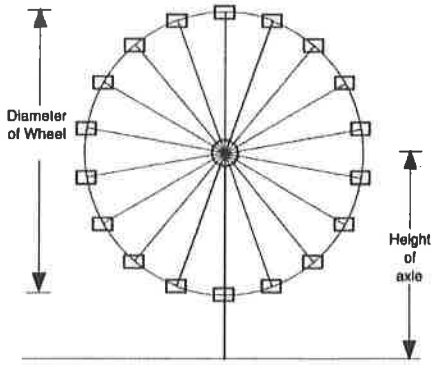
←Mathematical proof

Can the water ride be activated after 15 seconds? Why or why not?

←Mathematical proof

FERRIS WHEELS: Graphing and Equations

Ex 1: The height of the axle is 20 meters tall. The diameter of the wheel is 30 meters wide. The wheel turns clockwise.



a. If a person gets on the wheel at the very bottom of the wheel, how high off the ground will they be?

b. How high off the ground will they be half way up the wheel?

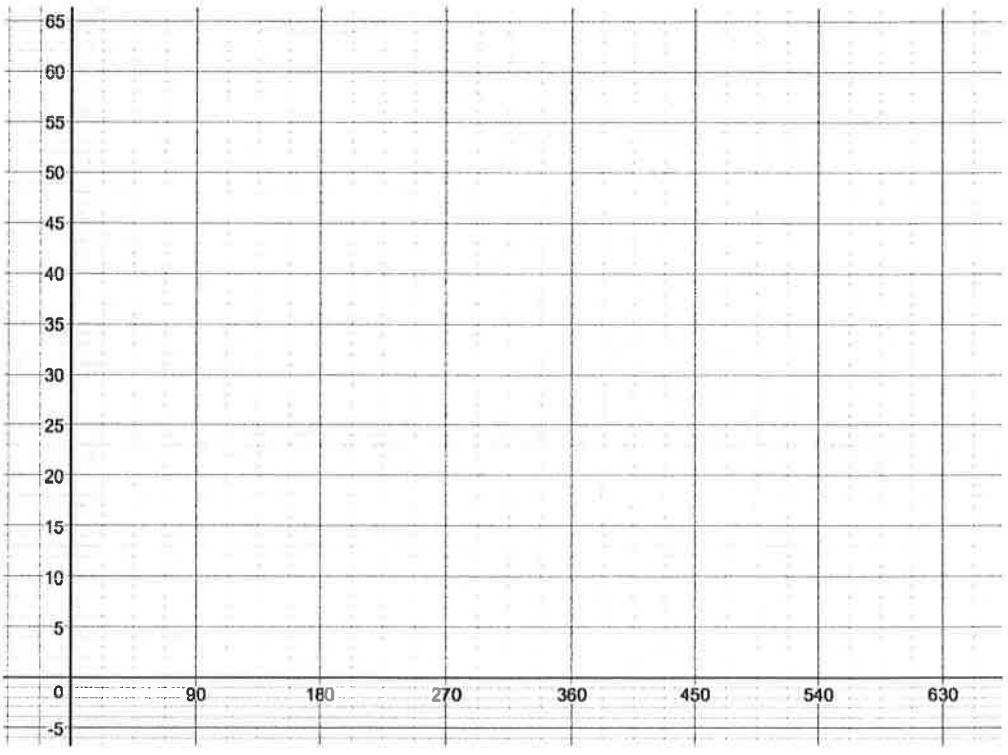
c. How high off the ground will they be at the top of the wheel?

d. How high off the ground will they be half down the wheel?

e. The Ferris wheel takes 6 minutes for a full rotation. Complete the table below.
*Note you must convert to seconds. (6 minutes = _____ seconds)

Time (t) seconds	0 sec	90 sec	180 sec	270 sec	360 sec	450 sec	540 sec
Height off ground (m)							

f. Graph the data.



h. Determine the following from the graph:

Peak:

Trough:

Equation of Axis:

Amplitude:

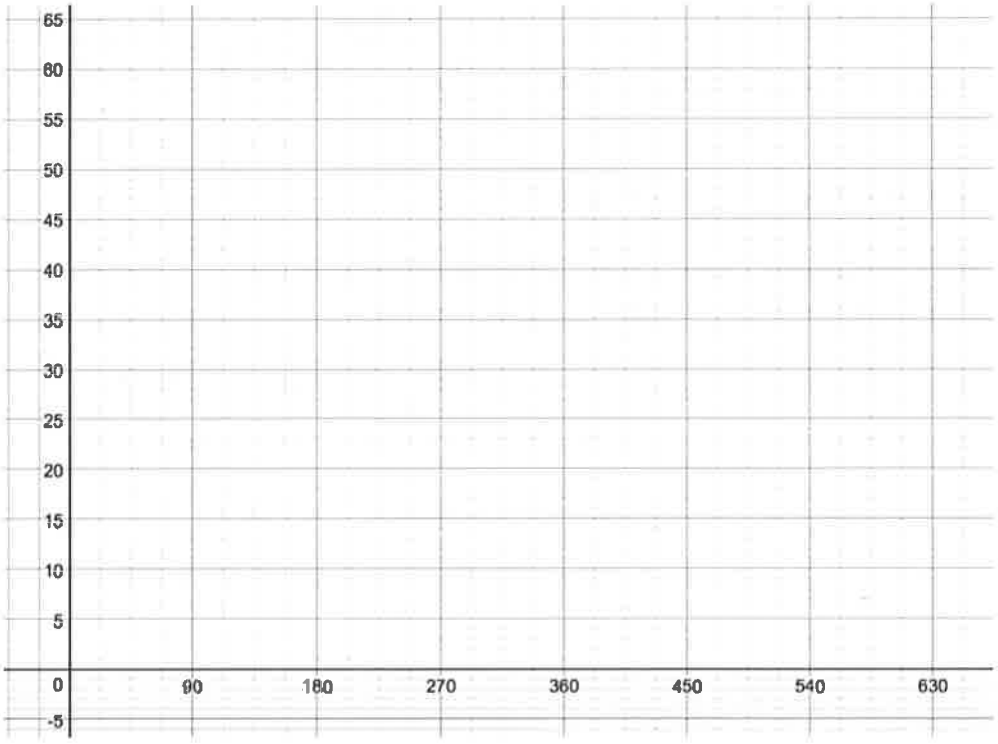
Range:

Equation:

Ex 2: In the Ferris Wheel above, the diameter of the wheel stays the same but the height of the axle is doubled how will that effect the graph? Create the NEW table of values and graph.

Time (t) seconds	0 sec	90 sec	180 sec	270 sec	360 sec	450 sec	540 sec
Height off ground (m)							

Determine the following from the graph:



Peak:

Trough:

Equation of Axis:

Amplitude:

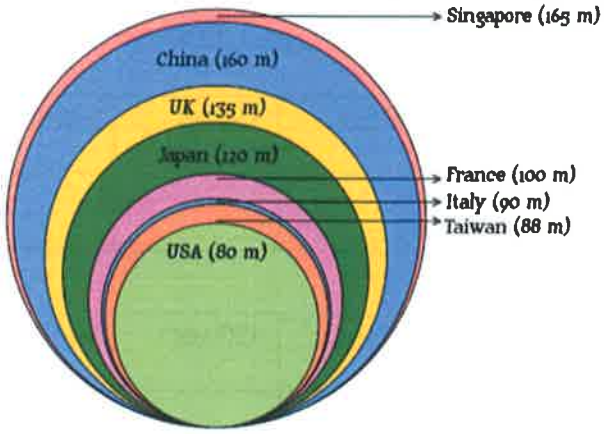
Range:

Equation:

Reflection... What changed?

Reflection... What would have to change in the Ferris Wheel in order for the amplitude to change?

Tallest Ferris Wheel by Country



** Numbers shown are the diameter of the wheel, ALL Ferris Wheels take 6 min. for a full rotation

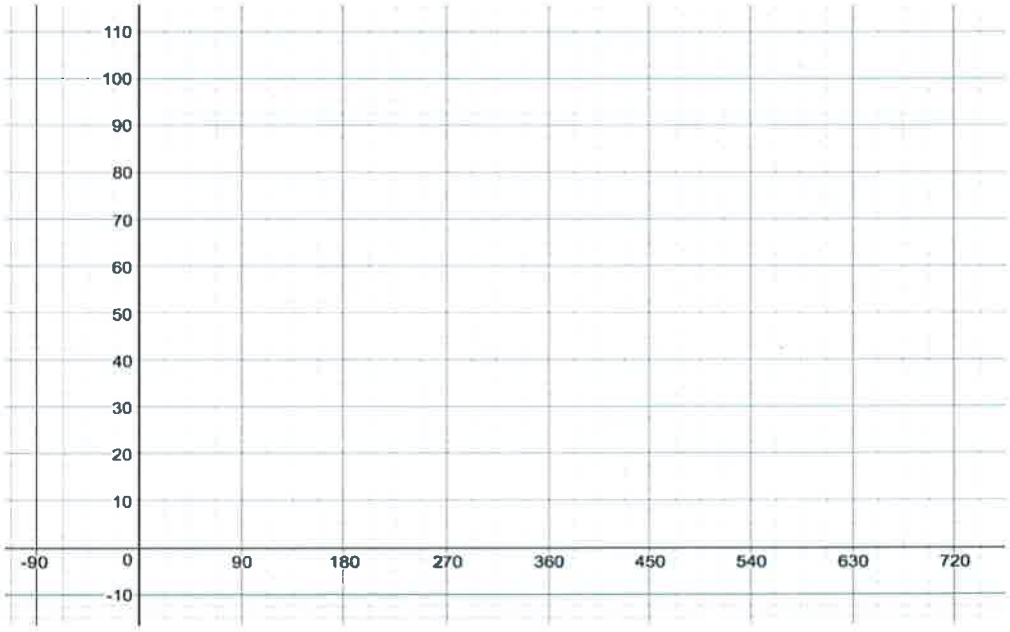
Ex 3: If the Ferris wheel in France and Japan have an axle height of 70 meters, create a table of values for each and then graph on the same graph.

France

Time (t) seconds	0 sec	90 sec	180 sec	270 sec	360 sec	450 sec	540 sec
Height off ground (m)							

Japan

Time (t) seconds	0 sec	90 sec	180 sec	270 sec	360 sec	450 sec	540 sec
Height off ground (m)							



France Equation:

Japan Equation:

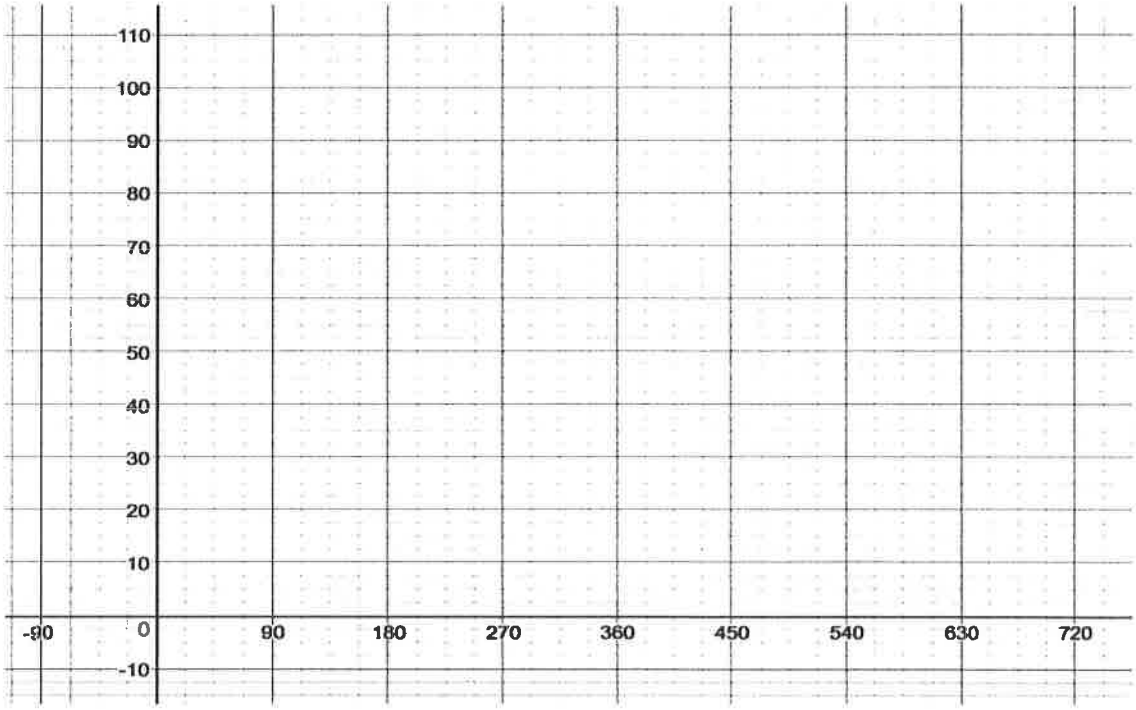
Ex 4: If the USA and Italy Ferris wheels have an axle height of 100 m, create a table of value and sketch the function

USA

Time (t) seconds	0 sec	90 sec	180 sec	270 sec	360 sec	450 sec	540 sec
Height off ground (m)							

France

Time (t) seconds	0 sec	90 sec	180 sec	270 sec	360 sec	450 sec	540 sec
Height off ground (m)							



USA		ITALY	
Peak:	Trough:	Peak:	Trough:
Equation of Axis:	Amplitude:	Equation of Axis:	Amplitude:
Range:		Range:	
Equation:		Equation:	

After you have done the calculations, summarize your engineering proposal here. What action needs to be taken to make the Ferris wheel thrilling and safe.

Final Proposal